

A C O N T R I B U T I O N T O T H E E P H E M E R O P T E R A
O F B R I T I S H C O L U M B I A

by

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A B S T R A C T

This thesis is an amalgamation of and a contribution to the knowledge of the Ephemeroptera of British Columbia, an order which has been largely neglected in Canada, and particularly in this province. The three families Heptageniidae, Ephemeridae, and Baetidae are replaced by the five superfamilies Heptagenioidea, Leptophlebioidea, Caenoidea, Ephemeroidea, and Prosopistomatoidea proposed by Edmunds and Traver (1954). 146 species in 23 genera have been recorded in British Columbia. Of these, 62 as yet unidentified species are designated by number. A checklist of all recorded species, and keys and descriptions of taxonomically important criteria of the species and higher ranks are included herein. A preliminary investigation of the ecology of the nymphs collected by the author in the Alouette River and by Dr. G.G.E. Scudder in the lakes of the Chilcotin, Cariboo, and Nicola Valley regions revealed no "preference" of the nymphs for the middle or edges of the river or for particle size of the substrate. An accurate determination of the latter, however, is not obtainable with the type of collecting equipment employed during this study. Some "preference" was shown by a number of species for specific rates of current flow. No correlation between the species of nymphs and the pH or the salinity of the environment was determined. Suggestions are put forward for the extension of our knowledge of the taxonomy, ecology, and biology of the Ephemeroptera.

A C K N O W L E D G E M E N T S

I wish to express my indebtedness to Dr. K. Graham, Dr. R.A. Ring, and Dr. G.G.E. Scudder of the Department of Zoology of the University of British Columbia for their very helpful criticisms and encouragement during the preparation of this thesis. I am especially grateful to Dr. Scudder, who is responsible for my interest in the Ephemeroptera, for supervising my work, for making available to me his own collection and that of the University, and for providing me with inspiration. I would also like to sincerely thank Dr. G.F. Edmunds and Dr. R.K. Allen of the University of Utah for identifying the nymphs of my own collection, and Dr. T.G. Northcote of the University of British Columbia for making available to me the collecting equipment used during this study. I would like to express a special thanks to Mr. G.J. Spencer of this university for providing me with the thorough taxonomic foundation necessary to the accomplishment of this thesis.

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L I S T O F I L L U S T R A T I O N S

P a g e

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Fig. 1. A diagram of the main topographic features of a mayfly wing (based on a fore wing of Ironopsis permagnus).

Fig. 2. Representative mouthparts of the mayfly nymph.

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Fig. 3. Male genitalia of some Heptagenine and Baetid nymphs.

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I N T R O D U C T I O N

The order Ephemeroptera represents a major taxonomic group of insects of considerable ecological interest and economic importance. Their taxonomy has been for the most part neglected in Canada. This neglect represents an impediment to any sound biological work in which it is necessary to define the material and differentiate between life forms.

Many workers in the United States have published taxonomic reviews of the Ephemeroptera of their particular regions, although there has been a scant amount published in the past ten years. A.E. Eaton (1883-1888, 1901) pioneered the study on this continent. Probably the most prolific contributor to the taxonomy of this order was J. McDunnough, who published a great many papers on the North America species over a twenty year period ending in 1943. Some of the more important workers in this field are W.W. Upholt (1936, 1937) and V.K. Mayo (1951, 1952) on the West Coast; W.C. Day (1954, 1955) in California; H.T. Spieth (1941, 1947), North America in general; L. Berner (1956) in Florida; and B.D. Burks (1946, 1949, 1953) in Illinois. The only comprehensive study of this order in North America is the excellent volume, The Biology of Mayflies, by J.G. Needham, J.R. Traver, and Yin-Chi Hsu in 1935.

The most important workers at present are G.F. Edmunds, J.R. Traver, and R.K. Allen. Edmunds and Traver (1954), Edmunds (1962) have revised the taxonomy of the order, replacing the original three families with five superfamilies. Edmunds and Traver (1959, 1963) are at present revising the Genus Ephemerella. Very little has been done on the Canadian Ephemeroptera. F.P. Ide (1954) has

done a large amount of work on the Ontario Ephemeropterans. Contributions in that province have also been made by W.M. Sprules (1947). The order has not been investigated at all in the rest of the country, including British Columbia.

The Ephemeroptera is a particularly satisfactory group with which to work, for although the members are fragile, they exhibit excellent morphological criteria. These include body form, wing venation, the proportions of the leg segments, genitalia and colour pattern in the adults; and body form, mouth parts, gills and colour pattern in the nymphs. There is, however, a difficulty, particularly in the construction of keys, in that the adults of these insects exhibit considerable sexual dimorphism, which is manifest especially in the colour, leg segment proportions, and wing venation.

An attempt has been made in the following keys to minimize this difficulty wherever possible by employing couplets which do not consider colour, leg segment proportions, and wing venation in those groups displaying a marked sexual dimorphism in these criteria. The use of genitalia as a taxonomic feature is kept to a minimum because their use presents technical difficulties and inconvenience to those who may wish to employ the key. However it is impossible to eliminate these characteristics entirely.

The considerable variation in body form of the nymphs among the various species affords an excellent opportunity to study the relationship between their morphology and ecology.

British Columbia is a particularly convenient area for the study of the Ephemeroptera, due to the diversity of the ecological zones, the abundance and accessibility of lakes and rivers, and the number of available specimens in the collection of the University of British Columbia.

The present study was therefore undertaken to clarify the taxonomy of the Ephemeroptera of British Columbia consistent with the newer ideas of taxonomy of this group. Included are a checklist of all species recorded from the province, keys of adults and nymphs, descriptions of the characteristics of taxonomic importance, and where possible, some account of their ecology.

For a discussion of the very interesting life history of the mayflies, and for an evaluation of their economic importance, especially as a source of fish food, I refer the reader to the very excellent accounts of Needham, Traver, and Hsu (1935).

M A T E R I A L S A N D M E T H O D S

The material examined during this study came from three sources, my own collections on the Alouette River near Haney, British Columbia, the collections of Dr. G.G.E. Scudder from lakes in the Chilcotin, Cariboo, and Nicola Valley regions, and the spirit collection of nymphs and the collection of pinned adults of the University of British Columbia. All specimens from these three sources were examined and identified or described.

The system of classification employed in this paper is that proposed by G.F. Edmunds and J.R. Traver, in which the three families Heptageniidae, Ephemeridae, and Baetidae are replaced by the superfamilies Heptagenioidea, Leptophlebioidea, Caenoidea, Ephemeroidea, and Prosopistomatoidea. All except the last are represented in British Columbia.

An attempt was made to investigate the ecological relationships of the nymphs collected in the Alouette River. This river was chosen because of its proximity to Vancouver, its accessibility, and the various types of habitats it affords from its headwaters to its mouth. The river is divided into two arms, the North and the South. The former drains Marian Lake, running for approximately ten miles to meet the South arm, which runs a ten mile course from Alouette Lake. The river then flows approximately two miles to empty into the Pitt River. The width of the river varies from twenty feet at the headwaters to seventy-five feet near the mouth. The rate of flow and character of the stream varies, being generally faster and more turbulent near the origins and slow and placid near

the mouth. There are also stagnant and quiet ponds and backwaters along the length of the river.

The character of the stream bed varies from the rocks and boulders of the headwaters to mud and silt near the mouth. Areas of gravel and sand are also plentiful and always in close association with larger rocks. Vegetation in the river is sparse, and consists for the most part of various types of mosses.

At the beginning of May 1959 the river was mapped and the character of flow and the stream bed at all accessible points was noted. Twenty-two of these points were chosen, care being taken to utilize as many different types of habitats as possible. These were divided into three groups of stations, and each week collections were made from one group, so that each station was visited every three weeks. During the winter, from September to May, each station was visited every six weeks. At each station collections were made from one to four habitats, usually the middle and edge of the river, and any backwaters or ponds. The edge of the river was considered to be that portion accessible by a dip net manipulated from the bank.

The components of the stream bed were divided for descriptive purposes into eight types, based on approximate particle size - mud, sand, fine gravel (particles up to 5mm. in size), coarse gravel (particles from 6mm. to 2cm. in size), small rocks (from 2cm. to 12cm. in size), large rocks (any rock larger than 12cm. but removable), boulders (any immovable rock), and bedrock.

The swiftness of the current in most locations prohibited the measurement of current speed with a current meter. Therefore in lieu of more accurate measurement of rate of flow, the following descriptive phrases are used: quiet or still, slow (a perceptible current but without ripples), slow ripples, fast ripples, and rapid (with turbulent, white water).

Most collecting was done with an ordinary dip net, although in some cases a Surber Sampler (Needham and Usinger, 1956) was used. In deep water near the mouth of the river, an Ekman dredge was lowered from various bridges. The material collected was brought in to the laboratory, counted, identified to family or order, and preserved in alcohol for more accurate identification at a later date.

A brief discussion at this point of the taxonomic features of the Ephemeroptera might benefit readers unfamiliar with the order. Although there is considerable variation in morphology among the various species and among higher ranks, the morphological details are remarkably constant within a species. The body form of the adult varies from long and slender to short and thick. The antennae are short and setaceous. The compound eyes are usually larger in the male than in the female, and may be approximated apically in the former. In some groups the dorsal portions are lighter in colour than the ventral portions, as in the genera Siphonurus and Heptagenia. The eyes in the genera Blasturus and Ephemerella are divided into a larger, lighter upper portion and a smaller, darker lower portion by a transverse groove, and in all the Baetinae the eyes are completely divided, the upper portion being turbinate. All species have three

ocelli, arranged to form a triangle, the distances between them varying.

The wings are not fragile, as befits an insect that spends the major part of its adult life in the air. They are strongly attached to a well-developed thorax which contains the powerful muscles of flight. They are usually hyaline, but may be tinted brown or amber, or suffused with brownish or blackish clouds. The venation is pale or dark. The forewings are large, fan-shaped, and fluted. They can be divided into three areas, the costal strip, the middle field, and the anal area. The three strong veins, the costa, the subcosta and the first branch of the radius occupying the costal strip are strengthened by a costal brace near the wing base. These veins may be broken at their midpoints by a bulla, providing greater flexibility. The venation of the middle field consists of the radial sector and media, both of which are forked almost at their bases. The anterior branch of the radial sector is dichotomously forked farther out, and its posterior branch is forked to form the "outer fork" (Of). Often these forks and the intercalaries between them form "triads". The anal area contains the cubitus, which is divided to its base, and several short anal veins. The fluting of the wings, caused by the convexity and concavity of the veins and their branches, is constant and distinct. This is an aid to identification when the forks become detached and appear to be intercalaries. Crossveins are numerous, and serve to strengthen the fluted arrangement of the longitudinal veins. They are particularly strong in the stigmatic area, and may be reduced or

wanting in the basal costal area in the more specialized species. Marginal veinlets, varying in number and form, may be present in some genera.

The hind wings are smaller than the forewings, and vary in shape. They become smaller with specialization, and may be absent in very specialized genera. Each bears a variable costal projection on the basal costal margin which underlies the anal area of the forewing, causing both wings to move synchronously. The venation is simpler, and the O_f of the R_s may be absent. Cross veins are often few or absent.

The legs are weak, and the middle and hind legs may even be vestigial. They consist of a short coxa, trochanter, and femur, a longer tibia, and usually a 5-jointed tarsus. In the middle and hind legs the first one or two tarsal joints may be fused to the tibia. The forelegs are longer and extend forward, those of the male being longer than those of the female, with a reversible joint at the tarsal base. The male fore tarsus is usually longer than the tibia. The paired tarsal claws may be similar or dissimilar. In the latter case one of each pair may be hooked and pointed, and the other lobelike and blunt. The legs are usually bare of vestiture, and colour differences of the segments are sometimes useful taxonomic criteria. Even more valuable for this purpose are the proportions of the leg segments, particularly of the tarsal joints, which are exact and constant for each species, but differ between the sexes, and among the various species.

The abdomen, composed of ten segments, has paired genital openings. The male genitalia are extremely important taxonomic features. The posterior margin of the 9th sternite articulates with a broad, freely moveable forceps base, bearing from its distal angles a pair of 3 or 4-jointed grasping forceps. The segmentation of the forceps is often incomplete and the second joint is the longest and may bear a tubercle on its inner margin. The forceps and forceps base vary in shape.

The paired penes, above and arising from the forceps base, are tubular extensions of the sperm ducts. They may bear chitinous appendages in the form of stout, sharp, posteriorly directed spurs on the basal inner margins, flat parameres on the outer margins, or, as in most of the Leptophlebiinae, large reflexed ventral spurs on the apices. There may also be lesser teeth, spines, and spinules.

The 9th sternite of the female is extended back as a notched or lobed subanal plate. The paired oviducts, opening between the 7th and 8th sternites, are covered by the 7th sternite which is produced backwards to form the egg valve.

The tails are two or three in number and vary in length. Sexual dimorphism may be exhibited, in that the middle tail (caudal filament) of the male may be absent. The abdominal tergites may bear lateral extensions ending in postero-lateral spines. The tergites of the thorax and the abdomen vary in colour and pattern among groups, but are constant for species. The abdominal sternites may exhibit ganglionic markings.

The nymphs vary in form from the stream-lined, laterally compressed, slender, hairless free-swimming species to the sprawling, depressed, setaceous, mud and silt dwellers. The head, thorax and abdomen may bear spines, as in the Ephemerella. The head varies in shape from high and narrow to the flat, depressed shape found in the Heptageniinae. If a frontal process is present it varies in shape. The antennae are longer than those of the adult, and are filiform. The compound eyes are lateral in position in the burrowers and free swimming groups, but dorsal in the flattened species. The three ocelli are directed forward in the free swimmers, and dorsally in the sprawlers.

The mouthparts of the nymphs are typical of chewing insects, with a few modifications. The simple, quadrate labrum may bear spines, and may be notched, emarginate, or bearing a fringe of hairs on its anterior margin. The asymmetrical mandibles each bear two toothed canines apically and a grinding molar surface. Between these is a small prostheca. Arising from the outer surface of each mandible in the Ephemeridae is a long, upward curved, blade-like tusk. The outer canines in the Paraleptophlebia are extended as long, blunt tusks directed obliquely upward. The cardo and stipes of each maxilla are discrete areas, but the galea and lacinia are fused. The maxillae may bear teeth, bristles, or a "diatom rake" on the crown (Ameletus). The palpi are usually 3-jointed. The labium is of the usual form, with long, well separated glossae and paraglossae. The labial palpi are ordinarily 2 or 3-jointed.

The legs of the nymph are shorter than those of the adult. The femora may be flattened in the sprawling forms, and may bear spines or hairs. The tarsi are 1-jointed and bear single claws which may be denticulate and which vary in form.

The lamellate, filamentous, or plumose gills arise laterally from all or some of the first seven abdominal segments, and some species also bear plumose gills at the bases of the coxae, and the maxillae. The gills may be double or single and are directed laterally, dorsally, or ventrally, and sometimes overlap each other to form a strong sucker disc. The gills of some groups are heavily chitinized on the anterior margins, or fringed with hairs on the posterior margins, as in the genus Caenis. In other groups, notably the Caenis, Tricorythodes, and some Ephemerella, the first pair of gills are operculate. Tracheation of the gills, if conspicuous, is simple, palmate, or pectinate.

The tails are two or three in number. The free swimming groups found in still water, such as the Siphonurus, Blasturus, and Callibaetis, and also the Ameletus in streams bear a heavy fringe of hairs on the inner surface of each lateral tail, and on both sides of the middle tail. The burrowers and sprawlers have bare tails, perhaps with whorls of a few hairs at the joinings of the tail segments. The tails may be unicolourous or banded.

The colour and pattern of the tergites and legs varies greatly among groups, but is constant for each species.

CHECKLIST OF THE EMPHEMEROPTERA OF BRITISH COLUMBIA

Order Ephemeroptera

Superfamily Heptagenioidea

Family Siphonuridae

Subfamily Siphonurinae

Ameletus celer McDunnough

Ameletus celeroides McDunnough

Ameletus connectina McDunnough

Ameletus cooki McDunnough

Ameletus monta Mayo

Ameletus oregonensis McDunnough

Ameletus guerulus McDunnough

Ameletus similior McDunnough

Ameletus sparsatus McDunnough

Ameletus suffusus McDunnough

Ameletus tuberculatus McDunnough

Ameletus validus McDunnough

Ameletis vancouverensis McDunnough

Ameletus vernalis McDunnough

Ameletus sp. 1 *

* Until further investigation of unidentified specimens can be undertaken, they have been numbered, rather than named by the author.

Parameletus columbiae McDunnough

Siphonurus autumnalis McDunnough

Siphonurus columbianus McDunnough

Siphonurus occidentalis Eaton

Siphonurus sp. 1

Siphonurus sp. 2

Siphonurus sp. 3

Siphonurus sp. 4

Siphonurus sp. 5

Siphonurus sp. 6

Siphonurus sp. 7

Siphonurus sp. 8

Siphonurus sp. 9

Family Heptageniidae

Subfamily Heptageniinae

Cinygma integrum Eaton

Cinygmula gartrelli McDunnough

Cinygmula kootenai McDunnough

Cinygmula mimus (Eaton)

Cinygmula par (Eaton)

Cinygmula ramaleyi (Dodds)

Cinygmula uniformis (McDunnough)

Cinygmula sp. 1

Cinygmula sp. 2

Epeorus deceptivus (McDunnough)

Epeorus dulciana McDunnough

Epeorus flavipennis Traver

Epeorus grandis (McDunnough)

Epeorus longimanus Eaton

Epeorus permagnus Traver

Epeorus sp. 1

Epeorus sp. 2

Epeorus sp. 3

Epeorus sp. 4

Epeorus sp. 5

Heptagenia elegantula (Eaton)

Heptagenia simplicoides McDunnough

Heptagenia solitaria McDunnough

Heptagenia sp. 1

Heptagenia sp. 2

Heptagenia sp. 3

Heptagenia sp. 4

Heptagenia sp. 5

Heptagenia sp. 6

Heptagenia sp. 7

Heptagenia sp. 8

Rithrogena doddsi McDunnough

Rithrogena jejuna Eaton

Rithrogena morrisoni Banks

Rithrogena robusta Dodds

Rithrogena virilis McDunnough

Rithrogena sp. 1

Rithrogena sp. 2

Rithrogena sp. 3

Stenonema terminatum (Walsh)

Family Ametropodidae

Subfamily Metretopodinae

Metretopus borealis Eaton

Family Baetidae

Subfamily Baetinae

Baetis bicaudatus Dodds

Baetis insignificans McDunnough

Baetis intermedius Dodds

Baetis jesmondensis McDunnough

Baetis parvus Dodds

Baetis persecuta McDunnough

Baetis sp. 1

Baetis sp. 2

Baetis sp. 3

Baetis sp. 4

Baetis sp. 5

Baetis sp. 6

Baetis sp. 7

Callibaetis carolus Traver

Callibaetis coloradensis Banks

Callibaetis hageni (Eaton)

Callibaetis nigritus Banks

Callibaetis sp. 1

Callibaetis sp. 2

Callibaetis sp. 3

Callibaetis sp. 4

Callibaetis sp. 5

Callibaetis sp. 6

Callibaetis sp. 7

Callibaetis sp. 8

Centroptilum album McDunnough

Centroptilum bellum McDunnough

Centroptilum bifurcatum McDunnough

Centroptilum conturbatum McDunnough

Centroptilum sp. 1

Centroptilum sp. 2

Centroptilum sp. 3

Centroptilum sp. 4

Neocloeon sp. 1

Superfamily Leptophlebioidea

Family Leptophlebiidae

Subfamily Leptophlebiinae

Leptophlebia sp. 1

Leptophlebia sp. 2

Blasturus cupidus (Day)

Blasturus gravastella (Eaton)

Blasturus nebulosus (Walker)

Blasturus sp. 1

Paraleptophlebia bicornuta (McDunnough)

Paraleptophlebia debilis (Walker)

Paraleptophlebia gregalis (Eaton)

Paraleptophlebia heteronea (McDunnough)

Paraleptophlebia pallipes (Hagen)

Paraleptophlebia rufivenosa (Eaton)

Paraleptophlebia temporalis (McDunnough)

Paraleptophlebia vaciva (Eaton)

Paraleptophlebia sp. 1

Paraleptophlebia sp. 2

Paraleptophlebia sp. 3

Paraleptophlebia sp. 4

Paraleptophlebia sp. 5

Family Ephemerellidae

Subfamily Ephemerellinae

Ephemerella coloradensis Dodds

Ephemerella doddsi Needham

Ephemerella flavilinea McDunnough

Ephemerella grandis ingens McDunnough

Ephemerella hecuba hecuba Eaton

Ephemerella heterocaudata McDunnough

Ephemerella hystrix Traver

Ephemerella inermis Eaton

Ephemerella infrequens McDunnough

Ephemerella jacobi McDunnough

Ephemerella lodi Mayo

Ephemerella spinifera Needham

Ephemerella teresa Traver

Ephemerella tibialis McDunnough

Ephemerella sp. 1

Family Tricorythidae

Subfamily Leptohyphinae

Tricorythodes minutus Traver

Tricorythodes sp. 1

Superfamily Caenoidea

Family Caenidae

Subfamily Caeninae

Caenis sp. 1

Caenis sp. 2

Caenis sp. 3

Caenis sp. 4

Superfamily Ephemeroidea

Family Ephemeridae

Subfamily Ephemerinae

Ephemera simulans Walker

Hexagenia limbata (Guerin)

Pentagenia sp. 1

ORDER EPHEMEROPTERA

KEY TO ADULTS

1. Veins M and Cul strongly divergent at base, with M2 strongly bent toward the Cu basally.....Superfamily Ephemeroidea
Veins M and Cul little divergent at base and the fork of M more nearly symmetrical.....2.
2. Tails two. Hind tarsi 4 or 5-jointed.....
.....Superfamily Heptagenioidea
Tails three. Hind tarsi 4-jointed.....3.
3. Forceps 1-jointed. Prosternum 2 or 3 times longer than broad, so that the coxae are very close together.....
.....Superfamily Caenoidea
Forceps 3 or 4-jointed. Prosternum not as above.....
.....Superfamily Leptophlebioidea

KEY TO NYMPHS

1. Mandibles each with an external tusk projecting forward and visible dorsally. Head with a conspicuous frontal process between the bases of the antennae..Superfamily Ephemeroidea
Mandibles with no external tusks, or if present, depressed, and head with no frontal process between the bases of the antennae.....2.
2. Outer tails fringed on the inner side only, perhaps with a few short hairs on the outer side. Tails may not be fringed, but may bear whorls of spines at each tail joining. If this is so, the head is strongly depressed, with eyes and antennae dorsal. Tails may be two.....
.....Superfamily Heptagenioidea

Outer tail fringed on both sides, or if not fringed, tails
with whorls of spines at each joining. In the latter case,
the gills of the second abdominal segment are elyteroid....3.

3. Gills of the second abdominal segment elyteroid, quadrate, and
the gills on segments 3-6 have deeply fringed margins.

All gills single.....Superfamily Caenoidea

Gills not elyteroid, or if gills of second abdominal segment
are elyteroid, they are triangular; the margins of the gills
on segments 3-6 are not fringed, and all gills are double..
.....Superfamily Leptophlebioidea

SUPERFAMILY HEPTAGENIOIDEA

Key to Adults

1. Hind tarsi 5-jointed. Eyes of male not turbinate. Outer fork
of Rs of hind wing present or absent. More than 2 cubital
intercalaries in forewing.....2.

Hind tarsi 4-jointed. Eyes of male turbinate. Outer fork of
Rs of hind wing absent. Four long cubital intercalaries
in forewing. Hind wing may be absent.....
.....Family Baetidae, Subfamily Baetinae

2. Cubital intercalaries in 2 parallel pairs, long and short
alternating. Eyes of male simple. Outer fork of Rs in
hind wing present or absent.....
.....Family Heptageniidae, Subfamily Heptageniinae

Cubital intercalaries of forewing not as above. Eyes of male
entire, horizontal line on surface marking out 2 areas.
Outer fork of Rs in hind wing present.....3.

3. Cubital intercalaries of forewing consist of a series of
forking or sinuate veinlets attaching Cul to hind margin..
.....Family Siphonuridae, Subfamily Siphonurinae

Cubital intercalaries of forewing 2-4 in number; free basally,
not forking or sinuate.....

.....Family Ametropodidae, Subfamily Metretopodinae

Key To Nymphs

1. Nymph depressed. Eyes and antennae dorsal. Gills of a single
lamella, usually with a fibrilliform tuft at or near the
base.....Family Heptageniidae, Subfamily Heptageniinae

Nymph not depressed. Eyes and/or antennae lateral, antero-
lateral, or anterior. Gill lamellae double or single.....2.

2. Claws of foreleg bifid. Claws of middle hind legs long and
slender, about as long as the short tibia.....
.....Family Ametropodidae, Subfamily Metretopodinae

Claws similar, sharp-pointed, much shorter than tibia. Claws
of middle and hind legs may be long and slender, of forelegs
short.....3.

3. Postero-lateral angles of the apical abdominal segments prolonged
into thin flat lateral spines - if weak, antennae less than
twice the width of the head. Variable appendage on fore
coxa.....Family Siphonuridae, Subfamily Siphonurinae

Postero-lateral angles of apical abdominal segments hardly more
than acute, not prolonged into flat thin lateral spines so, if weak,
antennae more than twice the width of the head. No appendage
on fore coxa.....Family Baetidae, Subfamily Baetinae

SUBFAMILY SIPHLONURINAE

ADULT

Fore wing narrowed just beyond the base and widened somewhat at the anal angle, relatively long for its width; the anterior branch of the cubital vein is attached to the inner margin by a series of cross-veins, which are often forked and sinuate; the hind wing is almost or fully as wide as long, the anal region well-developed; the costal projection is not especially prominent, usually somewhat obtuse; the tarsi are five-jointed; the basal joints of the middle and hind tarsi are more or less completely fused with the tibiae; all joints of the male fore tarsus free and movable, the first joint at least $1/3$ the length of the second joint, and may equal or exceed it; the forceps are more or less distinctly four-jointed; the forceps base is usually very long, more or less deeply emarginate in its apical margin, between the forceps limbs; basal joint is usually ring-like, often fused with the second joint, which is often strongly bowed; two (or rarely three) terminal joints, together not longer than the second. In Ameletus, subanal plate of female more or less deeply carved out in the apical margin, convex in other genera; two tails.

NYMPH

Body stream-lined, much compressed; head inflexed; legs long; claws long and slender, not denticulate; lateral margins of apical abdominal tergites expanded into flat lateral extensions, less so in Ameletus; a spine on the postero-lateral angle of each middle and apical tergite; gills on segments 1-7, simple and single, except

in Siphonurus where gills are double and lamellate, parts similar; three tails, middle one heavily fringed on each side, lateral ones on inner margins only.

SUBFAMILY SIPHLONURINAE

Key To Adults

1. Claws of each tarsus dissimilar. Costal angulation of hind wing acute. Fork of M detached. Subanal plate concave..
.....Ameletus Eaton
- Claws all sharp-pointed. Costal angulation of hind wing obtuse.
Fork of M not detached. Subanal plat convex.....2.
2. Hind tarsus shorter than or subequal to tibia. Posterior branch of M forms almost a right angle at its union with the stem..
.....Parameletus Bengtsson
- Hind tarsus longer than tibia. Fork of M normal.....
.....Siphonurus Eaton

Key To Nymphs

1. Gill lamellae single on all segments.....2.
- Gill lamellae double on segments one and two, and sometimes on other segments. Lamellae equal in size.....
.....Siphonurus Eaton
2. A fringe of pectinate spines on crown of galea-lacinia. No pincer like process on tip of labial palp.....
.....Ameletus Eaton
- No pectinate spines on crown of galea-lacinia. A pincer-like process near tip of labial palp.....Parameletus Bengtsson

GENUS AMELETUS EATON

Ameletus, Needham, 1935, The Biology of Mayflies, 446, (Bibliography)

Adult:

Medium sized, brownish or yellow brown, abdomen of female often darker than that of male; vertex and occiput of female usually with dark submedian marks; hind margin of head slightly concave; eyes of male large; usually contiguous above, not divided, a transverse band of paler colour may extend obliquely across the outer surface; forewing three times as long as wide; hind wing well-developed, costal angulation acute; median vein of hind wing forked near base; venation dark; humeral cross vein strong and dark; many crossveins in costal half of forewing may be brown-margined, so that wing looks speckled; stigmatic cross veins usually forked and anastomosed; fore leg of male as long as body; first fore tarsal joint $1/3$ to $1/2$ as long as second; all claws dissimilar; abdominal tergites usually with wide dark posterior margins, postero-lateral angles, and extensions along pleural fold; sternites often with black or brown ganglionic marks; forceps base with a tubercle or projection on each side of apical excavation; two terminal joints, shorter together than second joint; penes long and slender, may be with spines on inner margin, and tips may be seen beyond forceps plate, when viewed from beneath.

Nymphs:

Maxillary and labial palps three-jointed, former short and weak; maxilla with a broad crown, bearing long pectinate spines; mandibles triangular, with canines at one point and molar surface at another;

labrum a little longer than wide, emarginate on frontal border;
legs rather short; postero-lateral spines usually on segments 4-9,
but short and weak on segments 4-6; the lateral margins on these
only very slightly compressed; gills single, simple, small and
oval; tails usually with a wide dark transverse band at middle
and a narrow one at apex.

Genotype: Ameletus subnotatus Eaton.

AMELETUS

Key To Adults

1. Crossveins faintly or strongly marked with brown to
black.....2.
No marginal crossveins.....8.
2. Ganglionic markings dark.....3.
No dark ganglionic markings.....7.
3. Anterior two-thirds of abdominal tergites hyaline while
posterior one-third deep brown. Wings hyaline.....4.
Wings cloudy or tinted.....5.
4. Crossveins dark except in costa-basal area.....connectina McD
Crossveins inconspicuous and only faintly shaded.....
.....tuberculatus McD
5. Wings not tinged, although clouds present in wings.
Abdominal tergites deep brown.....similior McD
Wings tinged. Abdominal tergites light-coloured.....6.
6. Wings with reddish brown tinge. Abdominal tergite 1 dark brown,
rest semi-hyaline.....monta Mayo
Wings of male amber-tinged. Clouds in wings. Abdominal

- tergites yellow-brown.....sparsatus McD
7. Wings tinged with umber brown, paling somewhat outwardly. Abdom-
inal tergite 1 black, others bright yellow bordered
posteriorly with brown.....suffusus McD
Wings not tinged, although cloudy. Abdominal tergites pinkish
brown.....validus McD
8. Ganglionic areas marked with orange to black.....9.
No ganglionic markings.....12.
9. Wings not tinged.....10.
Wings faintly smoky or grey tinged. Not speckled or cloudy.....
.....celer McD
10. Ganglionic markings dark brown.....11.
Ganglionic markings orange.....cooki McD
11. Two small spines on inner margin of each division of penes.
Abdominal tergites 2 to 7 yellowish brown....celeroides McD
Single long slender spine on inner margin of each division of
the penes. Abdominal tergites 2 to 7 greyish white.....
.....vernalis McD
12. Wings tinged with brown, umber brown, or amber.....13.
Wings pale hyaline.....querulus McD
13. Wings tinged entirely or in part with brown or umber brown...14.
Wings entirely tinged with amber.....sp.1
14. Wings tinged with brown at base. Abdominal tergites yellow-
white.....oregonensis McD
Wings strongly and entirely tinged with umber brown. Abdominal
tergites yellow brown.....vancouverensis McD

Key To Nymph

1. Tails pale ochreous.....celer McD
Tails with one or more dark bands, in one or more of the three
tails.....2.
2. Middle tail paler than outer tails, which are light brown.
Middle tail with a faint brown narrow band in middle.....
.....validus McD
All three tails similarly marked.....3.
3. Tails with single median dark band and dark tips.....4.
Tails with single median dark band, but pale basally and
apically.....6.
4. Ventrally on first seven segments there is a broad dark broken
medio-ventral band, tapering cephalad on each segment to
a point and not quite attaining anterior margin, but
broadening out in posterior half of segments, especially
of segments 5 and 6, where it almost coalesces with a dark
lateral stripe, extending down segments slightly interior
to pale edges. Segments 8 and 9 brown with small white
spots on anterior margin.....suffusus McD
Ventrally pale brown with broadly pale lateral edges, except
on segment 9 and a small pale dot near antero-lateral
corner.....5.
5. Gills pale with faint tracheation. An interior dark band just
within the dorsal margin and faint traces of chitinous
thickening along ventral edge.....vernalis McD

- Tracheation more distinct but still not prominent. Interior dark band is closer to dorsal margin than previously, and thickening along ventral edge is heavier.....connectina McD
6. No dark interior chitinous band on gills.....7.
A dark interior or dorsal band of chitin on gills.....8.
7. Tracheation of gills sparse, indistinct.....celeroides McD
Tracheation of gills plentiful, distinct.....sparsatus McD
8. Ventrally pale brown with no pattern.....oregonensis McD
Ventrally pale with various dark patterns.....9.
9. Chitinous thickening along dorsal and ventral edge of gills....
.....similior McD
Chitinous band within dorsal edge of gills.....10.
10. Chitinous band near dorsal edge of gills.....cooki McD
Chitinous band well within dorsal edge of gills.....11.
11. Chitinous band of gills extends only 2/3 to tip of gill.....
.....guerulus McD
Chitinous band of gills as far from dorsal edge as width of base of gill.....monta Mayo

Unknown

Ameletus vancouverensis McD

Ameletus tuberculatus McD

AMELETUS CELER McDUNNOUGH

Ameletus celer McDunnough, Needham, 1935, The Biology of Mayflies, 451 (Bibliography)

Adults:

Head and thorax blackish brown, abdomen yellowish brown;

wings dull hyaline, faintly smoky or grey-tinged, not speckled or cloudy; longitudinal veins and crossveins fine and brown; abdominal tergites 2-7 semi-hyaline, pale yellowish-brown; posterior margins dark brown with narrow brown submedian streaks extending forward, and not attaining anterior margin; tergites 8-10 opaque, darker; sternites paler, ganglionic areas marked with brownish black; tails whitish and smoky, joinings blackish brown; penes with several small spines on inner margin of each division.

Nymph:

Tarsi with deep brown distal bands only; no dark longitudinal stripes on venter of the abdomen; ganglionic markings present; tracheation of gills sparse and indistinct, no dark interior chitinous band; tails pale ochreous.

Distribution: British Columbia, Alberta.

No specimens of this species were examined.

AMELETUS CELEROIDES McDUNNOUGH

Ameletus celeroides McDunnough, Needham, 1935, The Biology of May-flies, 451 (Bibliography)

Adult:

This species is similar to A. celer, but smaller and paler; postero-lateral area of pronotum creamy; wings not smoky; anterior portions of tergites creamy, especially laterally on segments 6-8, and also on sternites 7 and 8, and a pale creamy line on lateral edge of sternite 9; ganglionic markings dark brown; penes with two

small spines on inner margin of each division; penes lobes broadly divergent apically; all forceps joints slender.

Nymph:

Similar to A. celer, but tarsi dark banded basally as well as distally; tails pale at base and apex, with a broad dark median band.

Distribution: British Columbia, Alberta.

No specimens of this species were examined.

AMELETUS CONNECTINA McDUNNOUGH

Ameletus connectina McDunnough, McDunnough, 1939, Can. Ent. 71:50

(Bibliography)

Adult:

Wings hyaline with veins and fine crossveins dark, except in costa-basal area; abdomen dorsally with the anterior 2/3 of tergites dull; dirty whitish, veined with darker and with traces of two broken subdorsal lines; the posterior 1/3 dull black-brown; sternites with dark ganglionic markings.

Nymph:

Femora pale with a large rectangular brown patch in the median area, with small brown areas at base and apex, and with a brown streak extending back from apex along the dorsal edge; tibiae slightly tinged with brown at base. No distinct maculation on sternites, except a pale lateral edge and anterior white dots on each sternite. Gills with an interior dark band close to dorsal margin and a thickened ventral margin. Tracheation distinct but not prominent. Tails pale, whitish, very broadly banded with brown in middle and apically.

Distribution: British Columbia

No specimens of this species were examined.

AMELETUS COOKI McDUNNOUGH

Ameletus Cooki McDunnough, Needham, 1935, The Biology of Mayflies,
452 (Bibliography)

Adult:

Small dark species, with orange-brown abdominal tergites; thorax blackish-brown, with orange shading on and before mesothoracic scutellum, at wing and leg bases; wings hyaline, longitudinal veins amber; abdominal tergites orange-brown, with suffused brown shading along lateral margins, forming obscure semi-triangular patches in the postero-lateral corners, sometimes extending narrowly along the posterior margin. Sternites 2-6 dull hyaline whitish, 7 and 8 opaque, bright yellowish, 9 blackish brown shaded with orange; ganglionic markings orange; penes each bearing a spine on inner margin near middle; penes curved at tip; tails dirty whitish, joinings dark.

Nymph:

Femur with a brown central patch on outer side, which may be reduced; tibiae brown at base; sternites pale, sternites 3-7 each with a pair of small brown submedian spots near anterior margin and a lateral brown streak, which is faint on segments 6 and 7; sternites 8 and 9 are each crossed by a broad curved brown band, leaving only the antero-lateral and postero-medial areas pale; gills each with a thin black chitinous band near dorsal margin; tails pale with a broad deep brown median band.

Distribution: Montana, British Columbia.

No specimens of this species were examined.

AMELETUS MONTA MAYO

Ameletus monta Mayo, Mayo, 1952, Pan.Pac.Ent., 28:93 (bibliography)

Adult: (Male)

Wings with a reddish-brown tinge due to prominence of reddish-brown longitudinal veins; crossveins less distinct; stigmatic area milky; first abdominal tergite dark brown, tergites 2-7 semi-hyaline, washed with pale tracheations and very pale laterally, tergites 8-10 dark brown with a pale streak on the edges; sternites 2-8 with blackish ganglionic markings; penes narrow, parallel, slightly incurved at tips, each with 3 prominent spines at base; tails white with minute brown hairs, each segment delicately bordered posteriorly with reddish hair.

Nymph:

Legs yellowish brown, with last tarsal segment dark reddish brown; abdominal sternite 1 pale, 2-4 and 8 uniformly pale, 5-7 pale except around ganglionic markings; 9 pale; each sternite with brown patches on either side of midline, and small distinct white patches on antero-lateral corners; tracheae of gills numerous; sclerotized band on gills as far from dorsal margin as width of base; tails fringed, pale with dark brown median band.

Distribution: British Columbia

No specimens of this species were examined.

AMELETUS OREGONENSIS McDUNNOUGH

Ameletus oregonensis McDunnough, McDunnough, 1936, Can.Ent., 68:208

(Bibliography)

Adult:

Head and thorax blackish, abdomen yellowish white; wings hyaline, costal area faintly amber-tinged at base; basal anal area and stigmatic region of forewing suffused with sepia brown; the basal area of the hind wing, extending along costa half way to apex, is predominantly brown; Venation brown; crossveins numerous, anastomosed in stigma;; abdominal tergites 2 smoky brown, 3-6 semi-hyaline, pale yellowish white with posterior margins, triangles in the postero-lateral corners, and two narrow submedian streaks dark brown, 7-9 opaque, markings the same but blackish brown, 10 brown with pale posterior margin; sternites 1-6 semi-hyaline, pale yellowish white, 7-9 opaque, suffused with brown; no ganglionic markings; penes unique, each composed of a wide chitinous piece bearing three broad spines at its apex; penes short, not reaching the apex of the forceps base; tails pale smoky, not darkened at joinings.

Nymph:

Basal area of femur pale with a deep broad brown median band; apical section more or less lighter brown, especially in the fore femur; basal halves of tibiae pale, apical halves brown; abdominal sternites uniformly pale brown, with no ganglionic markings; gills pale, with poor tracheation; a dark brown interior band of chitin in the gills and with ventral margins broadly but indistinctly thickened with chitin; tails brown at base and then banded alternately pale and dark brown, tips whitish.

Distribution: Oregon, British Columbia.

No specimens of this species were examined.

AMELETUS QUERULUS McDUNNOUGH

Ameletus querulus McDunnough, McDunnough, 1938, Can. Ent., 70:29

(Bibliography)

Adult:(Male)

Wings pale hyaline with longitudinal veins and crossveins in pterostigmatic area brown; abdominal tergites 2-6 semi-hyaline, light yellow-brown shading into deeper brown along the posterior borders, and rather strongly marked with a fine dark tracheation arising from the dark lateral band, tergites 7-10 opaque, slightly deeper in colour than anterior tergites and with some lateral darker shading; sternites whitish, suffused with dull smoky; no ganglionic markings.

Nymph:

Femora pale, tipped with dark and each with small median oval dark spot; abdominal sternites 1-7 pale, 8-9 dark; sternites 1 and 2 each bear 2 dark submedian spots, much larger on 2; on sternites 3-6 these spots become progressively larger, uniting with dark shading on the anterior margins to form large irregularly triangular patches, occupying the whole median area, apices touching the posterior margins; faint lateral dark patches on sternites 3-4 also become progressively larger and on 5 connect with the dark median area; no lateral patches on sternite 6; on sternite 7 the triangular area is reversed; gills oval with the dark chitinous band well within the dorsal margin and extending only 2/3 to the tip of the gill;

tails pale with a moderately wide dark median band.

Distribution: British Columbia

No specimens of this species were examined.

AMELETUS SIMILIOR McDUNNOUGH

Ameletus similior McDunnough, Needham, 1935, The Biology of May-flies, 456 (Bibliography)

Adult:

Medium sized dark species; head and thorax shiny blackish brown in male; thorax bright reddish brown in female; wings hyaline, clouds of light umber brown in male; venation dark, several cross-veins of forewing margined with brown, so wing appears speckled; abdominal tergites deep brown with lighter shading on posterior margins; sternites with black, heart-shaped ganglionic markings; tubercles on forceps base poorly developed; penes slightly incurved at tips, each bears one or more spines on inner margin; subanal plate of female small, covering less than one half the tenth segment.

Nymph:

Femora each with a pale streak extending backward from distal extremity; tarsi with dark brown apical bands; sternites 3, 4, and 8 dark brown, others pale with faint dark lateral dashes and obscure submedian streaks uniting at times, especially on sternite 8, to form patches; sternite 9 entirely pale with a minute dark dot in each antero-lateral corner; ganglionic markings distinct and blackish; gills narrowly oval, feebly tracheated, and with a chitinous thickening along the dorsal and ventral edges; tails pale, with a broad deep brown median band.

Distribution: Alberta, British Columbia

No specimens of this species were examined.

AMELETUS SPARSATUS McDUNNOUGH

Ameletus sparsatus McDunnough, Needham, 1935, The Biology of May-flies, 456 (Bibliography)

Adult:

Head, pronotum and metanotum black, anterior part of latter shaded with brown; mesonotum reddish brown anteriorly, yellowish brown medially and blackish brown laterally; scutellum yellowish brown with black lateral margins; wings hyaline, amber-tinted in male; venation brown; crossveins in costal half of forewing basad of the bulla margined with brown, so that wing appears speckled; crossveins in stigmatic area strongly anastomosed; abdominal tergites 2-6 yellowish brown, rest golden brown; all tergites broadly shaded with darker brown on lateral and posterior margins; sternites 2-6 dull smoky brown, rest opaque yellowish brown, with dark antero-median patches on 7 and 8, and a broad deep brown lateral edging on 9; penes as in A. cooki.

Nymph:

Legs banded; abdominal tergites 1, 7 and 10 pale with a dark anterior margin; tergite 9 and sternites 8 and 9 dark reddish to orange brown; other tergites with pale large oval lateral spots, pale median areas bounded by dark brown submedian oblique streaks, anterior and posterior margins very narrowly black, especially in

postero-lateral corners; sternites similar, without pale median streak; tails pale, with wide median black band and narrow apical black band; no chitinous band in gills; tracheation of gills plentiful and distinct.

Distribution: British Columbia

No specimens of this species were examined.

AMELETUS SUFFUSUS McDUNNOUGH

Ameletus suffusus McDunnough, McDunnough, 1936, Can.Ent., 68:210

(Bibliography)

Adult: (Male)

Wings tinged with umber-brown, paling somewhat outwardly; longitudinal veins bright brown, crossveins smoky brown, those before the bulla numerous and those in the pterostigmatic area evenly anastomosed; abdominal tergite 1 blackish, others rather bright yellow, broadly bordered with brown posteriorly and slightly brown-shaded along lateral edges where tracheation shows as a fine dark network; tergites 8-10 are opaque with a more extended brown suffusion; sternites dull pale ochreous; sternite 9 and forceps plate tinged with yellow centrally; no ganglionic markings; penes lobes wide apart with apices directed outwardly; tails smoky, faintly dark ringed.

Nymph:

Legs pale with a dark central patch on each femur; tarsi banded basally and apically with brown; first 7 abdominal sternites with a broad dark broken medial band, tapering anteriorly on each to a

point and not quite attaining the anterior margin, and broadening posteriorly, especially in sternites 5 and 6 where it almost coelescences with a dark lateral stripe which is slightly medial to the pale edge; sternites 8 and 9 brown with small white spots on the anterior margins; gills pale, tracheation indistinct, dorsal edge strongly chitinized; tails pale brownish at base and whitish apically, with a broad deep brown median band and tips.

Distribution: British Columbia

No specimens of this species were examined.

AMELETUS TUBERCULATUS McDUNNOUGH

Ameletus tuberculatus McDunnough, McDunnough, 1939, Can. Ent.,

71:50 (bibliography)

Adult:

Wings hyaline; longitudinal veins brown, crossveins fine, inconspicuous, and faintly shaded with darker colour; abdominal tergites with anterior 2/3 semi-hyaline, light smoky, strongly veined with darker, posterior 1/3 deep brown; two submedian dark lines do not reach anterior margins; sternites pale dirty white with a median row of black ganglionic markings; male genitalia similar to A. connectina but penes shorter and a characteristic large tubercle between bases.

Nymph: Unknown

Distribution: British Columbia

No specimens of this species were examined.

AMELETUS VALIDUS McDUNNOUGH

Ameletus validus McDunnough, Needham, 1935, The Biology of Mayflies,
458 (Bibliography)

Adult:

Head and thorax brown, abdomen pinkish brown; wings hyaline, faintly clouded with pale umber brown in male, venation dark; several crossveins in forewing margined with brown so that wing appears speckled; abdominal tergites 1-6 semi transparent, sutures narrowly opaque; 7-10 opaque, 9 shaded laterally with smoky brown; no ganglionic markings; penes curve outward at tips; subanal plate of female almost attaining posterior margin of tenth segment.

Nymph:

Fine brown bands at bases of femora and tibiae; first and second femora each with an oval brown spot on outer side, near middle; sternites pale, with faint brown streaks along lateral edges of sternite 9; gills large, oval, pale, faintly tracheated, and with thin dark chitinous bands well within the dorsal margins; outer tails light brown, middle tail paler and with a faint brown narrow median band.

Distribution: Alberta, British Columbia

No specimens of this species were examined.

AMELETUS VANCOUVERENSIS McDUNNOUGH

Ameletus vancouverensis McDunnough, Needham, 1935, The Biology of
Mayflies, 458 (Bibliography)

Adult:

Deep mahogany brown species; with a light yellowish brown

U-shaped mark on mesonotum, the base of the U on the scutellum; wings strongly and entirely tinged with umber brown, stigmatic area deeper; venation dark brown, crossveins numerous, those in stigma anastomosed; abdominal tergite 1 mahogany brown, 2-7 semi-hyaline, shiny bright yellowish brown, shading to narrowly dark brown posterior margins, 8-10 opaque, mahogany brown, tinged anteriorly with yellowish brown; sternites 2-8 light ochraceous, tinged anteriorly with yellowish brown, 9 bright yellowish brown, dark brown anteriorly and laterally; no dark ganglionic markings; penes with two long sharp spines between the lateral portions; tails deep smoky, joinings dark.

Nymph: Unknown

Distribution: British Columbia

No specimens of this species were examined.

AMELETUS VERNALIS McDUNNOUGH

Ameletus vernalis McDunnough, McDunnough, 1936, Can. Ent., 68:208,

(Bibliography)

Adult:

Large species with deep blackish brown head and thorax; wings hyaline, forewings shaded with brown at apex and with a slight brown tinge at the base of R3, where there is a group of 6 crossveins; venation brown, except 3 or 4 costal crossveins beyond the bulla which are pale and indistinct; stigmatic crossveins anastomosed to form a series of smaller costal cells with larger ones below; abdominal tergites 2-6 translucent dull, greyish white, 7-10 opaque yellowish, although 9 is brown; tergites each with a deep purple-

brown subtriangular patch, based on posterior margin, apex almost attaining anterior margin, and brown lateral patches; sternites 2-6 with faint traces of mid-ventral brown spots connected by a fine line, 7 and 8 with brown lateral patches based on posterior margins, 9 brown, yellowish on posterior margin; venter of female largely tinged with purplish brown; each penes with a long spine on inner side.

Nymph:

Legs pale, femora with large brown median patches on outer side; tibiae entirely pale, except at extreme base; sternites pale brown with broadly pale lateral edges, except in sternite 9, and small pale dots near antero-lateral corners; gills pale with faint tracheation and an interior dark chitinous band just within dorsal margin and faint traces of chitinous thickening along the ventral edge; tails pale whitish, broadly banded with brown just beyond middle and at extreme tips.

Distribution: British Columbia

No specimens of this species were examined.

AMELETUS SP. 1

Ameletus sp. 1

Adult:

Head dark brown, mesonotum yellowish red, darker on each side of scutellum; metanotum darker; wings amber tinged, no margined crossveins; forelegs dark reddish brown, middle and hind legs yellow-red; abdominal tergites 1 and 10 dark brown, 2-9 yellow-

red, darker on posterior margins; sternites 1 dark brown, 2-8 yellow, 9 and 10 reddish brown; no dark ganglionic markings.

Nymph: Unknown.

Distribution: British Columbia

Material Examined:

1 Male, 1 Female, British Columbia: Courterlay, VIII.3.31,
(J. Spencer).

GENUS PARAMELETUS BENGTSSON

Parameletus, Needham, 1935, The Biology of Mayflies, 502 (Bibliography)

Adult:

Medium sized brownish mayflies, male and female very similar; eyes of male large, contiguous apically, not divided; foreleg of male as long as body; first joint of fore-tarsus and fore-tibia thickly set with blunt spine-like processes, spines at tips of tarsal joints of middle and hind legs; hind tarsus subequal to tibia; claws on tarsi similar, sharp-pointed; posterior branch of M of forewing forms almost a right-angle at its union with the stem; hind wing less than twice as long as wide, median vein simple, not forked; costal angulation obtuse; abdominal tergites 5-9 not dilated laterally into flat, broad extensions; forceps base shallowly excavated on its apical margin, very blunt projections on each side of this excavation; a short 5-jointed rudiment of the middle tail remains.

Genotype: Parameletus chelifera Bengtsson

PARAMELETUS COLUMBIAE McDUNNOUGH

Parameletus columbiae McDunnough, McDunnough, 1938, Can. Ent., 70:

23-34 (Bibliography)

Adult: (Male)

Wings hyaline with deep brown venation; abdominal tergites deep brown, paling along anterior borders of 1-6, 7-10 opaque, shaded with lighter brown, especially laterally; sternites the same, but ruddier, and posterior margins of anterior segments bordered narrowly with dirty white; basal plate dull ochreous, with a U-shaped ruddy work; tails smoky, paler at joints.

Nymph: Unknown

Distribution: British Columbia

No specimens of this species were examined.

GENUS SIPHONURUS EATON

Siphonurus, Needham, 1935, The Biology of Mayflies, 460 (Bibliography)

Adult:

Male and female similar, appearing annulate often; eyes of male large, usually contiguous apically, not divided. Eyes of both sexes with a transverse band, of different colour than the eye, obliquely across eye; foreleg of male as long or slightly longer than body; first fore tarsal joint of male $3/4$ to $7/8$ of or subequal to second; first and second joints of fore tarsus with blunt spine-like processes on margins; sharp spines on margin of fore tibia, and margins and tips of middle and hind tarsi; claws similar, sharp-pointed; hind tarsus longer than hind tibia; forewing long and narrow,

three times as long as wide; hind wing less than twice as long as wide; venation dark; hemeral cross vein strong and dark; stigmatic crossveins frequently anastomosed; costal angulation of hind wing merely a rounded elevation; median vein forked about $1/3$ the distance from the base to the outer margin; abdominal tergites with dark triangles with bases on posterior margins, and apices not quite attaining anterior margins, also dark oval submedian spots on anterior margins in anterior segments, but near center in apical segments; sternites with dark U-shaped marks, lateral dark triangles which may or may not be united at bases, or a continuous or discontinuous dark median line, with one or two pairs of small dots near it; forceps base very long, slightly concave in its apical margin; basal joint of forceps an imperfectly separated ring-like enlargement of the long joint; two distal joints together not longer than the long joint; the inner apical margin of the basal joint often extended laterally beyond the base of the long joint; penes complex, consisting usually of paired ventral and dorsal chitinized portions, of which one pair completely overlies the other; from beneath, the penes not usually seen above the apical margin of forceps base; subanal plate of female broad, convex in its apical margin.

Nymph:

Compressed, streamlined body; maxillary and labial palpi 3-jointed; maxilla conical at apex, with a few simple hairs and spines on outer and inner margins; frontal margin of labrum entire and

slightly concave; no spines on head or pronotum; claws long and slender, not pectinate, mesothoracic and metathoracic claws not longer than the prothoracic claws; well-developed postero-lateral spines on the thin flattened lateral margins of the abdominal tergites; gills large and platelike, retuse on apical margins; tracheation abundant; gills double on segments 1 and 2 or on segments 1-7; lamellae equal in size, except on segment 7.

Genotype: Siphonurus flavidus (in Baetis) Ed. Pictet

SIPHONURUS

Key To Adults

1. Abdominal sternites largely dark.....2.
Abdominal sternites largely pale.....3.
2. Costal intercalaries joining Cul to hind margin of forewing
forked.....sp. 1
Costal intercalaries joining Cul to hind margin of forewing
not forked.....autumnalis McD
3. No U-shaped marks on abdominal sternite.....sp. 2
U-shaped marks on abdominal sternites.....4.
4. U-shaped marks on sternites 8-9 diffused and poorly defined.
Pale ruddy spot on rear of mesonotum.....columbianus McD
U-shaped marks clearly defined on sternites 8-9. No ruddy spot
on mesonotum.....occidentalis Eaton

Key To Nymphs

1. Legs unbanded. Wide pale vertical band between antennae bases.
Gills on segments 1-2 double.....2.

- Legs banded. No pale band between antennae bases. Gills
double on segments 1-2 or segments 1-7.....4.
2. Tails pale, with dark proximal and medial transverse bands.
Small U-shaped dark markings on sternites. All tergites
darkly patterned.....sp. 4
- Tails pale, with a dark medial transverse band. Venter of
abdomen with no dark markings. All tergites not darkly
patterned.....3.
3. Tergites 2, 3, 6, 7, and 9 predominantly darkly patterned, others
pale. Gill tracheation pale.....sp. 3
- All tergites with a pale median triangular and pale lateral
markings. Gill tracheation dark.....sp. 5
4. Gills double on segments 1-2 only.....occidentalis Eaton
Gills double on segments 1-7.....5.
5. Tails unbanded. No pattern on tergites or sternites.....sp. 6
- Tails banded. Tergites or sternites patterned.....6.
6. Tails pale, with a very narrow dark medial band. Lateral transverse
dark bands on all tergites except 5 and 8, which are pale.
Sternites unicoloured. Dorsal gills patterned.....sp. 7
- Tails not as above. All tergites dark. Sternites patterned.
Gill tracheation dark.....7.
7. Tails pale, with proximal, medial, and apical dark transverse
bands. Sternites with two small dark oblique lines and
two medial and two lateral dark spots. Medial dark line
on venter.....sp. 8

Tails pale, with medial and apical dark transverse bands.

Sternites with dark submedial elongate spots. Tergites

dark with dark transverse lateral bands.....sp. 9

Unknown

S. autumnalis McD

S. columbianus McD

SIPHONURUS AUTUMNALIS McDUNNOUGH

Siphonurus autumnalis McDunnough, Needham, 1935, The Biology of
Mayflies, 467. (Bibliography)

Adult:

A large dark species; head and mesonotal scutellum and sternum blackish; pronotum deep smoky; mesonotum dark brown, pleural sutures pale yellowish; wings hyaline; venation deep brown; costal crossveins in basal 2/3 of costal space weak; stigmatic crossveins heavy and strongly anastomosed; abdominal tergites deep purplish brown; anterior triangles tinged with yellow; lateral margins, especially of the four apical segments, narrowly yellowish; sternites deep purplish brown, posterior margins narrowly yellowish; postero-medial area of sternite 9 yellowish; apical margin of forceps base weakly excavated.

Nymph: Unknown

Distribution: Alberta, British Columbia

Material Examined:

1 Male, British Columbia: Barkerville, VII.7.48. (H.R. McCarthy)

SIPHONURUS COLUMBIANUS McDUNNOUGH

Siphonurus columbianus McDunnough, Needham, 1935, The Biology of
Mayflies, 469 (Bibliography)

Adult:

A large dark species; pale ruddy spot anterior to black mesothoracic scutellum; wings hyaline; faint brownish tinge in stigmatic area; venation blackish; abdominal tergites deep purplish brown, anterior tergites yellowish; sternites dull yellowish; U-shaped marks purplish brown, diffuse and poorly defined on sternites 8 and 9, sternite 10 wholly brown; two tiny dots usually near center of each sternite; tails dark basally, paler distally; joinings brown.

Nymph: Unknown

Distribution: British Columbia, California

No specimens of this species were examined.

SIPHONURUS OCCIDENTALIS EATON

Siphonurus occidentalis Eaton, Needham, 1935, The Biology of
Mayflies, 473 (Bibliography)

Adult:

A large reddish and yellowish brown species; head and thorax yellowish brown; pronotum dark brown, grey laterally; mesonotal scutellum and lateral margins dark reddish brown, yellow areas anterior to mesonotal and metanotal scutella; antero-lateral corners of mesonotum and pleural sutures yellowish, often with orange

markings; white bands across mesa and metasterna; wings hyaline; venation purplish black; longitudinal veins heavier; thickened areas on bulla, Sc, R, and first division of Rs; narrow brown shading at base of forewing, costal and subcostal crossveins pale; stigmatic crossveins numerous, often forking near costal margin; median portion of each abdominal tergite yellowish brown; lateral triangles dark, prominent, confined to postero-lateral angles and lateral margins; dark oval spots conspicuous and reddish brown; pale areas semi-hyaline; all tergites pale on posterior margins; apical tergites marked with yellow, often with powdery areas; U-marks on sternites conspicuous, the arms may be united posteriorly by a brown crescentic or straight transverse band; two small dark spots within each U-mark, anterior to center; tails dark purplish brown basally, rest yellowish or whitish, joinings slightly darker.

Nymph:

Legs banded alternately light and dark; dark U-shaped markings on each abdominal sternite; gills double on segments 1 and 2 only; tails pale, dark banded at tip only.

Distribution: British Columbia

Material Examined:

1 (?) British Columbia: Jesmond, VIII.29.37 (J.K. Jacob)

Siphonurus sp. 1

Adult:

A very large dark species; head and thorax dark brown; forewings

with forked intercalaries joining Cul to hind margin; abdominal tergites and sternites black with yellow posterior margins; no U-shaped dark markings on sternites.

Nymph: Unknown

Distribution: British Columbia

Material Examined:

1 Female, British Columbia: Cowichan, VI.20.49 (G.S. Brown)

Siphonurus sp. 2

Adult:

Wings hyaline, unpatterned; abdominal tergites 3-6 only pale yellowish brown, each with two submedial triangles brown; tergites 1-2 and 7-10 brown, posterior borders black; sternites 2-8 pale, with dark ganglionic markings, 9-10 dark brown; no U-shaped markings; tails pale, darker at joinings.

Nymph: Unknown

Distribution: British Columbia

Material Examined:

1 Male, British Columbia: Trinity Valley, VII.2.43 (C.V. Morgan)

Siphonurus sp. 3

Adult: Unknown

Nymph:

A wide pale vertical band between antennae bases; legs unbanded; abdominal tergites 2, 3, 6, 7, and 9 predominantly darkly patterned,

others pale; gills double on segments 1 and 2 only; tracheation pale; no U-shaped markings on sternites; tails pale, with a dark median transverse band.

Ecology:

Nymphs of this species were taken from the edge of the Alouette River at a depth of 1 to 2 feet. The current was slow and the river bed consisted of a mixture of coarse and fine gravel, sand, mud, and organic silt and debris. All specimens were taken during mid-June.

Distribution: British Columbia

Material Examined:

7 Nymphs, British Columbia: Alouette River (Haney, B.C.) VI.?.59 (N. Filmer), Canim Lake, VI.27.61 (G.G.E. Scudder).

Siphonurus sp. 4

Adult: Unknown

Nymph:

Wide pale band between antennae bases, legs unbanded; all tergites darkly patterned; U-shaped markings on sternites; gills double on segments 1 and 2 only; tracheation dark; tails with proximal and median dark bands.

Distribution: British Columbia

Material Examined:

2 Nymphs, British Columbia: Canim Lake, VI.27.61 (G.G.E. Scudder)

Siphonurus sp. 5

Adult: Unknown

Nymph:

Wide pale band between antennae bases; legs unbanded; tergites with pale triangular and lateral marks; no marks on sternites; gills double on segments 1 and 2 only; tracheation dark; tails with dark median band.

Distribution: British Columbia

Material Examined:

1 Nymph, British Columbia: Canim Lake, VI.27.61 (G.G.E. Scudder)

Siphonurus sp. 6

Adult: Unknown

Nymph:

Legs banded; no pattern on tergites or sternites; gills double on segments 1 to 7; no tracheation; tails unbanded.

Distribution: British Columbia

Material Examined:

6 Nymphs, British Columbia: Nicola Creek.

Siphonurus sp. 7

Adult: Unknown

Nymph:

Legs banded; tergites with lateral transverse dark bands; tergites 5 and 8 pale; sternites unicoloured, with no pattern; gills double on segments 1 to 7, dorsal gills patterned; tails with a very narrow

dark medial band.

Distribution: British Columbia

Material Examined:

19 Nymphs, British Columbia: Nicola Creek.

J Siphonurus sp. 8

Adult: Unknown

Nymph:

Legs banded; tergites darkly patterned; sternites with two small oblique lines and two medial and two lateral dark spots, spots may be paler; dark medial line on sternites; gills double on segments 1 to 7; tracheation dark; tails with proximal, medial and apical dark bands.

Distribution: British Columbia

Material Examined:

4 Nymphs, British Columbia: nr. Rock Lake, VII.16.62 (G.G.E. Scudder).

Siphonurus sp. 9

Adult: Unknown

Nymph:

Legs banded; abdominal tergites dark with darker lateral transverse bands; sternites with dark submedial elongate spots; gills double on segments 1 to 7; tracheation dark; tails with median and apical dark bands.

Distribution: British Columbia

Material Examined:

6 Nymphs, British Columbia:

5 Brunson Lake, VI.25.61 (G.G.E. Scudder)

1 Williams Lake, VI.24.61 (G.G.E. Scudder)

SUBFAMILY HEPTAGENIINAE

Adult:

Eyes of males simple; hind tarsi with five freely movable joints; wing venation plentiful in both wings; two parallel pairs of cubital intercalaries, unattached basally, in forewing, the pair nearest the hind angle is longer; outer fork of Rs of hind wing present; forceps 4-jointed.

Nymphs:

Flattened, protectively coloured nymphs; heads strongly depressed; eyes lateral; labrum considerably wider than long; mandibles slender in basal half; two canines, the outer longer than the inner; canines scoop-shaped, margins more or less crenate, may be one or two sharp spines on tip of inner canine; lacinia present or absent, if absent, a row of hairs often in lacinial region; maxillary palpi two-jointed, distal joint often thickly set with apical spines; inner margin of galea-lacinia with a fringe of long hairs usually a second row parallel to these a short distance back from margin; upper margin or crown of galea-lacinia with spines or hairs, or both; labial palpi similar to maxillary palpi; gills present on abdominal segments 1-7; gills double, consisting of a dorsal lamellate and a ventral fibrillan portion, latter may be wanting, much reduced, or pushed upwards to appear to lie dorsal to lamellate portion.

SUBFAMILY HEPTAGENIINAE

Key To Adults

1. Basal joint of fore tarsus of male not as long as second joint.....2.
Basal joint of fore tarsus of male equal to or slightly longer than second joint.....Epeorus Eaton
2. Basal joint of fore tarsus of male $2/3$ to $3/4$ as long as second joint.....3.
Basal joint of fore tarsus of male $1/6$ to $1/2$ as long as second joint.....4.
3. Stigmatic area of forewing divided by a fine line into an upper and lower series of cellules. Basal costal crossveins very weak.....Cinygma Eaton
Stigmatic area of forewing not divided by a fine line into an upper and lower series of cellules. Basal costal crossveins usually well-developed.....Cinygmula McD
4. Stigmatic crossveins more or less anastomosed. Eyes of male usually contiguous.....Rithrogena Eaton
Stigmatic crossveins not anastomosed. Eyes of male not contiguous.....5.
5. Basal joint of fore tarsus of male $1/6$ to $1/3$ as long as the second joint. Penes not distinctly L-shaped. Stigmatic crossveins not slanted.....Heptagenia Walsh
Basal joint of fore tarsus of male $1/3$ to $1/2$ as long as the second joint. Penes more or less distinctly L-shaped. Stigmatic crossveins variably slanted.....Stenonema Traver

Key To Nymphs

1. Three tails.....2.
Two tails.....Epeorus Eaton
2. Gills of seventh pair of gills flat and plate-like, quite similar to preceding pairs. Tracheae with lateral branches always present in seventh pair. Either spines or hairs on crown of galea-lacinia, but not both.....3.
Gills of seventh pair of gills reduced to a single slender tapered filament on spine. Tracheae, if present in this filament, without lateral branches. Both spines and hairs on crown of galea-lacinia.....Stenonema Traver
3. Gills of first and second segments smaller than rest, all gills directed laterally, or dorsally and laterally, not converging beneath body. Fibrillar gills ventral.....4.
Gills of first and last segments much enlarged, converging beneath body of nymph. Fibrillar gills dorsal.....
.....Rithrogena Eaton
4. Fibrillar portion of gills well developed on segments 1 to 6, may be wanting on segment. Front of head entire or very slightly emarginate.....5.
Fibrillar portion of gills reduced to a few tiny threads.
Front of head distinctly emarginate.....Cinygmula McD
5. A chitinized area on each mandible below molar region. Inner canine 1/2 as long as outer. Hairs on crown of galea-lacinia. Lateral spines absent. Labrum extending not more than 1/4 distance along anterior margin of head.....Cinygma Eaton

No chitinized area on mandible. Inner canine at least $3/4$ as long as outer. Spines on crown of galea-lacinia. Labrum extending $2/3$ to $3/4$ distance along anterior margin of head.....Heptagehia Walsh

GENUS CINYGMA EATON

Cinygma, Needham, 1935, The Biology of Mayflies, 365 (Bibliography)

Adult:

Eyes of male not contiguous; fore leg of male as long as body; femur slightly shorter than tibia, which is about $1/2$ the length of the tarsus; basal fore tarsal joint $2/3$ to $3/4$ as long as the second, which is subequal to third; fourth joint about $3/4$ as long as the third; fifth joint $1/2$ as long as first; in hind tarsus basal joint slightly longer than second; fifth joint slightly longer than basal joint; all claws dissimilar; stigmatic area of forewing divided by a fine line into a series of small costal and larger subcostal cells; basal costal crossveins very weak; stigmatic crossveins slanted; posterior branch of M in forewing forms almost a right angle at its union with the anterior branch; outer fork of Rs of hind wing present; apical margin of forceps base not deeply excavated; forceps 4-jointed, united almost to base; a pair of small median spines on bases of penes, and a smaller spine on each division, below apex; posterior margin of subanal plate in female retuse.

Nymph:

Front of head entire or slightly emarginate; labrum extending not more than $1/4$ the distance along the anterior margin of the

head; mandible not visible dorsally; a chitinized area basad of molar area of each mandible; inner canine 1/2 as long as outer; hairs on crown of galea-lacinia; maxillary palpi usually not visible dorsally; glossae of labium distinctly triangular; gills on all segments directly laterally, 1st pair and 7th pair smaller than others; no fingerlike projections on gill lamellae; fibrillar portion of gills well developed on segments 1-6, may be wanting on segment 7, longer than lamellae on segment 1; all fibrillar portions ventral; three tails.

Genotype: Cinygma integrum Eaton

CINYGMA INTEGRUM EATON

Cinygma integrum Eaton, Spieth, 1941, Ann. Ent. Soc. Amer., 34:88

(Bibliography)

Adult:

Reddish-brown species; wings hyaline, tinged with faint greyish in stigmatic area and basal area; venation dark brown; abdominal tergites paler hyaline; tergite 2 purplish brown; tergites 3-7 with a median purple-brown stripe and a pair of submedial stripes, a pale crescentic area between these and the median stripe; sternite with pale purplish brown tinge or light burnt-umber.

Nymph: Unknown

Distribution: Oregon, British Columbia

No specimens of this species were examined.

GENUS CINYGMULA McDUNNOUGH

Cinygmula, Needham, 1935, The Biology of Mayflies, 384 (Bibliography)

Adult:

Eyes of male not contiguous, but separated only by a space less than $1/3$ the shorter diameter of the eye; fore leg of male longer than male; of female, as long as the body; fore femur of male $3/4$ as long as tibia; which is $2/3$ to $3/4$ the length of the tarsus; basal fore tarsal joint $2/3$ to $3/4$ the length of the second, basal joint of hind tarsus in both sexes slightly longer than the second joint, distal joint equal to first and second combined; fore claws in male blunt, dissimilar in middle and hind legs of male, on all legs of female; stigmatic area of forewing not divided by a fine line into an upper and lower series of cellules; stigmatic crossveins usually not anastomosed, but stunted, basal costal crossveins usually well-developed; outer fork of Rs of hind wing present; penes rod-like, separated almost to base; a pair of short spines, often outcurved slightly, usually on inner apical margin, often a single spine on each lower outer margin; subanal plate of female with a V-shaped cleft in apical margin.

Nymph:

Front of head emarginate, exposing mouthparts when viewed dorsally; mandible not visible dorsally; inner canine $1/4$ the length of the outer; spines on crown of the lacinia-galea; gills on segments 1-7, direct laterally; gills on segment 1 largest fibrillar portion ventral, reduced to a few tiny threads; no fingerlike projections on lamellae; postero-lateral margins of abdominal tergites

slightly produced; tails three.

Genotype: Cinygmula ramaleyi (Ecdyurus) Dodds.

CINYGMULA

Key To Adults

1. Crossveins margined with brown.....2.
Crossveins not margined.....3.
2. Crossveins in costal half of forewing only slightly margined
with brown. Wings tinged with amber at base and along
costal margin of both wings.....gartrelli McD
Crossveins very fine and brown, more distinct in pterostigmatic
area. Wings hyaline with traces of blackish shading at
extreme base.....kootenai McD
3. Ventral medial marks absent.....mimus (Eaton)
Ventral medial marks present.....4.
4. One or more spines subapically on each division of penes,
on inner margins.....5.
Lateral spines present on lower outer margins of penes.....
.....par (Eaton)
5. Two lobes at apex of each division of penes, the longer directed
laterally.....ramaleyi (Dodds)
A single well-defined lobe on apex of each division of
penes.....uniformus (McD)

Key To Nymphs

1. Apical abdominal tergites same colour as the others.....sp. 1
Apical abdominal tergites paler than the others.....2.
2. Apical abdominal tergites white. Femora brown with a pale

L-shaped or V-shaped longitudinal mark on each basal half....3.

Apical abdominal tergites may be paler than the preceding ones,

but each has a narrow dark anterior margin. Femora ochreous,

with two broad brown bands.....uniformis (McD)

3. Pale femoral mark L-shaped.....ramaleyi (Dodds)

Pale femoral mark V-shaped.....sp.2

Unknown:

Cinygmula gartrelli McD

Cinygmula mimus (Eaton)

Cinygmula par (Eaton)

Cinygmula kootenai McD

CINYGMULA GARTRELLI McDUNNOUGH

Cinygmula gartrelli McDunnough, Needham, 1935, The Biology of Mayflies,

388 (Bibliography)

Adult:

A medium sized brown species; a wine-coloured patch anterior to base of forewing from which a pale ochreous dash projects towards the pronotum; wings hyaline; tinged with amber at base and along costal margin; crossveins in costal half of forewing only slightly margined with brown; abdominal tergite 1 deep brown; tergites 2-7 pale semi-hyaline, posterior portions deep reddish brown; tergites 8-10 opaque dark brown, with pale lateral patches on tergites 8 and 9; sternites light-yellowish brown with posterior margins, and often the three apical segments, faintly tinged with reddish; faint ganglionic markings; a single well defined lobe on apex of each division of penes, each with a small ventral spine

on the inner margin; median apical spines slightly serrate on outer margins.

Nymph: Unknown

Distribution: British Columbia

No specimens of this species were examined.

CINYGMULA KOOTENAI McDUNNOUGH

Cinygmula kootenai McDunnough, McDunnough, 1943, Can.Ent. 75:3

(Bibliography)

Adult:

Wings hyaline; with traces of blackish shading at extreme base; venation fine, brown; 4 or 5 extremely faint crossveins before the bulla; stigmatic crossveins more distinct, with only an occasional trace of anastomoses; penes bent outward in apical half; the very distinctive stimuli are very long, thin, and curved inwards in their apical portions.

Nymphs: Unknown

Distribution: British Columbia

No specimens of this species were examined.

CINYGMULA MIMUS (EATON)

Cinygmula mimus (Eaton), Spieth, 1941, Ann. Ent. Soc. Amer., 34:89

(Bibliography)

Adult:

A large purplish brown species; pale yellowish or creamy areas anterior and ventral to wing bases; wings hyaline, tinged with amber, especially on hind wing and basal half of forewing; venation light yellowish or reddish brown; no margined crossveins; claws of forelegs

of male similar; abdominal tergites 2-7 semi-hyaline, pale purplish to light brown, anterior margins colourless, posterior margins narrowly darker, tergites 8-10 opaque, yellowish brown, tinged with purplish or brown; sternites similar to tergites, but paler; no ventral medial markings; penes divergent almost from base, each division with a single well-defined lobe at apex; no ventral sub-apical spines, but each penis with a single spine on inner margin.

Nymph: Unknown

Distribution: Utah, Wyoming, Montana, California, British Columbia.

No specimens of this species were examined.

CINYGMULA PAR (EATON)

Cinygmula par (Eaton), Spieth, 1941, Ann. Ent. Soc. Amer., 34:89

Mayo, 1952, Pan. Pac. Ent. 28:182 (Bibliography)

Adult:

A medium sized light brown species; claws of foreleg of male dissimilar; wings hyaline, may be faintly tinged with pale grey, darker at base and at stigma, brownish at extreme base; venation yellowish brown; no margined crossveins; abdominal tergites 2-7 semi-hyaline, light brown with pale dirty-whitish anterior margins, antero-lateral areas, narrow median and submedian streaks; streaks outlined in darker brown; tergites 8-10 opaque brown; sternites paler, ganglionic markings on sternites 3-7 sepia-brown; penes each with a large spine on lower outer margins and a smaller spine on inner margin.

Nymph: Unknown

Distribution: British Columbia

No specimens of this species were examined.

CINYGMULA RAMALEYI (DODDS)

Cinygmula ramaleyi (Dodds), Needham, 1935, The Biology of Mayflies,
390 (Bibliography)

Adult:

A medium sized reddish and purplish brown species; thorax reddish brown, mesonotum yellowish brown with reddish brown median stripe and purplish brown postero-lateral areas; lateral areas of metanotum purplish brown; claws of foreleg of male similar; wings hyaline, amber tinged throughout; venation fine, reddish brown; no margined crossveins; abdominal tergites 2-8 light red-brown, semi-hyaline in anterior portions, rest purplish brown; tergite 2 with narrow hyaline anterior margin; tergite 3 with 1/3 of anterior portion hyaline; tergites 4-7 with anterior 1/2 of anterior portions hyaline; tergites 8-10 opaque red-brown; pale submedian streaks outlined in darker colour on basal tergites; sternites greyish, tinged with pale brown; pale red-brown ganglionic markings on sternites 7-9 only; penes with 2 lobes at apex of each division, the larger directed laterally; a curved spine subapically on inner margin only of each penis.

Nymph:

Femora brown with a pale L-shaped longitudinal mark on basal half of each; apical abdominal tergites white.

Distribution: Montana, British Columbia

No specimens of this species were examined.

CINYGMULA UNIFORMIS (McDUNNOUGH)

Cinygmula uniformis (McDunnough), Needham, 1935, The Biology of Mayflies, 392 (Bibliography).

Adult:

Wings hyaline, uniformly suffused with light amber; venation fine brown; no margined crossveins; abdominal tergites in C. gartrelli but brown posterior margin narrower, and anterior hyaline areas wider, and with no reddish tinges; apical tergites opaque, almost sepia-brown; tergite 8 with a narrow blackish posterior margin; sternites very pale ochreous, 8 and 9 light yellow-brown; ganglionic markings faint ruddy; each division of penes with a well-defined apical lobe, each bearing a small ventral subapical spine on the inner margin; median spines not serrate on outer margins.

Nymph:

Femora ochreous, each with 2 broad brown bands; apical abdominal tergites may be paler than the others, but each has a narrow dark anterior margin.

Distribution: British Columbia

No specimens of this species were examined.

Cinygmula sp. 1

Adult: Unknown

Nymph: All abdominal tergites unicoloured.

Ecology:

Specimens of this species were taken from the middle and edges of a number of locations on the Alouette River. The river bed in these locations varied from mud, through sand, gravel, and rocks, to large boulders. They were taken at a depth of 1 to 3 feet, although at one location, in quiet water, they were taken from a depth of 4 to 5 feet. The current varied from quiet to ripples to rapids and falls. The specimens were collected during the entire year.

Distribution: British Columbia

Material Examined:

3 Nymphs, British Columbia: Alouette River, VI.2.59 (N. Filmer)

3 Nymphs, Loon Cr. (H. Lorz).

Cinygmula sp. 2

Adult: Unknown

Nymph:

Identical to C. ramaleyi, but pale femoral markings distinctly V-shaped, rather than L-shaped.

Distribution: British Columbia

Material Examined:

3 Nymphs, British Columbia: nr. Hell's Gate, VI.19.59 (G.G.E. Scudder).

GENUS EPEORUS EATON

Epeorus Eaton, Eaton, 1881, Ent. Mon. Mag., 18:26 (Bibliography)

Adult:

Basal joint of fore tarsus of male equal to or slightly longer than the second joint; fore tarsus of male longer than the tibia, outer fork of the Rs of the hind wing present; apical margin of forceps base not deeply excavated; male forceps 4-jointed.

Nymph:

A flattened, sprawling species; maxillary palpi 2-jointed, 2nd joint less than 4 times the length of the galea-lacinia; fibrillar portion of each pair of gills present; no fingerlike projection of gill lamellae; claws not elongated; 2 tails.

SUBGENUS IRON EATON

Iron, Edmunds and Allen, 1957, Ann. Ent. Soc. Amer. 50 (4):319

Needham, 1935, The Biology of Mayflies, 392 (Bibliography)

Adult:

Eyes of male large, usually contiguous apically; posterior margin of head of female very slightly emarginate; posterior margin of pronotum somewhat excavated medially; fore leg of male as long as or slightly longer than the body; fore femur of male $\frac{2}{3}$ as long as the tibia, which is $\frac{3}{4}$ the length of the tarsus; fore femur of female only slightly shorter than the tibia; tarsus subequal to femur; in hind leg of both sexes, femur about $\frac{3}{4}$ the length of the tibia, tarsus about $\frac{1}{2}$ as long as femur; usually a prominent black mark in middle of femora, claws usually dissimilar; stigmatic crossveins of forewing not anastomosed; basal costal crossveins often weak and indistinct; second fork of Rs of hind wing arises basad of first fork; second joint of forceps longer than 3rd and 4th joints combined; penes usually united in the basal $\frac{2}{3}$; a pair of median spines on penes; apical margin of subanal plate of female emarginate medially.

Nymph:

Frontal and lateral margins of head expanded, completely covering the mouthparts; labrum small, $1\frac{1}{2}$ to 2 times as wide as long, antero-lateral corners rounded, anterior margin with small medial excavation; inner canine $\frac{1}{2}$ to $\frac{3}{4}$ as long as the outer one; lacinia-absent or represented by 2 to 3 short hairs; inner apical margin of galea-lacinia each with a triad of slightly incurved stout spines, each bearing a slender thread-like appendage at its apex; may be

5-7 slender spines at the bases of these spines; no spines along upper margins of maxillae; median portion of hypopharynx longer and narrower than lateral portions; glossae conical, may be slightly convergent apically; lateral margins of pronotum slightly dilated at or anterior to middle; leg joints fringed with hairs; femoral flange sharp pointed or blunt; claws with 3 to 6 lateral apical pectinations; abdominal tergites with a pair of spines at each posterolateral angle; fibrillar portion of each gill well developed, apparently dorsal; lamellate portion of each gill narrowly thickened along outer margin, which bears many minute spines; each gill overlaps the one behind it, outer margins pressed against the surface; anterior lobe of first gill well developed, may or may not meet beneath the body; gills of last segment usually approach one another beneath body.

Genotype: Iron longimanus Eaton

SUBGENUS IRONODES TRAVER

Ironodes, Edmunds and Allen, 1957, Ann. Ent. Soc. Amer. 50 (4): 319

Needham, 1935, The Biology of Mayflies, 413 (Bibliography.)

Adult:

Eyes of male small to moderate, usually not contiguous apically; posterior margin of head of female deeply emarginate; fore leg of male slightly longer than body; femur $\frac{2}{3}$ as long as the tibia; fore femur of female slightly longer than tibia; tarsus subequal to femur; in hind leg of both sexes, tibia slightly shorter than femur; male tarsus $\frac{1}{2}$ to $\frac{2}{3}$ the length of the tibia, female tarsus $\frac{1}{2}$ the length of the tibia; claws dissimilar; basal costal crossveins

strong; stigmatic crossveins numerous, simple, aslant; posterior branch of M in forewing forms almost a right angle with anterior branch; forks of Rs of hind wing arise at about the same point; media of hind wing forked about $1/3$ from base; second joint of forceps longer than 3rd and 4th combined, often more or less bowed near middle or in apical third; penes usually separated almost to base, somewhat compressed, elongate, divergent apically; a series of small spines on ventral surface of each division; apical margin of subanal plate of female slightly emarginate.

Nymph:

Lateral and frontal margins of head expanded, completely covering the mouthparts; frontal margin slightly emarginate medially, densely fringed with hairs; labrum $1-1/2$ to 2 times as wide as long, frontal margin widely excavated medially; antero-lateral angles slightly rounded, lateral margins sloping toward base; inner canines $3/4$ to $7/8$ as long as the outer ones; a few hairs in lacinial region; upper margins of mandibles slope sharply from bases of canines to molar surfaces; a thickened area below and subparallel to molar area; galea-lacinia with a fringe of long hairs on outer and upper margins; no triad of stout spines at tip, but a few slender straight spines; second joint of maxillary palpi clavate, many series of short spines curved at tips in apical half; glossae slightly concave in inner margin, strongly convex on outer, close together and slightly convergent apically; medial portion of hypopharynx much narrower and shorter than lateral portions; frontal margin of pronotum emarginate, lateral margins slightly expanded, posterior margin with a medial and 2 sub-medial emarginations; a transverse ridge $1/3$ distance from anterior margin of pronotum, dividing pronotum into a lower anterior $1/3$

and a higher posterior $2/3$; each coxa with two prominent flange-like projections; femoral flanges short and blunt; claws with pectinations near apex; gill-bearing abdominal segments only with very short blunt postero-lateral spines; tergites 1-9 with a row of submedial spines, each arising $1/3$ from anterior margins; fibrillar portion of gills well developed, apparently dorsal; lamellate portions small, obovate, first pair smallest, seventh pair slightly larger.

Genotype: Ironodes nitidus (in Iron) Eaton

SUBGENUS IRONOPSIS TRAVER

Ironopsis, Edmunds and Allen, 1957, Ann. Ent. Soc. Amer. 50 (4) : 319

Needham, 1935, The Biology of Mayflies, 420 (Bibliography)

Adult:

Large purplish brown species; eyes of male large, contiguous apically; posterior margin of head of female emarginate; posterior margin of pronotum deeply excavated medially; foreleg of male much longer than body; fore femur of male $3/4$ as long as tibia; fore femur of female almost as long as tibia; all claws dissimilar; stigmatic crossveins strongly anastomosed; may be a long intercalary between Cul and first set of paired intercalaries; forks of Rs of hind wing arise at about the same point; second joint of forceps not as long as 3rd and 4th combined; penes rod-like, divergent at tips; a cluster of small spines on ventral surfaces of each penis some distance below apex; apical margin of subanal plate of female with a V-shaped median cleft.

Nymph:

Frontal margin of head and lateral margins anterior to eyes expanded; frontal margin very slightly emarginate medially; canines

wider and blunter than in Iron; a row of hairs in lacinial region of each mandible; a thickened area below and parallel to molar area of each mandible, and another below this, on inner margin, at right angles to molar area; glossae conical, divergent apically, widely separated at base; a triad of stout spines at tip of galea-lacinia; labrum deflexed, antero-lateral angles angulate, not rounded, frontal margin not emarginate; antero-lateral angles of pronotum rounded; femora, tibiae and tarsi with fringes of long hairs, claws with three lateral pectinations near apices; abdominal tergites with postero-lateral expansions short and blunt; gills of 1st segment enlarged, anterior lobes meeting beneath the body; intermediate gills well-developed, thickened on outer margins, and overlapping those behind them; seventh gills meet beneath the body; fibrillar portion of gills short, not prominent, apparently dorsal.

Genotype: Ironopsis grandis (in Iron) McDunnough

EPEORUS

Key To Adults

1. Basal costal cross veins of forewing weak. Eyes of male usually contiguous.....2.
Basal costal cross veins of forewing strong. Eyes of male not contiguous.....Ironodes Traver 3
2. Stigmatic cross veins slanting. Stigmatic cross veins of fore wing more or less strongly anastomosed, sometimes forming 2 series of cellules.....Ironopsis Traver 4
Stigmatic crossveins not slanting. Stigmatic crossveins of forewing not anastomosed.....Iron Eaton 5
3. Wing membrane faintly amber-tinged, stigmatic area smoky.

- Mesonotum black-brown.....flavipennis Traver
4. Mesonotum light brown. Small spines on ventral surface of penes relatively few in number.....grandis (McD)
- Mesonotum black-brown. Small spines on ventral surface of penes very numerous.....permagnus Traver
5. Abdominal tergites 2-7 yellowish, tergites may be faintly smoky. Thoracic pleurae with distinct blackish markings. Genitalia of albertae type (fig. 3).....dulciana McD
- Abdominal tergites 2-7 brown. No dark marks on pleurae. Genitalia not of albertae type.....6.
6. Venation dark brown. Genitalia of deceptivus type (fig. 3).....deceptivus (McD)
- Venation pale brown. Genitalia of longimanus (fig. 3) or of pleuralis type (fig. 3).....longimanus (Eaton)

Key To Nymphs

1. Triad of stout spines present at tip of galea-lacinia.....2.
- No triad of spines on galea-lacinia.....Ironodes Traver 3
2. Anterior margin of head entire. Median abdominal row of hairs poorly developed or absent. Anterior pair of gills variable. Gills usually thin and light, anterior and outer margins not noticeably darker.....Iron Eaton 4
- Anterior margin of head slightly emarginate. Dense row of long setae on median line of abdominal tergites. Anterior gills meet beneath the body. Gills thick and darkened, especially on the anterior and outer margins.....Ironopsis Traver 6
3. Body dark blackish brown. All joints of legs concolourous, no portion darker than the others.....flavipennis Traver
- All tergites unicoloured brown. Apical half of tarsi darker

- than the rest of the legs.....sp.1
4. Anterior lobes of first gills not greatly prolonged, and so
lack much of meeting beneath the the body. May or may not
be a wedge-shaped pale mark on the median line of the meso-
notum.....5.
Anterior lobes of first gills meet beneath the body. No pale
median line on mesonotum.....7.
5. Wedge-shaped pale mark on median line of mesonotum present,
widest near anterior margin.....deceptivus (McD)
Wedge-shaped pale mark on median line of mesonotum absent...sp. 5
6. Three lateral pectinations near apex of each claw. Gills on
7th segment meet beneath the body.....grandis (McD)
No lateral pectinations near apex of each claw. Gills on 7th
segment do not meet beneath the body.....permagnus Traver
7. Anterior margin of all sternites with a dark transverse streak
on each side of the median line. Two dark small dots near
middle of sternite 9. Three teeth on claw.....
.....longimanus (Eaton)
No dark streaks on sternites. No dark dots on sternit 9. Less
than three teeth on the claw.....8.
8. Medial projection of anterior lobe of the first pair of gills
narrow and pointed. Gills separated.....9.
Medial projection of anterior lobes of first pair of gills broadly
rounded. All gills overlapping to form a light suction
disc.....sp. 2
9. Legs not banded.....sp. 3
Legs banded.....sp. 4

Unknown:

Iron dulciana McDunnough

EPEORUS DECEPTIVUS (McDUNNOUGH)

Epeorus deceptivus (McDunnough), Needham, 1935, The Biology of May-flies, 399 (Iron) (Bibliography)

Adult:

A light brown species; no markings on femora; foreleg of male much longer than body; tibia slightly more than 1-1/2 as long as femur; wings hyaline, venation fine, light brown; may be a faint brown stain in stigmatic area; costal crossveins in basal area indistinct; abdominal tergites 2-7 semi-hyaline, 8-10 opaque; anterior portions pale brown; posterior portions purplish brown; posterior margins and anterior projections from them darker purplish brown; 8-10 may have opaque pinkish white markings; sternites paler; small oval brown ganglionic markings; penes may be widened subapically, lateral lobes prominent, or may be long, slender, finger-like, lateral lobes folded flat and barely noticeable; median spines long, slender and slightly incurved.

Nymph:

Wedge-shaped pale mark on median line of mesonotum, widest portion near the anterior margin; flange on femora 2 and 3 blunt at tip; anterior lobes of 1st pair of gills not greatly prolonged or meeting beneath the body; outer postero-lateral spines on the middle abdominal tergites short and blunt, not more than 1/4 as long as the tergite, and about as long as their width at base.

Distribution: British Columbia

No specimens of this species were examined.

EPEORUS DULCIANA (McDUNNOUGH)

Epeorus dulciana (McDunnough), Needham, 1935, The Biology of Mayflies, 401 (Iron) (Bibliography)

Adult:

Head yellowish, red patches on head, lateral areas of anterior portion of mesonotum; femora with median blackish spots and narrow apical red-brown bands; fore femur slightly shorter than tibia; wings hyaline; venation yellowish in male, crossveins, except in stigmatic area, indistinct; humeral crossveins near subcosta black; in female, venation fine, dark brown, crossveins distinct; abdominal tergites yellowish to olive brown, posterior margins narrowly blackish; sternites paler.

Nymph: Unknown

Distribution: British Columbia

No specimens of this species were examined.

EPEORUS FLAVIPENNIS TRAVER

Epeorus flavipennis Traver, Needham, 1935, The Biology of Mayflies, 418 (Ironodes) (Bibliography)

Adult:

A dark brown species; eyes large, almost contiguous apically; head with deep red markings; a conspicuous creamy patch containing a narrow reddish streak anterior to base of forewing; a red spot above fore coxa; a smaller creamy patch anterior to base of hind wing;

wings hyaline, pale amber; venation dark brown except longitudinal veins of costal margin which are amber-brown; stigmatic area smoky brown; in female, entire wing deep greenish amber; abdominal tergites 2-7 semi-hyaline, dark brown with a faint red-brown tinge; anterior margins paler, posterior margins opaque dark brown; pleural fold narrowly dark brown; tergites 8-10 opaque deeper brown; sternite 9 bright red-brown.

Nymph:

Dorsally blackish brown; ventrally yellowish; legs concolourous with white marks basally on femora; gills purplish black; tracheae indistinct.

Distribution: British Columbia

No specimens of this species were examined.

EPEORUS GRANDIS (McDUNNOUGH)

Epeorus grandis (McDunnough), Needham, 1935, The Biology of Mayflies, 421 (Ironopsis) (Bibliography)

Adult:

A light brown species, with a darker abdomen; two prominent black lines in a light olive brown patch anterior to wing roots, fore femora blackish brown, paler at base, may be shaded with olive brown with faint black pencillings; wings hyaline; venation fine, dark; stigmatic area faintly brown-tinged; humeral crossvein faintly dark; crossveins strongly anastomosed; abdominal tergites deep brown with pale yellowish lateral margins and pale yellowish submedian spots on posterior margins of segments 4 to 8, smaller on tergite 4;

tergites 9 and 10 largely yellowish; pale areas may be obscured by reddish shading; sternites purplish brown, paler posteriorly; relatively few small spines on ventral surfaces of each division of penes.

Nymph:

Deep purplish brown species; lateral margins of pronotum yellowish fringe of long hairs on femur, tibia and tarsus; three lateral pectinations near apex of each claw; median areas of tergites 1 to 4 and 8 to 9 yellowish; sternite mahogany brown medially, pale laterally, with a series of dark lateral marks at the edges of the median dark areas; gills of 7th segment meet beneath the body.

Distribution: British Columbia, Alberta, California, Montana

No specimens of this species were examined.

EPEORUS LONGIMANUS (EATON)

Epeorus longimanus (Eaton), Spieth, 1941, Ann. Ent. Soc. Amer. 34:88

(Iron) (Bibliography)

Adult:

A pale brownish species; femora with a round black spot near middle; wings hyaline; venation light brownish amber; venation of hind wing paler; fore claws dissimilar; abdominal tergites 2-7 semi-hyaline, posterior margins and shading along mid-dorsal line purplish brown; the dark borders do not extend to the postero-lateral angles, but an oblique black line may extend from this band obliquely to the pleural fold; median line narrowly pale, with a darker streak on each side; pale submedian lunate marks lie on each side within the shaded areas; tergites 8-10 opaque; sternites pale yellow, nerve cord and ganglia whitish and opaque, sometimes traces of pale oblique sub-

median streaks on basal and middle segments; each division of penes with an erect apical lobe and a larger lateral lobe, bearing a sharp lateral spine; penes bear a median pair of strong spines with divergent tips.

Nymph:

Flange on femora 2 and 3 blunt at tip; three teeth on claws; outer postero-lateral spines on middle abdominal segments short and blunt, not more than 1/4 as long as the respective segments, and about as wide at their bases as long; anterior margins of all sternites with a dark transverse streak on each side of the median line; 2 dark small spots near the middle of sternite 9.

Distribution: Colorado, Wyoming, Utah, Montana, Alberta, British Columbia.

No specimens of this species were examined.

EPEORUS PERMAGNUS (TRAVER)

Epeorus permagnus (Traver), Needham, 1935, The Biology of Mayflies, 423 (Ironopsis) (Bibliography)

Adult:

A dark brown species; yellowish area containing a single short black streak anterior to roots of forewing; wings hyaline; longitudinal veins Sc, C and R thickened, dark reddish to purplish brown, except bases of Sc and R and base and apical third of C, which are yellowish; other longitudinal veins finer, light red-brown; crossveins fine, yellowish to pale red-brown; humeral crossvein pale; abdominal tergites yellowish to olive brown, with black-brown patches; tergites 2 and 3 with 2 large patches each, leaving pale lateral margins and median

line; tergites 4 and 5 with smaller patches, lateral margins irregular, median line obscured; tergites 6-8 with dark median triangles, apex pointing posteriorly, extending $3/4$ the length of each tergite, with a dark spot in each pale lateral area; tergites 9 and 10 reddish brown, anterior margins narrowly black; lateral black spots on 9, a black median line and median posterior margin on 10; sternites olive brown, basal sternites and sternite 8 shaded with red brown; sternite 9 deeper brown, intermediate sternites each with a round smoky spot near antero-lateral angles, spots in each sternite connected by a smoky transverse band; penes with numerous small spines on ventral surface of each division.

Nymph:

No lateral pectinations near apex of each claw; gills of 7th segment do not meet beneath the body.

Ecology:

Specimens of this species were taken from the middle and edge of a number of locations on the Alouette River. The stream bed varied from mud, through sand, gravel and large and small rocks, to boulders. The depth of the river in these locations varied from 1 to 3 feet, and the current was in most cases a moderate ripple, although specimens were also found in rapids and under falls, and in quiet water. The specimens collected in this latter location may have been washed there by the swifter water in the middle of the river. The specimens were collected during the entire year.

Distribution: Oregon, British Columbia

Material Examined:

2 Nymphs, British Columbia: Alouette River (Haney, B.C.)

VI.2.59 (N. Filmer); 1 Nymph, British Columbia: Alouette River
(Haney, B.C.) V.26.59 (N. Filmer).

Epeorus sp. 1

Adult: Unknown

Nymph:

Apical half of tarsi darker than the rest of the legs; tergites unicoloured brown, no tracheation on gills; general description as for subgenus Ironodes.

Distribution: British Columbia

Material Examined:

3 Nymphs, British Columbia: Loon Creek (Clinton), VI.16.56

(H. Lorz); 8 Nymphs, British Columbia: nr. Hell's Gate, VI.19.59
(G.G.E. Scudder).

Epeorus sp. 2

Adult: Unknown

Nymph:

Fringe on anterior margin of the frons; no pale median line on mesonotum; less than 3 teeth on each claw; no dark streaks or dots on the abdominal sternitis; anterior lobes of first pair of gills broadly rounded and meet beneath the body; all gills overlap the following pair; and last pair meet beneath the body to form a strong suction disc; other taxonomic characteristics as for the subgenus Iron.

Ecology:

Nymphs of this species were taken from the middle and edges of 5 locations on the Alouette River, always from a depth of one to two feet. The substrate consisted of gravel, rocks, boulders, and bedrock. In all cases except one, the current was very rapid. The exception was a quiet gravel-lined pool, into which the nymphs had no doubt been washed by the turbulence of the current. All nymphs were collected during June, August, and November.

Distribution: British Columbia

Material Examined:

3 Nymphs, British Columbia: Alouette River (Haney, B.C.) VI.2.59 (N.J. Filmer); 1 Nymph, British Columbia: Alouette River (Haney, B.C.) VIII.18.59 (N.J. Filmer); 1 Nymph, British Columbia: Loon Creek (Clinton), VI.16.59 (H. Lorz); 5 Nymphs, British Columbia: nr. Hell's Gate, VI.19.59 (G.G.E. Scudder); 8 Nymphs, British Columbia: Smith Falls Hatchery Creek, Cultus Lake, VI.12.? (H. Lorz).

Epeorus sp. 3

Adult: Unknown

Nymph:

Legs not banded alternately light and dark; less than 3 teeth on each claw; no pale line on mesonotum; gills lamellate, separated, not forming a suction disc; anterior lobe of 1st pair of gills narrow and pointed, meet beneath the body; abdominal sternites with no dark streaks or dots; general description as for subgenus Iron.

Ecology:

Nymphs of this species were collected from the middle and edges of a number of locations on the Alouette River. Generally they were taken at depth of one to two feet, although they were also taken at depths of two inches and five feet. The stream bed included mud, silt, sand, gravel, rocks, boulders, and bedrock. The current was usually rapid or ripply; although in two cases the water was quiet and slow. They were taken the year round.

Distribution: British Columbia

Material Examined:

2 Nymphs, British Columbia: Alouette River (Haney, B.C.)

VI.2.59 (N.J. Filmer)

Epeorus sp. 4

Adult: Unknown

Nymph:

Very similar to Epeorus sp. 3 but legs banded alternately light and dark; gills very large; postero-lateral angles of the abdominal tergites bear two sharp spines each.

Ecology:

This species was taken from the middle of 3 locations on the Alouette River, all at a depth of one to two feet. The substrate consisted of gravel, rocks, boulders, and bedrock. In all cases the current was rapid. All specimens were collected in August.

Distribution: British Columbia

Material Examined:

2 Nymphs, British Columbia: Alouette River (Haney, B.C.),
VIII.26.59 (N.J. Filmer).

Epeorus sp. 5

Adult: Unknown

Nymph:

Very similar to E. deceptivus, but lacking the wedge-shaped pale mark on the mesonotum.

Distribution: British Columbia

Material Examined:

3 Nymphs, British Columbia: nr. Hell's Gate, VI.19.59, (G.G.E. Scudder)

GENUS HEPTAGENIA WALSH

Heptagenia, Needham, 1935, The Biology of Mayflies, 335 (Bibliography)

Adult:

Eyes of male usually large, not contiguous apically, pronotum deeply excavated on posterior margin medially; fore leg of male longer than body; of female, about $3/4$ the length of the body; fore femur of male subequal to or slightly shorter than the tibia; tarsus about $1-1/4$ times the length of the tibia; basal joint of fore tarsus of male $1/6$ to $1/3$ as long as the second joint; fore femur of female subequal to tibia; tarsus about $3/4$ the length of the tibia; basal tarsal joint about $1/2$ the length of the second joint; in hind leg of both sexes, tibia about $3/4$ the length of the femur; tarsus slightly more than $1/2$ the length of the tibia; all claws dissimilar; typical Heptagenine wing venation; stigmatic crossveins not anastomosed or slanted, Of of Rs of hind wing present; apical margin of forceps

base of male usually slightly emarginate medially, may be deeply emarginate, or convex; forceps 4-jointed; penes usually united in basal half or two-thirds, not distinctly L-shaped, distal portions divergent apically; usually each division with an apical lobe and a lateral lobe-like extension often bearing a prominent marginal spine; a pair of stout spines between divisions; one to three pairs of slender spines may be on or near the inner margin of each division, near apex; subanal plate of female well developed, obtusely or retusely rounded in its apical margin.

Nymph:

Head depressed, often large for body; front entire or very slightly emarginate; labrum more than four times as wide as long, extending $2/3$ to $3/4$ the distance along the anterior margin of the head; no chitinized areas on mandibles; inner canine of right mandible at least $3/4$ as long as the outer; canines subequal on left mandible; 2 or 3 blunt teeth at tip of each outer canine; lacinia of right mandible may be represented by a row of long hairs, of the left by a large slender spine, or on both mandibles by 2 or 3 long slender spines; pectinate spines on crown of galea-lacinia; maxillary palpi 2-segmented, second joint shorter than 4 times the length of the galea-lacinia and not visible dorsally; palpi slender, many long hairs near tip of distal joint; glossae of labrum strongly arched away from each other, may converge at tips; lateral spines of abdominal tergites variable; filamentous portion of gills well developed, directed ventrally; lamellate portions directed laterally, not converging beneath the body; 1st and 7th gills smaller than intermediate gills,

7th larger than the 1st; fibrillar portion may be wanting on segment 7; no fingerlike projections on gill lamellae; 3 tails, equal in length.

Genotype: Heptagenia flavescens Walsh

HEPTAGENIA

Key To Adults

1. Abdominal tergites pale.....2.
Abdominal tergites patterned with brown or purplish-brown.....3.
2. Abdominal tergites pale creamy to yellowish white, 2-6 semi-hyaline, 7-10 opaque, the latter more distinctly hyaline. Within the dark band on each sternite are two pale dots, one on each side of the median line near center of each sternite, and two pale oblique median dashes from anterior margin. Veins pale. Genitalia of simplicoides type (fig. 3).
.....simplicoides McD
Abdominal segments pale, 2-7 semi-hyaline, 8-10 opaque. Posterior margins of tergites 2-7 smoky grey or brownish, tergites 8-10 tinged with pink. Sternites pale yellowish. Veins black. Genitalia of elegantula type (fig. 3).....elegantula (Eaton)
3. Thoracic notum brown, with a deeper brown mid-dorsal stripe, most evident on anterior portion of mesonotum. Abdominal tergites very pale brownish, 2-7 with a dark purplish-brown median stripe enclosing a pale narrow mid-dorsal line, on posterior margins a narrow dark band of the same colour, with submedian broad dark bands projecting forward from it, but not attaining the anterior margin. The dark dorsal and submedian stripes may coalesce to form a simple dark

shading, or with paler lunate marks submedially from the anterior margin. Tergites 8-10 opaque, light reddish brown.

Sternites pale.....solitaria McD

Not as above.....4.

4. Thoracic notum light brown, with two purplish patches on the pleura anterior to mesothoracic wing bases. Tergites pale brown with a purplish tinge, 7-10 dark purplish-brown.

Sternites pinkish.....sp. 1

Not as above.....5.

5. Thoracic notum brown. All tergites brown with a pale area on lateral posterior borders. Sternites pale, with darker ganglionic markings.....sp. 2

Not as above.....6.

6. Thoracic notum brown. Tergites brown with a thin pale median line, flanked by two pale submedian dots. Sternites pale.....sp. 3

Thoracic notum dark brown. Tergites very dark brown, with no pale markings. Pale spot on midline of mesonotum.....sp. 4

Key To Nymphs

1. Pronotum widest at anterior margin. Filamentous portion of 7th pair of gills present. Claws lacking pectinations. No abdominal spines on segment 8.....3.
- Pronotum widest at or near the middle. Filamentous portion of 7th pair of gills wanting. Claws with or without pectinations. Segment 8 with or without abdominal spines.....2.

2. Claws with pectinations. Abdominal spines on Segment 8.

Tergites 8-10 largely dark.....simplicoides McD

Claws without pectinations. No abdominal spines on segment

8. Tergite 8 largely pale.....sp.4

3. Pale submedian streaks coalesce on tergites 8 and 9 to form a

large pale blotch on each.....elegantula (Eaton)

No pale submedian streaks.....4.

4. Tergites 8-10 or 9-10 completely pale. No pale spots on head.

Frontal plate does not extend beyond eyes.....sp. 5

Tergites 8 and 9 with pale blotches or completely dark. Pale

spots on head. Frontal plate extends beyond the anterior

half of the lateral edges of the eyes.....5.

5. Tergites 8 and 9 with pale blotches or completely dark. Large

pale spot between the bases of the antennae and anterior

margin of the head.....sp. 6

Tergites 8 and 9 dark. Four pale spots on the anterior and

lateral margins of the frontal plate.....sp. 7

Unknown:

Heptagenia solitaria McD

HEPTAGENIA ELEGANTULA (EATON)

Heptagenia elegantula (Eaton), Needham, 1935, The Biology of May-
flies, 345 (Bibliography)

Adult:

A yellowish species; thoracic notum pale yellowish; a median
reddish brown stripe on mesonotum; a black streak above middle and
hind coxae and a black dot posterior to hind coxae; wings hyaline;

costal margin of forewing may be tinged with pale lemon yellow, with greenish or bistre-grey; venation fine, black, except for yellow amber basal halves of Sc and R; humeral crossvein and costal crossveins thicker; a well marked black bulla; abdominal tergites pale; tergites 2-7 semi-hyaline with smoky grey or brownish posterior margins; tergites 8-10 opaque, tinged with pink; sternites pale yellowish; genitalia of elegantula type.

Nymph:

Pronotum widest at the anterior margin; pronotum with a wide pale median streak and pale lateral areas; claws lacking pectinations; no oblique dark lines on abdominal tergites; pale submedian streaks on tergites 8 and 9 coalesce to form a large pale blotch on each; no postero-lateral spines on tergites 6 to 8; filamentous portion of 7th pair of gills present.

Distribution: Colorado, Nebraska, Kansas, Montana, Utah, British Columbia.

No specimens of this species were examined.

HEPTAGENIA SIMPLICOIDES McDUNNOUGH

Heptagenia simplicoides McDunnough, Needham, 1935, The Biology of Mayflies, 361 (Bibliography)

Adult:

A pale yellowish species; thorax pale creamy to yellowish white; wings hyaline; venation pale; basal costal crossveins few in number, almost invisible; abdominal tergites creamy white to pale yellowish, 2-6 semi-hyaline, 7-10 opaque, with no semi-translucent patches or

dark markings; tracheae on tergites outlined in pale grey; genitalia of simplicoides type; median spines on penes not long, very slightly twisted at base only, no lateral spines near margin.

Nymph:

Head of normal size, width no more than pronotum, and head and thorax together no more than $3/4$ as long as the abdomen; no dark spots on frontal margin of head; pronotum widest at or near the middle; femora largely brown, with pale basal and distal spots and a pale median zigzag band; tarsus wholly dark brown; claws with pectinations; abdominal tergites with pale submedian markings obscured; tergites 8-10 largely dark; spines on postero-lateral angles of tergite 8, and perhaps also on 6 and 7; filamentous portion of 7th pair of gills wanting.

Distribution: Alberta, Washington, British Columbia

No specimens of this species were examined.

HEPTAGENIA SOLITARIA McDUNNOUGH

Heptagenia solitaria McDunnough, Needham, 1935, The Biology of Mayflies, 361 (Bibliography)

Adult:

A brown species; thoracic notum brown with a deeper brown middorsal stripe, particularly evident on mesonotum; short black streaks just above bases of middle and hind coxae, and above these, other black streaks in line with wing roots; these streaks may be obscured; wings hyaline; venation fine brown, except for basal halves of Sc and R which are thickened and pale yellowish; costal margin tinged with pale lemon yellow; crossveins thicker than longitudinals; abdominal

tergites very pale brownish; tergites 2-7 with a broad dark purplish brown median stripe enclosing a narrow pale mid-dorsal line; posterior margin dark purplish brown with broad submedian bands extending forward from this, but not attaining the anterior margin; these markings may be obscured and form a dark shading, or the pale submedian markings from anterior margin may be lunate; tergites 8-10 opaque, light reddish brown; sternites paler, no ruddy tinge; genitalia of pulla type (fig. 3); upper pair of median spines smaller than lower ones.

Nymph: Unknown

Distribution: Montana, Colorado, British Columbia

No specimens of this species were examined.

Heptagenia sp. 1

Adult:

Thorax light brown; a purplish patch anterior to each mesothoracic wing base; forelegs light brown; other legs yellow; abdominal tergites pale brown with a purplish tinge; tergites 7-10 dark purplish brown, sternite pinkish; tails yellow; genitalia with penes elongate, tubelike, each with two lateral sharp short spines from base of second division.

Nymph: Unknown

Distribution: British Columbia

Material Examined:

1 Female, British Columbia: Quesnel, VIII.2.48 (G.J. Spencer)

1 Female, British Columbia: Quesnel, VIII.13.48 (G.J. Spencer)

2 Males, British Columbia: Cowichan Lake, VI.12.35 (J.L. McHugh)

1 ?, British Columbia: Nanaimo, VI.11.35 (J.L. McHugh)

Heptagenia sp. 2

Adult:

Very similar to Heptagenia sp. 1; thorax and abdominal tergites brown, lacking the purplish tinge; pale area on postero-lateral angles of tergites; sternites pale, with dark ganglionic markings; all legs and tails pale; 2nd cubital intercalary bends forward basally toward 1st cubital intercalary; short spines on penes wanting.

Nymph: Unknown

Distribution: British Columbia

Material Examined:

- 1 Male, British Columbia: Quesnel, VIII.3.48, (G.J. Spencer)
- 1 Male, British Columbia: Lytton, VIII.23.31 (G.J. Spencer)
- 3 teneral adults taken at Lytton, British Columbia on VII.12.31 and one on VIII.23.31, by G.J. Spencer are probably of this species.

Heptagenia sp. 3

Adult:(Female)

Very similar to Heptagenia sp. 2, but pale markings on the abdominal tergites consist of a thin median line flanked on each tergite by 2 light dots; no ganglionic markings; crossveins on wings more numerous.

Nymph: Unknown

Distribution: British Columbia

Material Examined:

- 1 Female, British Columbia: Australian, VIII.15.48 (G.J. Spencer)

Heptagenia sp. 4

Adult: (Male)

Similar to Heptagenia sp. 3, but no pale areas on tergites;
a very dark brown species; pale spot on midline of mesonotum.

Nymph: Unknown

Distribution: British Columbia

Material Examined:

1 Male, British Columbia: Chilcotin, IX.22.62 (G.G.E. Scudder)

Heptagenia sp. 5

Adult: Unknown

Nymph:

Frontal plate does not extend beyond the eyes; no pale spots
on head; pronotum widest at anterior margin; claws lacking in pect-
inations; abdominal tergites with no pale submedian streaks; tergites
8-10 or 9-10 completely pale; filamentous portion of 7th pair of gills
present; no abdominal spines on tergite 8.

Distribution: British Columbia

Material Examined:

2 Nymphs, British Columbia: Alouette River (Haney, B.C.) II.15.60
(N.J. Filmer)

Heptagenia sp. 6

Adult: Unknown

Nymph:

Frontal plate of head extends beyond the anterior half of the
lateral edges of the eyes; large pale spot between the bases of the
antennae and the anterior margin of the head; pronotum widest at the

anterior margin; claws lacking in pectinations; abdominal tergites with no pale submedian streaks; tergites 8 and 9 may have pale blotches, or may be completely dark; no abdominal spines on tergite 8; filamentous portion of 7th pair of gills present.

Distribution: British Columbia

Material Examined:

1 Nymph, British Columbia: Alouette River (Haney, B.C.)

II.15.60 (N.J. Filmer)

Heptagenia sp. 7

Adult: Unknown

Nymph:

Frontal plate of head extends beyond the anterior half of the lateral edges of the eyes, four pale spots on the anterior and lateral margins of the frontal plate; pronotum widest at the anterior margin; claws lacking in pectinations; abdominal tergites with 2 pale spots laterally on each; tergites with no submedian pale streaks; tergites 8 and 9 dark; no abdominal spines on tergite 8; filamentous portion of 7th pair of gills present.

Ecology:

Specimens of this species were taken from the middle and edge of the Alouette River, from stream beds varying from silt, through sand, mud, gravel, rocks, boulders, to bedrock, at a depth of 1 to 2 feet. The majority were taken from the edges of the river. The current was quiet or rippley in these locations. All were taken from July 28 to August 11, 1959.

Distribution: British Columbia

Material Examined:

1 Nymph, British Columbia: Alouette River (Haney, B.C.) VII.28.59
(N.J. Filmer); 1 Nymph, British Columbia: Alouette River (Haney, B.C.)
VIII.11.59 (N.J. Filmer); 5 Nymphs, British Columbia: Nicola Creek

Heptagenia sp. 8

Adult: Unknown

Nymph:

Frontal plate of head extends beyond the eyes; three pale spots between the eyes and the antennal bases; pronotum widest near the middle; femora brown with the basal part pale and bearing a pale zigzag mark; tarsus brown with middle part pale; claws without pectinations; abdominal tergites brown; tergite 4 with a pale oblong patch on its posterior margin; tergite 8 largely pale; no abdominal spines on tergite 8; filamentous portion of 7th pair of gills wanting.

Distribution: British Columbia

Material Examined:

43 Nymphs, British Columbia: Nicola Creek.

GENUS RITHROGENA EATON

Rithrogena, Needham, 1935, The Biology of Mayflies, 369 (Bibliography)

Adult:

Medium to large, dark brown or reddish brown mayflies; eyes of male large, usually contiguous apically; posterior margin of pronotum deeply excavated medially; fore leg of male longer than body, of female, slightly less than or equal to length of body; fore femur of male $\frac{3}{4}$ the length of the tibia, which is $\frac{3}{4}$ the length of the tarsus; basal fore tarsal joint $\frac{1}{6}$ to $\frac{1}{4}$ the length of the 2nd joint; fore femur

of female $3/4$ the length of the tibia, which is about twice as long as the tarsus; basal fore tarsal joint $1/2$ the length of the 2nd joint; in hind leg of both sexes, tibia $1/4$ the length of the femur; tarsus $1/2$ or less than $1/2$ the length of the tibia; all claws dissimilar; typical Heptageinine wing venation; stigmatic crossveins anastomosed and slanted; basal costal and subcostal crossveins weak; Of of Rs of hind wing present; second fork of Rs usually arises basad of first fork; apical margin of forceps base of male usually slightly excavated medially, flanked by two slightly rounded projections; forceps 4-jointed, 2nd joint long and slender; penes usually rod-shaped, separated very near the base; spines usually present on penes; subanal plate of female well-developed, apical margin entire, usually obtusely rounded.

Nymph:

Head flattened and slightly deflexed; frontal margin entire and slightly emarginate medially; head widest at level of the anterior portion of the eyes; labrum 4 times as wide as long, anterior margin slightly emarginate medially; outer canines of mandibles at least twice the length of the inner ones, slanting obliquely inwards, and sharply truncate at their outer bases opposite the inner canines; lacinia replaced by a row of finely pectinate spines; crown of galea-lacinia bearing a series of pectinate spines; maxillary palpi 2-jointed, first joint dilated broadly near the base, 2nd joint stoutly clavate, oblique apically; shorter than 4 times the length of the galea-lacinia, bearing many parallel series of pectinate spines; glossae of labium conical, widely separated at base, usually slightly divergent apically;

lateral margins of pronotum flare slightly near anterior margin; posterior margin excavated medially; femur flattened, upper surface and margins bearing many minute spine-like processes, those on posterior margin longer; femur subequal to or slightly longer than tibia; tibia usually with a few short spines on median portion of upper surface and along margins; tibia more than twice the length of the tarsus; claws with a single stout spine $1/3$ the distance from the base on the inner margin and 2 or 3 smaller pectinations laterally near apex; abdominal tergites each bearing a short anterior and a blunt posterior spine-like process laterally near bases of gills; gills on segment 1-7, consisting of a lamellate and a fibrillar portion; fibrillar portions dorsal, may be wanting on segment 7; anterior lobe of 1st and posterior lobe of 7th pairs of gills enlarged and elongated, meeting beneath the body; other gills oval, each overlapping the one behind it, forming a "sucker disc"; lateral margins of lamellae not thickened and bear no fingerlike projection; 7th lamellae always show tracheae with lateral branches; three tails, middle tail fringed with fine hairs on each side, except in basal third; outer tails fringed in apical $2/3$ on inner margin only.

Genotype: Rithrogena semicolorata (in Baetis) Curtis

RITHROGENA

Key To Adults

1. Brunnea type of genitalia (fig. 3).....2.
- Not this type of genitalia.....4.
2. Five to six small apical ventral spines.....morrisoni Banks

- No prominent spines on inner apical margin of penes.....3.
3. Small sharp spine present on latero-apical margin on each division
of penes.....virilis McD
- No small sharp spine present on latero-apical margin of penes...
.....doddsi McD
4. Genitalia of robusta type (fig. 3). No marks on femur. Strong
lateral spine present on each division of penes near base,,,
.....robusta Dodds
- Genitalia of jejuna (fig. 3) type. Streak on femur. No lateral
spines on penes, or spine-bearing process.....jejuna Eaton

KeyTo Nymphs

1. Gills colourless.....2.
- Gills rose or tinged with purplish in the dorsal half.....5.
2. Each gill with a setose ridge on the ventral side.....3.
- No setose ridge on the ventral side of gills.....4.
3. Labrum with a slight indentation in the midline. Tracheation
in the proximal half of gills.....robusta Dodds
- Labrum with no indentation in the midline. No tracheation
visible in gills.....sp. 1
4. Intermediate pairs of gills each bear a rounded, ear-like erect
dorsal lobe.....sp. 2
- No erect dorsal lobe on gills.....sp. 3
5. Tergites red-brown.....morrisoni Banks
- Tergites not red-brown.....6.
6. Intermediate pairs of gills each bear a rounded, ear-like erect
dorsal lobe. Tergites green brown. Gills bright rose
pink.....doddsi McD.
- No erect dorsal lobes on gills. Tergites brown. Gills tinged

with purplish in the dorsal half.....virilis McD

Unknown:

Rithrogena jejuna Eaton

RITHROGENA DODDSI McDUNNOUGH

Rithrogena doddsi McDunnough, Needham, 1935, The Biology of Mayflies,
376 (Bibliography)

Adult:

A brown species; legs dark umber-brown; femora with a dark longitudinal streak in basal halves, entire femur may appear shaded with black; wings hyaline; venation fine, dark brown; basal costal crossveins obsolescent; abdominal tergites brown, intersegmental areas paler; latero-apical angles of tergites rounded, with no small sharp spine; sternites dull yellowish brown; genitalia of brunnea type; penes almost straight, long and slender, slightly divergent but not outcurved or truncate apically; each division broad at apex; strong lateral spine present on each division of penes, near base, and a ventral spine, near inner margin, on each division in central portion; latero-apical spines on penes minute.

Nymph:

Abdominal tergites green-brown; gills bright rose-pink in colour; intermediate pairs of gills each bear a rounded, ear-like erect dorsal lobe.

Distribution: British Columbia

No specimens of this species were examined.

RITHROGENA JEJUNA EATON

Rithrogena jejuna Eaton, Needham, 1935, The Biology of Mayflies,
380 (Bibliography)

Adult:

A dark brown species; legs sooty brown; femora each with a black longitudinal streak, beginning near base and tapered at each end; wings hyaline; faint greyish tint; venation very dark brown; many costal crossveins anastomosed; abdominal tergites 2-5 translucent burnt-umber brown; posterior margins darker; sternites paler; apical tergites opaque; genitalia of jejuna type; penes strongly outcurved at tips; penes distinctly narrowed apically; no small spines apically on divisions; no lateral spine or spine bearing process on penes; apical margin of forceps base projecting backward with a distinct rounded median excavation.

Nymph: Unknown

Distribution: Quebec, British Columbia

No specimens of this species were examined.

RITHROGENA MORRISONI BANKS

Rithrogena morrisoni Banks, Needham, 1935, The Biology of Mayflies,
381 (Bibliography)

Adult:

A dark brown species; fore legs brown, other legs paler; femora of latter with dark brown streaks; wings hyaline; venation fine, brown; humeral crossveins deep blackish; stigmatic area smoky; crossveins mostly anastomosed or forking; abdominal tergites dull brown, apical ones darker; posterior margins darker; lateral margins pale yellowish; sternites dull yellowish; genitalia of brunnea type; penes

relatively long and slender, strongly divergent apically, narrowed at apex with lateral apical margins rounded; each division with a strong lateral spine and a small distinct ventral spine near inner margin in central portion; and 5-6 small apical ventral spines.

Nymph:

A red-brown species; legs pale; outer surface of femora brown, each with a large median dark brown spot and black apex; abdominal tergites 8-10 with pale submedian spots; gills sometimes rose-tinted.

Distribution: British Columbia

No specimens of this species were examined.

RITHROGENA ROBUSTA DODDS

Rithrogena robusta Dodds, Needham, 1935, The Biology of Mayflies, 382 (Bibliography)

Adult:

A large dark brown species; fore legs dark brown, other legs slightly paler brown; no marks on femora although the apices are darker brown; wings hyaline; not tinted, except in stigmatic area, which is brown-tinged; venation dark brown; humeral crossveins light red-brown, pale at costal margin; basal costal and subcostal crossveins pale and faint; stigmatic costal crossveins anastomosed; abdominal tergites 2-7 semi-hyaline, dark red-brown; lateral and posterior margins and intersegmental areas pale yellowish brown; each tergite with a narrow paler mid dorsal line and pale hyaline wedge-shaped submedian streaks near center; tergites 8-10 opaque, almost black-brown; sternites pale red-brown with ganglionic areas outlined in dark brown in most segments; ganglionic areas blackish in apical segments; genitalia of robusta type; divisions of penes relatively short and stout, widely divergent apically, roundly truncate at tips;

a strong lateral spine-like process is present on each division, the outer short and stout, and the larger on the inner margin with its tip slightly curved inward and the smaller one directed upward.

Nymph:

Gills colourless, no erect dorsal lobe on gills.

Distribution: British Columbia

No specimens of this species were examined.

RITHROGENA VIRILIS McDUNNOUGH

Rithrogena virilis McDunnough, Needham, 1935, The Biology of Mayflies, 384 (Bibliography)

Adult:

A large brown species; fore legs deep smoky; other legs lighter brown; all femora with a longitudinal dark streak; wings hyaline; costa faintly amber-tinged; venation fine, dark brown; stigmatic crossveins anastomosed; abdominal tergites brown with irregular paler lateral margins; sternites brown, posterior sternites paler; genitalia of brunnea type; divisions of penes relatively long and slender, not truncate apically; a strong lateral spine present near base of each division; no prominent spine on inner apical margins, but on each lateral apical margin is a small sharp spine.

Nymph:

Tergites brown; gills tinged with purplish in the dorsal half; no erect dorsal lobe on gills.

Distribution: Alberta, British Columbia

No specimens of this species were examined.

Rithrogena sp. 1

Adult: Unknown:

Nymph:

Gills colourless; first and last gills meeting beneath the body; each gill with a setose ridge on the ventral side; no tracheation visible in the gills; a small dark square on the 7th sternite, labrum with no indentation in midline.

Distribution: British Columbia

Material Examined:

3 Nymphs, British Columbia: Alouette River (Haney, B.C.) XI.26.59

(N.J. Filmer)

1 Nymph, British Columbia: Alouette River (Haney, B.C.) XI.8.59

(N.J. Filmer)

Rithrogena sp. 2

Adult: Unknown

Nymph:

Gills colourless; no setose ridge on ventral side of gills; intermediate pairs of gills each bear an erect rounded ear-like lobe; first pair of gills meet beneath the body.

Distribution: British Columbia

Material Examined:

10 Nymphs, British Columbia: Loon Creek, (H. Lorz); 1 Nymph, British

Columbia: Loon Creek Hatchery Ponds, Clinton, VI.16.56 (H. Lorz);

1 Nymph, British Columbia: Alouette River (Haney, B.C.) V.14.59,

(N.J. Filmer)

Rithrogena sp. 3

Adult: Unknown

Nymph:

A unicoloured brown species; gills pale; no setose ridge on ventral side of gills; no erect dorsal lobe on gills; no tracheation

on gills; no indentation on midline of labrum.

Distribution: British Columbia

Material Examined:

2 Nymphs, British Columbia: Loon Creek, Clinton, VI.16.56 (H. Lorz)

GENUS STENONEMA TRAVER

Stenonema, Needham, 1935, The Biology of Mayflies, 295 (Bibliography)

Adult:

Small to moderate sized mayflies; eyes of male moderate size, not contiguous apically; posterior margin of pronotum deeply excavated medially; fore leg of male as long or slightly longer than body; fore femur of male $3/4$ as long as tibia, which is $3/4$ as long as the tarsus; basal fore tarsal joint $1/3$ to $1/2$ as long as the second; fore femur of female subequal or slightly shorter than tibia, which is slightly longer than the tarsus; in hind leg of both sexes, femur subequal or slightly longer than tibia, which is twice as long as the tarsus; all claws dissimilar; typical Heptagenine wing venation; basal costal crossveins strong; crossveins at and below the bulla may be crowded; stigmatic crossveins slanted, not anastomosed, though a few may be forked; costal crossveins and those at bulla may be dark margined; Of of Rs of hind margin present; forceps 4-jointed; apical margin of forceps base not deeply excavated; penes more or less distinctly L-shaped; division of penes with a pair of stout median spines, may be smaller lateral and apical spines; subanal plate of female well developed, extending beyond 10th segment, its apical margin entire, truncate or very slightly emarginate in middle area.

Nymph:

Front of head may be slightly emarginate; inner mandibulan canine about $7/8$ as long as the outer one; upper crown of galea-lacinia

bears both spines and hairs or a row of pectinate spines; maxillary palpi 2-jointed, second joint shorter than 4 times the length of the galea-lacinia; claws may or may not have pectinations; gills consist of a lamellate and a fibrillar portion; fibrillar portion ventral; no fingerlike projections on gill lamellae; gills do not meet beneath the body; lamellate portion of gills may be rounded, truncate or pointed at apex; gills of 7th segment threadlike or spine-like; this gill may contain a single trachea with no lateral branches or a single forked trachea, and may be fringed with long hairs or may have a few fine hairs along the margin; spines on postero-lateral angles of apical tergites, and may or may not be present on middle tergites; tails three.

Genotype: Stenonema tripunctatum (in Heptogenia) Banks

STENONEMA TERMINATUM (WALSH)

Stenonema terminatum (Walsh), Needham, 1935, The Biology of Mayflies, 331

Spieth and Ide, 1939, Can. Ent. 71:167

(Bibliography)

Adult:

A light ruddy species; head yellowish; notum reddish to dark olive brown, fore femora yellowish, with indistinct middle and apical ruddy bands; basal joint of fore tarsus less than 1/2 or little more than 1/3 the length of the second; scutellum whitish at tip; wings hyaline; longitudinal veins of costal margin yellowish, rest red-brown; basal costal and subcostal crossveins thickened equally, not more in the center than elsewhere; crossveins at and below the bulla, in 1st three spaces, arranged as 1,1,1 - 1,2,1 - 1,2,2 - or 1,2,3 - or 2,2,2 - stigmatic area slightly cloudy, not dark-stained; hind wing

venation hyaline; not dark-margined; abdominal tergites 1-6 hyaline whitish, posterior margins narrowly or widely red-brown in dorsal portions; anterior half of tergite 7 hyaline whitish, posterior half opaque red-brown; tergites 8-10 opaque red brown; no spiracular dots; sternites paler; genitalia of pulchellum type (fig. 3); tails wholly pale, not darker at joinings, or purplish at basal joinings and others faintly dark.

Nymph:

Tergite 7 largely dark; 2 narrow pale submedian streaks and narrow pale line next to posterior margin; a dark lateral mark on each side of sternite 9; dark ventral markings on segments 8, 9, or 9 only; Posterior lateral spines on segments 7-9 only; spine on segment 8 longer than 9; dorsium of abdomen with a distinct pattern of pale and dark areas; abdominal segments without dark conspicuous posterior bands dorsally and ventrally; gills on segments 1-6 truncate at apex; 7th gill without a trachea; claws not toothed.

Distribution: Idaho, Manitoba, British Columbia

No specimens of this species were examined.

SUBFAMILY METRETOPODINAE

Adult:

Eyes of male not turbinate; eyes of male entire, a horizontal line on the surface dividing each into two areas; tarsi five-jointed, the basal joint, except in the fore leg of the male, completely fused with the tibia; first tarsal joints of middle and hind legs as long or slightly longer than the second; femora of middle and hind legs

longer than the tibiae; all claws dissimilar; Of of forewing and posterior branch of the M normal, attached basally; cubital intercalaries 2-4 in number, free basally, not forking or sinuate or joined to the hind margin by crossveins; 1st anal vein ends in hind margin; costal angulation of hind wing variable, Of present; forceps base roundly excavated in hind margin; forceps 4-jointed; second joint longest; penes may be united at apex or divided half-way from base into rod-shaped portions; subanal plate of female variable; tails two.

Nymph:

Nymph not depressed; eyes and/or antennae lateral, antero-lateral, or anterior; no setae on latero-lateral angles of head; no setae on inner surface of forelegs; no gill tufts on maxillae or fore coxae; claws of fore-leg bifid; claws of middle and hind legs long and slender, about as long as the short tibia; gills on segments 1-7, rarely on 1-5; gills dorsal and without a fringed margin; outer tails fringed on inner side only, or there may be a few short hairs on the outer side.

GENUS METRETOPUS EATON

Metretopus, Needham, 1935, The Biology of Mayflies, 434 (Bibliography)

Adult:

A medium sized brownish species; fore femur of male about $1/2$ the length of the tibia, which is $1/3$ the length of the tarsus; 1st tarsal joint subequal to the second; in the female, the femur and the tibia are subequal; the tibia is about $3/4$ the length of the tarsus; 1st tarsal joint about $1-1/3$ times the length of the second; all claws dissimilar; forewing with a single pair of cubital inter-

calaries, the anterior vein being the longest; stigmatic crossveins tend to anastomose; costal angulation of hind wing acute; M2 normal, forked near the base; forceps base roundly excavated in apical margin; forceps 4-jointed, the first 2 joints more or less fused; penes divided in the apical half into two rod-like structures, each curving outward slightly, with a rounded lobe on the inner apical margin; subanal plate of female obtuse; tails two, the median tail is represented by a partly segmented rudiment.

Nymph:

Maxillary palpi 2-jointed; basal joint of labial palp longer and stouter than the apical joint, swollen on its outer margin; apical joint long and thin, thicker on its inner side, rounded apically; femora about as long as tibiae and tarsi together; tarsi longer than the tibiae; claws dissimilar on foreleg, similar on others; gills on segment 1-7, similar in form; all gills single.

Genotype: Metretopus norvegicus Eaton

METRETOPUS BOREALIS EATON

Metretopus borealis Eaton, Edmunds and Allen, 1957, Ann. Ent. Soc.

Amer. 50 (4) : 320 (Bibliography)

Adult:

Abdominal tergites 1, 7-10 brown, middle tergites translucent; posterior margins of tergites narrowly marked with brown; each tergite with a brown mid-dorsal line with a dark streak proceeding forward from it in each segment to form a triangle with the apex directed posteriorly; tails dark grey.

Nymph: Unknown

Distribution: British Columbia

No specimens of this species were examined.

SUBFAMILY BAETINAE

Adult:

Eyes of male divided, upper portion turbinate, set on a cylindrical stalk with facets on the upper flattened surface only; facets of turbinate portion longer than those of lower portion; foretarsi with 5 joints, the basal joint very short; other tarsi 4-jointed, basal joint partially fused with tibia; all claws dissimilar; wing venation reduced; Of of Rs and posterior branch of the M are detached basally from their respective stems; 1st anal vein ends in the hind margin; basal costal crossveins often wanting; behind subcosta, other crossveins few in number and usually arranged in several or less definite series across the wing; 2 long cubital intercalaries present; short, well-developed marginal intercalaries occur singly or in pairs in each interspace between the main veins or the long intercalaries; hind wing reduced in size, much longer than wide, or wanting; if present, venation consists of 2 or 3 longitudinal veins and a few or no crossveins; Of of hind wing absent; costal angulation variable; if absent or greatly reduced, anal portion of forewing greatly developed; tails two; penes internal; may be a single or divided "penis cover" between the basal joints of the forceps.

Nymph:

A slender streamlined species with a downward flexed head and long slender legs; antennae lateral, antero-lateral, or anterior; antero-lateral angles of the head without setae; forelegs without a dense row of setae on the inner surface; no gill tufts on maxillae

or forecoxae; no appendages on fore coxae; claws similar, sharp-pointed, and much shorter than the tibiae; claws of the middle and hind legs may be long and slender, and of the forelegs short; postero-lateral angles of the apical abdominal tergites usually not prolonged into flat thin lateral spines, but if weakly so, the antennae are more than twice the width of the head; gills on segments 1-7, and rarely on 1-5 only; gills lamellate, margins entire; gills single, apical ones may bear a minute ventral recurved flap; tails 2 or 3, outer ones with a heavy fringe of hairs on the inner margin, and few or none on the outer; middle tail, if present, fringed on both sides.

SUBFAMILY BAETINAE

Key To Adults

1. Hind wings absent.....2.
Hind wings present.....3.
2. Marginal intercalaries of forewing occur in pairs. First joint of third tarsus short, equal to segments 2 and 3.....
.....Pseudocloeon Klapalek
Marginal intercalaries of forewing occur singly. First joint of third tarsus long, equal to segments 2 and 3 and 4.....
.....Neocloeon Traver
3. Forewing usually with numerous costal crossveins before the bulla. Hind wings with a moderate number of crossveins, at least in the costal region.....Callibaetis Eaton
Forewing without costal crossveins before the bulla. Hind wings with no crossveins, or with very few.....4.
4. Marginal intercalaries of forewing occur in pairs. First joint of third tarsus short, equal to segments 2 and 3.....
.....Baetis Leach

Marginal intercalaries of forewing occur singly. First joint
of third tarsus long, equal to segments 2 and 3 and 4.....

.....Centroptilum Eaton

Key To Nymphs

1. 3 tails. Middle tail may be shorter than 10th tergite.....2.
2 tails.....Pseudocloeon Klapalek
2. Metathoracic wing pads absent.....Neocloeon Traver
Metathoracic wing pads present, may be minute.....3.
3. Gill lamellae double on abdominal segments 1-6 (dorsal portion
often merely a recurved flap). Tails equal.....4.
Gill lamellae single on all abdominal segments. Middle tail
shorter and weaker (may be shorter than 10th tergite) than
outer ones.....Baetis Leach
4. Double portion of gill is a flap on the ventral surface. Maxillary
palps 2 jointed. Distal joint of labial palp conical. .
Claws toothed.....Callibaetis Eaton
Double portion of gill is a flap on the dorsal surface. Maxillary
palp 3 jointed. Distal joint of labial palp dilated.
Claws not toothed.....Centroptilum Eaton

GENUS BAETIS LEACH

Baetis, Needham, 1935, The Biology of Mayflies, 674 (Bibliography)

Adult:

Small brownish mayflies; turbinate eyes of male small, moderate
or large; eyes of female not turbinate, but small and remote; head
of female with hind margin emarginate medially, with a slight outward
prolongation on each side of this emargination; prothorax small; a
short protuberance near the middle of the metanotum; fore leg of male

as long as the body; femur $\frac{3}{4}$ the length of the tibia, which is as long as or slightly shorter than the tarsus; basal tarsal joint very short; hind femur and tibia subequal, tibia longer than the tarsus; basal tarsal joint of hind leg not longer than 2nd and 3rd joints together; marginal intercalaries of forewing occur in pairs; costal crossveins wanting before the bulla; hind wing fairly well developed; costal projection usually present, may be acute or slightly curved; 2 or 3 longitudinal veins, the 3rd, if present, rather short; no crossveins, or very few; abdominal tergites of female unicoloured reddish or brownish; of male, 2-6 are usually semi-hyaline or hyaline, pale to olivaceous to deep brown; 2nd and 3rd joints of forceps fused; genitalia variable.

Nymph:

Labrum with a distinct narrow notch in the apical margin; maxillary palp 2 or 3-jointed; labial palp 3-jointed, the distal joint rounded; metathoracic wing pads present, may be minute; claws toothed on inner margin; gills single, on segments 1-7; gills obovate, pinnately branched, gills on 6 and 7 may be narrow and lanceolate; usually 3 tails, the middle one shorter and weaker than the others; there may only be 2 tails, or the third tail may be shorter than the 10th tergite.

Genotype: Baetis bioculatus (in Ephemera) Linnaeus

BAETIS

Key To Adults

1. Costal projection of hind wing prominent, acute.....2.
Costal projection of hind wing wanting.....
.....insignificans McD

2. Hind wing with 2 longitudinal veins only, equal in length.
 3rd vein wholly wanting.....bicaudatus Dodds
 Hind wing with 3 longitudinal veins. 3rd vein may be short or
 weak.....3.
3. 2nd longitudinal vein of forewing forked about 1/3 the distance
 from the base to the margin.....parvus Dodds
 2nd longitudinal vein of forewing not forked.....4.
4. One intercalary vein between veins 2 and 3 of hind wing.....5.
 No definite intercalaries on hind wing.....persecuta McD
5. 3rd vein of hindwing ending near middle of hind margin.....
 intermedius Dodds
 3rd vein of hindwing ending 2/3 along hind margin.....
 jesmondensis McD

Key To Nymphs

1. Two tails only.....2.
 Three tails.....3.
2. Distinct pale J-shaped mark on 1st femur, L-shaped on femora 2
 and 3. Tergites 3, 4, and 7 darker than the others.....
 bicaudatus Dodds
 No distinct J or L-shaped marks on femora. Tergites 3, 4 and 7
 not darker than the others.....sp. 1
3. Middle tail about 1/6 the length of the outer ones.....4.
 Middle tail at least 1/2 the length of the outer ones.....5.
4. First femur with a J-shaped pale mark. Second femur with an L-
 shaped pale mark. All tergites with pale markings, tergites
 5-8 and 9 paler than the others.....intermedius Dodds

- No J or L-shaped markings on the femora. Tergites mostly without pale markings. Tergites 5, 8 and 9 paler than the others, those on segments 5 and 8 each with two submedial dots...sp. 2
5. Middle tail $3/4$ to $5/6$ the length of the outer ones.....6.
Middle tail about $1/2$ the length of the outer ones.....9.
6. Middle tail at least $5/6$ the length of the outer ones.....7
Middle tail $3/4$ to $5/6$ the length of the outer ones..parvus Dodds
7. Tergites patterned with brown, some paler than others. Two pale sublateral lines on tergites. Wing pads dark or light.....8.
Tergites patterned with brown, none lighter than others. Tergites 8, 9, and 10 with lateral dark lines. Wing pads dark...sp. 4
8. Tergites patterned with brown, tergites 5, 6, 9 and 10 paler than the others. The pattern on tergites 7 and 8 is a dark triangle, apex anterior, with a spot on each side of the apex. A dark medial line on tergites 9 and 10. Wing pads light.....sp. 5
- All tergites brown, those on segments 8-10 paler, with lateral and medial dark bands. Wing pads dark or light.....sp. 6
9. Gill tracheation not distinct. Gills of average size.....sp. 3
Gill tracheation distinct. Gills large.....sp. 7

Unknown:

Baetis insignifians McD

Baetis persecuta McD

Baetis jesmondensis McD

BAETIS BICAUDATUS DODDS

Baetis bicaudatus Dodds, Needham, 1935, The Biology of Mayflies,

Adult: (Female)

A uniformly light brown species; costal projection of hind wing prominent and acute; hind wing with two longitudinal veins only, which are approximately subequal in length.

Nymph:

Abdominal tergites 1 to 10 pale with dark markings, numbers 3, 4 and 7 distinctly darker than the others; apparently only two tails, the middle tail being represented by a minute stub.

Distribution: Colorado, British Columbia

No specimens of this species were examined.

BAETIS INSIGNIFICANS McDUNNOUGH

Baetis insignificans McDunnough, Needham, 1935, The Biology of
Mayflies, 692 (Bibliography)

Adult:

Turbinate eyes small, bright red; thorax deep brown with anterior projection of metanotum pale cream-coloured; all femora tinged with smoky brown; fore femora may be banded apically with black; wings hyaline; venation pale; hind wing narrow; costal projection wanting; only two longitudinal veins present, equal in length; abdominal tergites 2-6 pale semi-hyaline, tinged with smoky brown; tergites 7-10 opaque light sepia-brown; sternites whitish; a short projecting plate between the bases of the forceps; genitalia of modified moffati type (fig. 3).

Nymph: Unknown

Distribution: British Columbia

No specimens of this species were examined.

BAETIS INTERMEDIUS DODDS

Baetis intermedius Dodds, Needham, 1935, The Biology of Mayflies,
693 (Bibliography)

Adult:

Thorax dark brown; hind wing twice as long as wide, the margins rounded, not parallel to one another; costal projection well developed, acute, not curved; 3 longitudinal veins in hind wing, first 2 approximately equal in length, 2nd not forked; 3rd vein faint, running close to hind margin, and ending basad of middle on hind margin; usually no crossveins; one short intercalary between veins 2 and 3; abdominal segments 2-6 olivaceous to deep brown; genitalia of moffati type; no tubercle at inner apical margin of basal forceps joint; no excavation on spine between the bases of the forceps.

Nymph:

Gills of segments 6 and 7 oval and rounded; middle tail about 1/6 the length of the outer ones; tails unbanded.

Distribution: Colorado, British Columbia

No specimens of this species were examined.

BAETIS JESMONDENSIS McDUNNOUGH

Baetis jesmondensis McDunnough, McDunnough, 1938, Can. Ent., 70:25
(Bibliography)

Adult:

Eyes of male rather small; femora light smoky brown; wings hyaline; venation faintly brown-tinted, especially the C and Sc; intercalaries of C and Sc moderately long but practically lacking in 1st costal interspace; crossveins heavier and deeper brown in female; hind wing with 3 longitudinal veins; veins 1 and 2 bend a very little towards

each other at outer margin; vein 3 extends $\frac{2}{3}$ the length of the hind margin; costal projection prominent, acute, not curved; well defined intercalary between veins 2 and 3; abdominal tergites 1-6 semi-hyaline, uniformly smoky brown, ruddier in the female; the posterior edges of the tergites are narrowly and obscurely pale; anterior to this is a faint dark transverse line in each tergite; abdominal tergites 7-10 opaque, deep russet brown.

Nymph: Unknown

Distribution: British Columbia

No specimens of this species were examined.

BAETIS PARVUS DODDS

Baetis parvus Dodds, Needham, 1935, The Biology of Mayflies, 696

(Bibliography)

Adult:

Turbinate eyes moderate in size, dark orange brown in dried specimens; thorax deep blackish brown with the tip of the scutellum paler; legs whitish; wings hyaline; venation pale; forewing with 5 to 8 stigmatic crossveins, often with short horizontal veins between them, aslant, often incomplete on the subcostal margin, and sometimes forking toward the subcosta; usually one short intercalary in the first interspace, those of the 2nd interspace slightly shorter than the following pairs; hind wing unusually wide for its length; costal projection well developed, acute; 3 longitudinal veins, the 1st and 2nd approximately equal in length; the 2nd vein forked about $\frac{1}{3}$ the distance from the base; 1, 3 or 4 intercalaries in this fork, one being long and the others short; 3rd vein may be weakly developed, end near middle of hind margin; first abdominal tergite dark brown;

tergites 2-6 hyaline white; tergites 7-10 opaque, brown, wholly or partly suffused with deep rose; sternite 1 light brown, rest opaque creamy white, shaded and marked with rose; no dark spiracular markings; tubercle on inner apical margin of basal forceps joint absent or poorly developed; genitalia of intercalaries type. (fig. 3)

Nymph:

Gills of segments 6 and 7 oval, rounded; middle tail $3/4$ to $5/6$ the length of the outer ones; tails unbanded.

Distribution: Montana, Wyoming, Alberta, West Virginia, British Columbia.

Material Examined:

No specimens of this species were examined. One very young, white unpatterned specimen taken by Mr. R. Humphries at Corbett Lake, British Columbia (IX.21.63) seems to be of this species.

BAETIS PERSECUTA McDUNNOUGH

Baetis persecuta McDunnough, McDunnough, 1939, Can. Ent., 71:52

(Bibliography)

Adult:

Small oval turbinate eyes; fore femora of male whitish, suffused with smoky; femora of female light smoky amber; wings hyaline; venation pale in male, tinged with brown in female; intercalaries of first interspace very weak; costal projection of hind wing well developed; third longitudinal vein weak in male, obsolescent in female; no definite intercalaries in hind wing; abdominal tergites 1-6 of male hyaline whitish with a faint smoky tinge; tergites 7-10 light wood-brown; abdominal tergites of female brown; genitalia of moffati type; inner apical margin of first joint of forceps more bulging than usual,

but not tuberculate.

Nymph: Unknown

Distribution: British Columbia

No specimens of this species were examined.

Baetis sp. 1

Adult: Unknown

Nymph:

Large, single gills on segments 1-7; abdominal tergites brown, tergites 4 and 5 pale; 2 dark spots on each tergite; middle tail represented by an unsegmented rudiment.

Ecology:

Specimens of this species were taken from the middle and edges of the Alouette River, from a depth of 1 to 2 feet generally, although they have also been collected at depths of 2 inches and 5 feet. The substrates varied from mud, through sand, gravel, rocks, boulders, to bedrock. The most common of these were coarse gravel and small rocks. The current was usually a gentle ripple, although they have been taken in rapids and in quieter water. They were collected the year round.

Distribution: British Columbia

Material Examined:

1 Nymph, British Columbia: Alouette River (Haney, B.C.) V.19.59 (N.J. Filmer); 2 Nymphs, British Columbia: Alouette River (Haney, B.C.) VI.2.59 (N.J. Filmer); 1 Nymph, British Columbia: Loon Creek (Clinton) (H. Lorz), 2 Nymphs, British Columbia: Nr. Hell's Gate, VI.19.59 (G.G.E. Scudder); 1 Nymph, British Columbia: Cultus Lake, V.9.59 (G.G.E. Scudder), 6 Nymphs, British Columbia: Nicola Cr.

Baetis sp. 2

Adult: Unknown

Nymph:

Large, single gills on segments 1 to 7; abdominal tergites 5, 8 and 10 paler than the others; two dark submedial dots on tergites 5 and 8 or 4 and 5; tails three, middle tail usually $1/6$ the length of the laterals, but may extend to $1/2$ their length.

Ecology:

Specimens of this species have been taken from the middle and edges of various locations on the Alouette River, in depths of 1 to 5 feet, although generally they were not found at a depth greater than 2 to 3 feet. The stream bed varied from mud, through sand, gravel, rocks and boulders, to bedrock. The current varied from quiet pools to rapids and falls. This species was taken from June 1959 to the following February.

Distribution: British Columbia

Material Examined:

3 Nymphs, British Columbia: Alouette River (Haney, B.C.)

VI.23.59 (N.J. Filmer); 9 Nymphs, British Columbia: Nicola Cr.

Baetis sp. 3

Adult: Unknown

Nymph:

Average-sized, single gills on segments 1-7; gill tracheation indistinct; abdominal tergites unicoloured, with no dark markings; tergite 5 and 10, or only 10 may be paler; tails 3, middle tail varies from $1/2$ the length of the laterals to almost subequal in length to them.

Ecology:

Nymphs of this species have been taken from the middle and edges of various locations on the Alouette River, from depths of 1 to 3 feet, although occasionally from deeper water. The substrate varied from mud, through sand, gravel, rocks, and boulders, to bedrock. The current varied from quiet water to rapids. They were taken the year round.

Distribution: British Columbia

Material Examined:

3 Nymphs, British Columbia: Alouette River (Haney, B.C.) V.26.59 (N.J. Filmer); 2 Nymphs, British Columbia: Alouette River (Haney, B.C.) VI.9.59 (N.J. Filmer); 2 Nymphs, British Columbia: Alouette River (Haney, B.C.) VI.26.59 (N.J. Filmer); 2 Nymphs, British Columbia: Alouette River (Haney, B.C.) VI.16.59 (N.J. Filmer).

Baetis sp. 4

Adult: Unknown

Nymph:

Front of head ochreous; wing pads dark brown; all abdominal tergites brown, none paler than the others; tergites 8, 9 and 10 with sublateral dark lines; tails 3, middle tail 5/6 the length of the lateral tails.

Distribution: British Columbia

Material Examined:

1 Nymph, British Columbia: Squamish, VIII.25.61 (G.G.E. Scudder);
1 Nymph, British Columbia: Brunson Lk., VI.25.61 (G.G.E. Scudder);
3 Nymphs, British Columbia: Springhouse Lk., VII.4.63 (G.G.E. Scudder);
1 Nymph, British Columbia: Pavilion, VI.30.61 (G.G.E. Scudder);

3 Nymphs, British Columbia: Williams Lake, VI.24.61 (G.G.E. Scudder);

41 Nymphs, British Columbia: Quesnel, VI.24.61 (G.G.E. Scudder).

Baetis sp. 5

Adult: Unknown

Nymph:

Front of head light brown; wing pads light brown; abdominal tergites brown, patterned with darker brown; tergites 5,6, 9 and 10 may be paler; each tergite with a pair of pale sublateral lines; pattern on each of tergites 7 and 8 is a dark median triangle, apex directed anteriorly, and a dark spot on each side of the apex; tergites 9 and 10 each with a dark medial line; tails 3, middle tail 5/6 the length of the lateral tails.

Distribution: British Columbia

Material Examined:

1 Nymph, British Columbia: Warmspring Lk., VII.15.62 (G.G.E. Scudder); the author has also examined many other nymphs of this species taken by Dr. G.G.E. Scudder, from IV.4.59 to IX.23.63 at the following locations: British Columbia - Rock Lk., Springhouse Lk., Boitano Lk., Riske Cr., Racetrack Lk., nr. Phalerope, Quesnel, Westwick Lk., Felker Lk., McIntyre Lk., Brunson Lk., White Lk., Nicol Cr., Dougout Lk., Pavilion, Sorenson Lk., Williams Lk., Phalerope Lk., Beaver Lk.

Baetis sp. 6

Adult: Unknown

Nymph:

Wing pads may be light or dark brown; gills large; tracheation distinct; abdominal tergites brown, 8-10 paler; each tergite with a pair of pale sublateral stripes; tergites 8 to 10 each with a medial

and 2 lateral dark bands; tails 3, middle tail 5/6 the length of the laterals.

Distribution: British Columbia

Material Examined:

1 Nymph, British Columbia: Nicola Lake, 59 Nymphs, British Columbia: Springhouse Lk., V.5.63 (G.G.E. Scudder).

Baetis sp. 7

Adult: Unknown

Nymph:

Gills large; tracheation distinct; abdominal tergites unicoloured; tails 3, middle tail 1/2 the length of the laterals.

Distribution: British Columbia

Material Examined:

1 Nymph, British Columbia: Racetrack Lake, VI.21.61 (G.G.E. Scudder).

GENUS CALLIBAETIS EATON

Callibaetis, Needham, 1935, The Biology of Mayflies, 657 (Bibliography)

Adult:

Small to medium sized mayflies; bodies and usually legs thickly sprinkled with small reddish or dark brown spots, often appearing to be set in small depressions; males usually darker in colour than the females; turbinate eyes of male moderately large, lengthily oval; eyes of female large, not set high on the side of the head; posterior margin of head of female slightly emarginate medially, on each side of which is a posteriorly directed slightly rounded lobe; fore leg of male slightly shorter than the body; femur about 3/4 the length of the tibia, which is slightly shorter or subequal to tarsus; 1st joint of tarsus equal to joints 3 and 4; in foreleg of female, femur

subequal to tibia, which is slightly shorter than the tarsus; hind tibia of both sexes $1/2$ to $3/4$ the length of the femur, tarsus slightly shorter than the tibia; forewing of female usually ornamented with brownish along the costal margin, and sometimes in the disc; forewing of male may be wholly hyaline, or with some dark colour, but less than in the female; forewing usually with numerous costal crossveins before the bulla; other crossveins usually numerous, although they may be few in number in some species; marginal intercalaries occurring singly or in pairs, the number not constant within any one species; usually, the intercalaries at the tip and in the anal region are paired, while the rest may be single; hind wing relatively large, widened at base; costal projection large and very obtuse; three longitudinal veins; several well-developed crossveins, especially in the costal region; a few intercalaries present between veins 2 and 3; forceps 4-jointed; a small rounded or conical "penis cover" is present between the forceps bases; posterior margin of sternite 9 of female almost straight.

Nymph:

Maxillary palp two-jointed; canines of mandibles long and slender; labial palp 3-jointed, the distal joint short and conical; claws long and slender, $1/2$ to $3/4$ the length of the tarsus, and denticulate; 2 pairs of wing buds present; gills large, irregularly subovate, pointed at tip; gills double on segments 1-6 or 1-7, or the ventral portion being a small recurved flap; the ventral flap on segments 1 and 2 well developed, may bear a small secondary flap; tracheation pinnate or palmate, or simple on the outer margin; tails three, all equal in length and thickness.

Genotype: Callibaetis pictus (in Baetis) Eaton

CALLIBAETIS

Key To Adults

1. Marginal intercalaries single in female, barely visible.....
.....carolus Traver
Marginal intercalaries paired.....2.
2. Vitta not patterned in brown or black.....3.
Vitta patterned in brown or black.....5.
3. Longitudinal veins alternately light and dark.....sp. 1
Longitudinal veins completely pale..... 4.
4. Colouring dark. Fine crossveins between Rs and Of of forewing....
.....sp. 2
Colouring lighter. More than five crossveins between Rs and
Of of forewing.....sp. 5
5. Longitudinal veins completely pale.....sp. 3
Longitudinal veins alternately light and dark.....6
6. Lateral areas of mesonotum yellow.....sp. 4
Lateral areas of mesonotum not paler than rest of mesonotum.....7.
7. Abdominal tergites unicoloured.....8.
Abdominal tergites with dark or pale longitudinal stripes,.....10.
8. Abdomen dark brown, almost blackish.....coloradensis Banks
Abdomen reddish brown.....9.
9. Wings of male almost clear with two narrow widened brown portions
on the costa, stigma slightly brown-tinged. Vitta of female
wide, dark brown, its hind margin with about 5 lobes.....
.....hageni (Eaton)
Vitta wide, its hind margin with 4 lobes. Many hyaline spots
in costal cell.....sp. 7

10. Tergites with a dark median stripe (pale in the middle in the last few segments).....nigritus Banks
- Tergites with a light median and 2 light submedian stripes..sp. 6

Key To Nymphs

1. Femur with a broad pre-apical band.....hageni (Eaton)
- No such band on femur.....sp. 8

Unknown:

Callibaetis coloradensis Banks

Callibaetis nigritus Banks

Callibaetis carolus Traver

CALLIBAETIS CAROLUS TRAVER

Callibaetis carolus Traver, Edmunds and Allen, 1957, Ann. Ent. Soc.

Amer. 50 (4) : 320 (Bibliography)

Adult:

A brown mayfly; turbinate eyes of male orange-brown; thoracic notum of male red-brown; thoracic notum of female yellowish; postero-lateral margins of mesonotum dark red-brown; in the male, the fore leg is brownish; the femora may be yellowish basally, tarsi pale, or the entire leg may be smoky to pale red-brown, the femur with a distinct pre-apical dark band; middle and hind legs whitish or yellowish white, faint dark band near apex of femur and occasional longitudinal dark streaks; stippling, if present, very faint; tarsi shaded with light brown; in female, legs whitish or yellowish; tarsi usually brown; femora usually with some reddish brown stippling; wings hyaline, iridescent; more than 35 crossveins; in male marginal intercalaries usually paired; longitudinal veins alternately brown and pale; crossveins pale; outer margins brown; usually faint blackish-brown markings along the costa; extreme apical portion of costal

space shaded with brown; marginal intercalaries of female often single, may be barely visible; vitta blackish brown except basad of costal brace; vitta narrow, sinuate in its posterior margin, extending into 4 distinct lobes, the most apical of which has 3 or more small secondary lobes; costal space interrupted brown and white; crossveins in vitta fenestrate with hyaline; costal brace brown on each end and pale in the middle, and on each side near Sc is a brown cloud; small dark clouds along longitudinal veins, and some on the posterior margin; longitudinal veins as in male; abdominal tergites of male dark red-brown, posterior margins deeper; each tergite with two dark submedian lines, usually separated by a narrow pale median line, and flanked by 2 paler yellowish streaks; dark line along pleural fold; stippling moderately dense and regular; sternites paler yellowish brown, with dark submedian streaks; stippling finer; apical sternites often opaque creamy or yellowish white; abdomen of female similar, but paler; forceps and tails pale, joinings narrowly blackish.

Nymph: Unknown

Distribution: California, British Columbia

Material Examined:

- 1 Female, British Columbia: Vernon, VII.26.63 (G.G.E. Scudder)
- 2 Females, British Columbia: Lytton, VIII.30.31 (G.J. Spencer),
- 1 Female, British Columbia, Vernon, VII.10.48 (D. Evans).

CALLIBAETIS COLORADENSIS BANKS

Callibaetis coloradensis Banks, Needham, 1935, The Biology of Mayflies, 664 (Bibliography)

Adult: (female)

A dark brown mayfly; thorax dark brown; femora finely stippled

with brown; tips of tarsi brown; crossveins of forewing behind the vitta more than 35, usually several close to hind margin, arranged in 2 or more irregular rows across the wing; most crossveins white; marginal intercalaries usually paired; vitta dark brown, broken up into three main spots, one apical, one stigmatic, and one before the middle, with a smaller one at base; basal costal space hyaline; longitudinal veins brown in places, or alternately light and dark; no clouds on veins; hind wing long and narrow; costal margin somewhat emarginate behind the costal projection; marginal intercalaries very long, resembling longitudinal veins, and 3 or 4 in number; crossveins tend to be arranged in groups of 2; abdomen blackish brown, relatively short.

Nymph: Unknown

Distribution: British Columbia, Colorado

No specimens of this species were examined.

CALLIBAETIS HAGENI (EATON)

Callibaetis hageni (Eaton), Needham, 1935, The Biology of Mayflies, 668 (Bibliography)

Adult: (Female)

A piceous species; dorsal sutures of notum yellowish; darker, polished in male; legs brown in both sexes, femora densely, finely, and inconspicuously speckled; more than 35 crossveins behind the vitta of the forewing, usually several close to the hind margin, and arranged in 2 or more irregular rows across the wing; crossveins mostly white; marginal intercalaries mostly paired, a few single; vitta of female dark brown, wide, extending in its posterior margin

into 5 lobes; the second being the largest; basal costal space included in vitta; behind the vitta, along the longitudinal veins, are 3 rows of brown spots, the middle one being the largest, longitudinal veins interrupted brown and white, as is the outer margin of the wing; intercalaries brown, sometimes in a faint brownish cloud; crossveins in the vitta fenestrate with hyaline; stigmatic crossveins few in number, aslant, fenestrate, less so and faint in male; clouds on crossveins; wing of male almost clear, with 2 brown widened portions on the costa; stigma slightly brown-tinged; abdomen deep reddish brown; almost blackish dorsally, paler ventrally; thickly stippled; tails white, joinings black.

Nymph:

Femur with a broad pre-apical band; tails wholly pale, or with a narrow dark band near tip only.

Distribution: Oregon, Colorado, California, Wyoming, Montana, Washington, New York, British Columbia.

No specimens of this species were examined.

CALLIBAETIS NIGRITUS BANKS

Callibaetis nigrinus Banks, Needham, 1935, The Biology of Mayflies, 669 (Bibliography)

Adult: (Male)

A dark brown mayfly; thoracic notum blackish; fore legs blackish; middle and hind legs pale, femora darker before apex, tarsi darker; femora finely and regularly stippled; crossveins of forewing behind vitta more than 35, usually several close to hind margin, arranged in 2 or more regular rows across the wing; intercalaries mostly in pairs;

wings hyaline; longitudinal veins alternately white and black; crossveins mostly pale; outer margin alternately dark and pale; costal area marked with black spots, with various dots on costal margin, and streaks and dots along veins and beyond the middle, two being larger than the others; abdominal tergites with a darker median stripe which is pale in the middle on the apical segments; sternites with a pair of dark submedian stripes; forceps and tail yellowish.

Nymph: Unknown

Distribution: Colorado, British Columbia

Material Examined:

3 Male, British Columbia: Chilcotin, V.28.63 (G.G.E. Scudder);
1 Male, British Columbia: Springhouse Lake (Cariboo) V.25.63
(G.G.E. Scudder); 1 Male, British Columbia: Chilcotin, VI.17.63
(G.G.E. Scudder).

Callibaetis sp. 1

Adult: (Male)

Lateral areas of mesonotum yellow; legs yellowish-red; more than 35 crossveins in forewing; marginal intercalaries paired; no dark vitta; longitudinal veins alternately light and dark, strongly so in costal veins; no clouds on wings; abdominal tergites dark reddish-brown; venter pale and lightly stippled; tails and genitalia pale.

Nymph: Unknown.

Distribution: British Columbia

Material Examined:

1 Male, British Columbia: Lytton, VIII.9.31 (G.J. Spencer).

Callibaetis sp. 2

Adult: (Male)

This species exactly resembles Callibaetis sp. 1, with the difference that there is absolutely no pigmentation in the wing membrane or venation; there are 5 crossveins between the Of and Rs of the forewing.

Nymph: Unknown

Distribution: British Columbia

Material Examined:

- 1 Male, British Columbia: Lytton, VIII.9.31 (G.J. Spencer),
- 1 Male, British Columbia: Quesnel, VIII.12.48 (H.R. McCarthy),
- 1 Male, British Columbia: Nicola, VIII.30.25 (G.J. Spencer)
- 1 Male, British Columbia: Nanaimo, VII.19.61 (G.G.E. Scudder).

Callibaetis sp. 3

Adult: (Male)

Very similar to Callibaetis sp. 1, mesonotum reddish brown; crossveins of forewing more numerous than in Callibaetis sp. 1; longitudinal veins not alternately light and dark; vitta consisting of alternately light and dark areas; stigmatic area yellowish.

Nymph: Unknown

Distribution: British Columbia

Material Examined:

- 1 Male, British Columbia: Pavilion Mt., VI.27.43 (G.J. Spencer),
- 1 Male, British Columbia: Quesnel, VI.3.48 (G.J. Spencer).

Callibaetis sp. 4

Adult (Male):

Lateral areas of mesonotum yellow; legs yellow; more than 35 crossveins in forewing; marginal intercalaries paired; longitudinal veins alternately light and dark; vitta wide, extending on posterior margin into 4 lobes; many hyaline spots in costal cell; no clouds on wings; abdominal markings much as in Callibaetis nigrinus; tails pale, joinings dark.

Nymph: Unknown

Distribution: British Columbia

Material Examined:

1 Male, British Columbia: Pavilion Mt., VI.27.43 (G.J. Spencer)

Callibaetis sp. 5

Adult: (Male)

This species is similar to Callibaetis sp. 2, but lighter in colour; more than 5 crossveins between Rs and Of of forewing.

Nymph: Unknown

Distribution: British Columbia

Material Examined:

6 Males, British Columbia: Kamloops, VIII.4.34, (G.J. Spencer),

2 Males, British Columbia: Nicola, VIII.30.25 (G.J. Spencer),

1 Male, British Columbia: Quesnel, VII.23.48 (G.J. Spencer),

1 Male, British Columbia: Quesnel, VIII.12.48 (H.R. McCarthy),

2 Males, British Columbia: Okanagan Lake, VII.25.35 (J.L. McHugh),

3 Males, British Columbia: Nicola, VIII.21.32 (G.J. Spencer).

Callibaetis sp. 6

Adult: (Male)

A species very similar to Callibaetis sp. 4; lateral areas of

mesonotum brown; legs and tails brownish yellow; abdominal markings darker than in Callibaetis sp. 4, with each tergite having a median and 2 submedian pale streaks.

Nymph: Unknown

Distribution: British Columbia

Material Examined:

1 Male, British Columbia: Blanket Mt., VIII.1.46

Callibaetis sp. 7

Adult: (Female)

Closely resembling Callibaetis sp. 4, but abdominal tergites and sternites reddish brown; mesonotum all brown; legs brown; a larger species.

Nymph: Unknown

Distribution: British Columbia

Material Examined:

1 Female, British Columbia: Nicola, VII.10.32 (G.J. Spencer)

Callibaetis sp. 8

Adult: Unknown

Nymph:

No pre-apical band on femur; gills on segments 1-7 large, heavily tracheated; no light spots on tergites; tails heavily fringed, dark at tips.

Ecology:

Specimens of this species were taken from the edges only of the Alouette River. The substrate was mud, silt, and in one case, sand and gravel. They were taken at a depth of 1-4 feet, in quiet, slow water, although in one case (from sand and gravel), the current

produced ripples. All specimens were collected on July 1, 1959, and were found at not any other time.

Distribution: British Columbia

Material Examined:

1 Nymph, British Columbia: Alouette River (Haney, B.C.)

VII.1.59 (N.J. Filmer)

GENUS CENTROPTILUM EATON

Centroptilum, Needham, 1935, The Biology of Mayflies, 705 (Bibliography)

Adult:

Small, pale mayflies; turbinate eyes of male moderate to large, usually lengthily oval; eyes of female large, set high on the sides of the head; posterior margin of head of female distinctly emarginate medially; fore leg of male as long as body; fore femur $1/2$ to $2/3$ the length of the tibia, which is slightly shorter than the tarsus; in female, fore femur slightly longer than the tibia, which is a little longer than the tarsus; first joint of tarsus equal to joints 2, 3 and 4 in hind leg of both sexes; tarsus, tibia, and femur subequal; marginal intercalaries of forewing occur singly; no costal crossveins before the bulla; hind wing small, narrow, and elongate; costal projection curved; two longitudinal veins; crossveins absent or few; basal abdominal segments of male usually pale yellowish or whitish, often with extensive ruddy or brownish markings; females paler, often light reddish-brown; basal forceps joints wide apart, stout, usually slightly wider than long; second joint stout, often prolonged inward on its outer margin; third joint long and slender, frequently bowed; distal joint sometimes half as long as third joint, usually shorter, clavate, 2 or 3 times as long as wide; a large

"penis cover" between basal joints; posterior margin of 9th sternite of female prolonged backwards very slightly medially.

Nymph:

Maxillary palp 3-jointed, extending beyond the tip of the galealacinia; canines of mandibles long, slender, and sharp-pointed, or shorter and stouter; labial palp 3-jointed, distal joint dilated and truncate apically; claws long and slender $1/2$ to $3/4$ the length of the tarsi, not denticulate; 2 pairs of wing buds; gills usually single, may be double on segments 1-6, the second portion consisting of a small recurved dorsal flap; tracheation pinnate, may be on inner side only; tails three, approximately equal in length and thickness.

Genotype: Centroptilum luteolum (in Ephemera) Muller

CENTROPTILUM

Key To Adults

1. Abdominal tergites 7-10 opaque creamy whitish. Inner margin of second forceps joint with a poorly developed tubercle. Eyes orange brown. Mesothorax yellow brown.....album McD
Abdominal tergites 7-10 not whitish. Inner margin of forceps joint with a distinct tubercle on inward bulge.....2.
2. Inner margin of second forceps joint distinctly and prominently tuberculate. Distal joint of forceps very long. Eyes black-brown. Mesothorax black. Abdominal tergites 2-6 hyaline white.conturbatum McD
Inner margin of second joint of forceps may possess a distinct inward bulge, but is not tuberculate. Distal joint of forceps is shorter. Eyes not black-brown. Mesothorax not black. Abdominal tergites 2-6 not hyaline white.....3.

3. A distinct tubercle is present between the bases of the forceps limbs. Tergites 2-4 with narrow ruddy posterior margins, 7-9 chocolate brown, 10 yellowish. Mesothorax deep olive brown. Eyes orange-brown.....bifurcatum McD
- No tubercle between the bases of the forceps limbs. Wedge shaped ruddy lateral markings on tergites 2-6, 7-10 red-brown. Mesothorax olivaceous. Eyes red.....bellum McD

Key To Nymphs

1. Gills single on all segments.....2.
- Gills double on some or all segments.....3.
2. Abdominal segments 7-10 largely shaded with brown. Lateral edges of all tergites pale, with a brown transverse band on each. Gill tracheation quite distinct, usually pinnate....
.....album McD
- Abdominal tergites brown, patterned with 3 pale spots on each. Tergites 7 and 10 largely pale. Gills tracheation not distinct.....sp. 1
3. Gills double on segments 1-7. Tails with a dark apical band.....
.....bellum McD
- Gills double on segments 1-2. No banded tail.....4.
4. Faint pattern on tergites, but posterior borders dark brown..sp. 3
- Tergites unicoloured on lateral edges largely pale.....5.
5. No pattern on tergites.....sp. 4
- Abdominal tergites 7-10 largely shaded with brown. Lateral edges of all tergites pale, with brown transverse band on each...
.....sp. 2

Unknown:

Centroptilum bifurcatum McD

Centroptilum conturbatum McD

CENTROPTILUM ALBUM McDUNNOUGH

Centroptilum album McDunnough, Needham, 1935, The Biology of May-flies, 708 (Bibliography)

Adult:

Turbinate eyes orange-brown; mesonotum pale ochreous with brown shading, scutellum and posterior portion almost entirely white with faint pink shading; metanotum deep brown posteriorly, anterior margin white with pinkish shading, and a median dark spot; pleura and sterna deep brown; legs white; wings hyaline; venation pale; hind wing very narrow; costal projection prominent; abdominal tergites hyaline in male, yellowish or whitish; tergites 7-10 opaque, creamy white; tails white; inward bulge of second forceps joint slight.

Nymph:

Gills single on segments 1-7 (no recurved flap); gill tracheation normally pinnate, distinct; abdominal tergites 7-10 largely shaded with brown.

Distribution: British Columbia, Eastern North America

No specimens of this species were examined.

CENTROPTILUM BELLUM McDUNNOUGH

Centroptilum bellum McDunnough, Needham, 1935, The Biology of May-flies, 709 (Bibliography)

Adult:

Turbinate eyes deep reddish; mesonotum olivaceous shaded with yellowish subdorsally; lateral and posterior margins tinged with

ruddy; metanotum deep olive brown, sutures darker, anterior dorsal portion shaded with ruddy; legs yellowish white; wings hyaline; hind wing moderately broad; two longitudinal veins; abdominal tergites 2-6 semi-hyaline, pale yellowish, the posterior margins narrowly ruddy brown ending in faint small reddish patches in the spiracular area; tergites 7-10 bright ruddy brown; sternites 2-6 pale; sternites 7-10 opaque yellowish shaded laterally with reddish and with faint ruddy posterior margins; spiracular line blackish; forceps and tails white.

Nymph: Gills double on all segments; abdominal tergites marked with brown; tergites 4, 5, 7, 8, and 10 paler; tails dark in apical 1/3.

Distribution: British Columbia, Quebec.

Material Examined:

1 Nymph, British Columbia: Williams Lake, VI.24.61 (G.G.E. Scudder)

CENTROPTILUM BIFURCATUM McDUNNOUGH

Centroptilum bifurcatum McDunnough, Needham, 1935, The Biology of Mayflies, 711 (Bibliography)

Adult:

Thorax deep olive brown, mesonotum with a pale yellow line extending forward along each lateral margin from the wing base, ending in a small round yellowish patch, and yellowish sutures and posterior margin; legs pale yellowish white, femora deeper in colour; wings hyaline; hind wing relatively wide; two longitudinal veins, the second may be faintly forked near its apex; abdominal tergites 2-6 hyaline, yellowish white; tergites 2-4 with a faint reddish dorsal hair-line, and traces of ruddy shading on posterior margins; on segments 2-6, spiracular area marked by a broken blackish line;

tergites 7-9 deep chocolate brown; tergite 10 pale yellowish; sternites 7-9 alabaster white; forceps and tails whitish; plate between forceps base large and dome-shaped; bearing a small pointed tubercle.

Nymph: Unknown

Distribution: Idaho, British Columbia

No specimens of this species were examined.

CENTROPTILUM CONTURBATUM McDUNNOUGH

Centroptilum conturbatum McDunnough, Needham, 1935, The Biology
Mayflies, 712 (Bibliography)

Adult:

Turbinate eyes dark blackish brown; thorax shiny black; legs white; wings hyaline; venation pale; abdominal tergites 2-6 and part of 7 hyaline white, sometimes with faint dusky shading posteriorly on middle segments; tergites 8-10, and often part of 7, chocolate brown; sternites white, 2-6 hyaline, 7-10 opaque; tails white; inner margin of second forceps joint distinctly tuberculate; third joint strongly bowed; distal joint unusually long; plate between forceps base conical on its posterior margin.

Nymph: Unknown

Distribution: Wyoming, California, British Columbia

No specimens of this species were examined.

Centroptilum sp. 1

Adult: Unknown

Nymph:

Pectinate spines on galea; gills single on segments 1-7, large; tracheation indistinct; abdominal tergites brown, markings variable

usually 3 pale spots on each tergite, but there may be fewer or none; tergites 7 and 10, or 7 only, or 1, 2, 6, 7, and 10, may be pale; tails 3, heavily fringed; tails usually pale with a dark middle and apical band or may be entirely pale.

Ecology:

This species was taken from the middle and edges of various locations on the Alouette River, from depths ranging from 1 to 5 feet, generally, however, at depths of 1 to 2 feet. The stream bed varied from mud, through sand, gravel, rocks and boulders to bedrock. The current was also variable, from quiet, still water, to swift rapids. This is a very plentiful and common species.

They were taken the year round.

Distribution: British Columbia

Material Examined:

3 Nymphs, British Columbia: Alouette River (Haney), V.14.59 (N.J. Filmer), 1 Nymph, British Columbia: Alouette River (Haney), VIII.26.59 (N.J. Filmer), 2 Nymphs, British Columbia: Alouette River (Haney), XI.26.59, (N.J. Filmer).

Centroptilum sp. 2

Adult: Unknown

Nymph:

Maxillary palp 2-jointed; slight spines on postero-lateral angles of abdominal tergites; gills large, on segments 1-7, distinctly tracheated; gills on segments 1-2 double, rest single; lateral margins of all abdominal tergites pale, each margin with a brown transverse band; tergites 7-10 largely shaded with brown; tails 3, entirely pale.

Ecology:

This species was taken from only one location on the Alouette River, from the edge, at a depth of 1 to 2 feet. The stream bed consisted of mud and silt, with some rocks. The water was still. All specimens were taken in mid-August.

Distribution: British Columbia

Material Examined:

1 Nymph, British Columbia: Alouette River (Haney),
VIII.11.59 (N.J. Filmer); 9 Nymphs, British Columbia:
Springhouse Lake, VIII.31.62 (G.G.E. Scudder).

Centroptilum sp. 3

Adult: Unknown

Nymph:

Both mandibles equal in size; gills double on segment 1 and 2, single on segments 3-7; abdominal tergites with a faint pattern, but posterior borders dark brown; tails entirely pale.

Distribution: British Columbia

Material Examined:

7 Nymphs, British Columbia: Babine Lake, VII.10.61 (T. Northcote).

Centroptilum sp. 4

Adult: Unknown

Nymph:

Mandibles equal in size; gills double on segments 1 and 2, single on segments 3 to 7; abdominal tergites and sternites unicoloured, brown, with no pattern; tails 3, entirely pale.

Distribution: British Columbia

Material Examined:

1 Nymph, British Columbia: Springhouse Lake, VIII.18.62 (G.G.E. Scudder), 1 Nymph, British Columbia: Westwick, VI.1.62 (G.G.E. Scudder).

GENUS NEOGLOEON TRAVER

Neogloeon, Needham, 1935, The Biology of Mayflies, 730 (Bibliography)

Adult:

Small mayflies; turbinate eyes large, lengthily egg-shaped; eyes of female large and set high on the side of the head; posterior margin of head very slightly emarginate; fore leg of male slightly shorter than the body; femur $3/4$ the length of the tibia, which is subequal to the tarsus; in female, femur and tibia subequal; tibia about $1-1/2$ as long as tarsus; in hind leg of male, femur $1-1/3$ to $1-1/2$ times the length of the tibia, which is subequal to the tarsus; basal tarsal joint of both sexes very long, equal to other 3 joints combined; in hind leg of female, femur almost twice the length of the tibia, which is slightly larger than the tarsus; marginal intercalaries of forewing single; hind wing absent; basal joint of forceps $1-1/3$ times as wide as long; 2nd joint short and broad, its inner margin with a prominent, axe-shaped extension; slight swelling near base on inner margin of 3rd joint; and a more distinct swelling apically, the whole being slightly bowed; distal joint $2-1/2$ to 3 times as long as wide; apical margin of sternite 9 of female almost straight.

Nymph:

Maxillary palpi 3-jointed, extending well beyond to tip of the galea-lacinia; canines of mandibles long and slender; labial palpi 3-jointed, distal joints widely dilated apically; claws long and

slender; almost $3/4$ as long as the tarsi, not denticulate; meta-thoracic wing buds absent; gills single on segments 1-7; gills assymmetrically shaped, straight on anterior margin and lobed on posterior margin; tracheation pinnate, all branches on the posterior side; tails 3, approximately equal in length and thickness.

Genotype: Neocloeon alamance Traver.

Neocloeon sp. 1

Adult: Unknown

Nymph:

No pectinate spines on galea; gills single on segments 1-7; a generally pale species; with abdominal tergite 7 dark; tails entirely pale, or with a dark tip.

Ecology:

Specimens of this species were taken from the middle and edges of many locations on the Alouette River. The depth varied from $1/2$ to 5 feet, although usually the water was 1 foot deep. The stream bed varied from mud, through sand, gravel, rocks, and boulders, to bedrock. The current was generally still to quiet ripples.

Specimens were taken from May to December.

Material Examined:

1 Nymph, British Columbia: Alouette River (Haney), V.26.59 (N.J. Filmer), 1 Nymph, British Columbia: Alouette River (Haney), V.19.59, (N.J. Filmer), 1 Nymph: British Columbia: Alouette River (Haney), VI.9.59 (N.J. Filmer), 1 Nymph, British Columbia: Alouette River (Haney), VII.1.59 (N.J. Filmer).

SUPERFAMILY LEPTOPHLEBIOIDEA

Key To Adults

1. Hind wings absent. Outer fork of Rs of forewing very deep.

Posterior branch of M in forewing and intercalary between
branches of this vein much shorter than anterior branch,
not extending to base of wing. Forceps 3-jointed.....

.....Family Tricorythidae, Subfamily Leptohyphinae

Hind wing present. Outer fork of Rs of forewing normal. Posterior
branch of M of forewing normal. Forceps 1, 2, or 3 jointed..

.....2.

2. No true intercalaries in forewing between median intercalary

and posterior branch of M, or between M and Cul. Male
forceps with 2 or 3 short terminal joints.

.....Family Leptophlebiidae, Subfamily Leptophlebiinae

Two short intercalaries in forewing between median intercalary

and posterior branch of M, also between M and Cul. Male
forceps with a single short terminal joint.....

.....Family Ephemerellidae, Subfamily Ephemerellinae

Key To Nymphs

1. Gills present on segments 1 to 7. No elyteroid gills. Gills

tuning-fork shaped, without fringed margins. Depressed
mandibular tusks visible from above.....

.....Family Leptophlebiidae, Subfamily Leptophlebiinae

Gills not on segments 1 to 7. May or may not be elyteroid or

semi elyteroid gills. No mandibular tusks..... 2.

2. Gills present on segment 3 or 4 to 7. Gills on segments 3 or 4 may be elyteroid, semi elyteroid, or similar to those on segments 4 or 5 to 7. A rudimentary gill is often present on Segment 1.....Family Ephemerellidae, Subfamily Ephemerellinae
- Gills present on segments 1 to 6 only, rudimentary on segment 1.
1. Gills on Segment 2 elyteroid; triangular or oval, covering all others.....Family Tricorythidae, Subfamily Leptohyphinae

SUBFAMILY LEPTOPHLEBIINAE

Adult:

Eyes of male not turbinate, but grooved; hind femur usually shorter than tibia, which is longer than the tarsus; tarsi 4-jointed, except for a very short extra basal joint in the male fore tarsus; all claws dissimilar; no true intercalaries between the median intercalary and the posterior branch of the media in the forewing, or between the posterior branch of the media and the anterior branch of the cubitus; the two branches of the cubitus usually separated at base; between these two branches are 2 to 4 long intercalaries; Of of forewing and posterior branch of the media normal, attached basally; first anal vein ends in the hind margin, but not by a series of veinlets; Of of hind wing absent; costal projection present or absent; forceps 3-jointed, although there is occasionally a small fourth apical joint; basal joint longer than any other; subanal plate of female with a deeply excavated median cleft; tails three.

Nymph:

May be depressed in head and thorax with head prognathous, or compressed, with head hypognathous; mandibles often visible dorsally; may be depressed mandibular tusks, visible dorsally; labial palpi 3-jointed; all claws similar, denticulate; gills present on segments

1-7; gills forked, without fringed margins, or with outer margins bearing long fringes which are united at the base, or terminating in a filament or point; postero-lateral spines present on segments 8 and 9, or 9 only; tails 3, the outer tails fringed on both sides.

SUBFAMILY LEPTOPHLEBIINAE

Key To Adults

1. Middle tail shorter and weaker than laterals.....Blasturus Eaton
Middle tail approximately equal to laterals in length and thickness.....2.
2. Penes separated almost to base. A long flap-like appendage, narrowed distally, is attached near apex of each penis and extends inward and downward between lobes of penes.....
.....Leptophlebia Westwood
Penes not separated almost to base. Usually two sets of appendages, an upper and shorter pair extending laterally, and a longer pair (the reflexed spur) extending backward, often obliquely.....Paraleptophlebia Lestage

Key To Nymphs

1. Gills broad, not lobed, lamelliiform. Gill on segment 1 different from rest, bifid except at base.....Blasturus Eaton
Gills lanceolate, and tuning-fork shaped. Gill on segment 1 like all the rest.....Paraleptophlebia Lestage

GENUS LEPTOPHLEBIA WESTWOOD

Leptophlebia, Needham, 1935, The Biology of Mayflies, 507 (Bibliography)

Adult:

Male fore tarsus longer than tibia; posterior branch of Of of Rs of forewing sagged to rearward; hind wing with no costal projection

but a slight concavity near the middle of the anterior margin; media of hind wing forked; penes separated almost to base; a long, distally narrowed, flap-like appendage extends inward and downward from the apex of each penis, reaching between the lobes of the penes; cleft in the base of each forceps; cleft in apical margin of subanal plate of female deep; long, approximately equal in length and thickness.

Nymph:

Labrum much narrower than the head; 5-6 maxillary spines; 1 row of teeth on claws; gills broad, lanceolate, not fringed; gills on segment 1 bifid, except at base, differing in form from following pairs; no lateral lobes on bases of gills; terminal extension of each gill long and slender; well-developed postero-lateral spines on segments 8 and 9; posterior margins of all abdominal tergites with a dense row of minute spinules.

Genotype: Leptophlebia vespertina (in Ephemera) Linnaeus

LEPTOPHLEBIA

Key To Adults

1. Shiny dark brown. C, Sc and R, brown, heavy, other veins pale brown. Short, stout abdomen. Distinct crossveins between M2 and Cu.....sp.1
Shiny dark brown, but anterior 1/4 of tergites 2-7 pale hyaline. Long, slender abdomen. Faint crossveins between M2 and Cu.
C, Sc and R, yellow, heavy, other veins pale.....sp. 2

Leptophlebia sp. 1

Adult:

A shiny dark brown species; legs reddish yellow, forelegs darker;

C, Sc and R1 heavy, dark brown, other veins light brown.

Nymph: Unknown

Distribution: British Columbia

Material Examined:

- 2 Female, British Columbia: Chilcotin, VI.16.29, (G.J. Spencer),
- 2 subimago, British Columbia: Chilcotin, VI.15.29 (G.J. Spencer)
- 1 subimago, British Columbia: Quesnel, VII.16.49 (G.J. Spencer)
- 1 subimago, British Columbia: Quesnel, VI.25.49 (G.J. Spencer)
- 1 Female, British Columbia: Phililloa Lake, VI.6.60, (E.Adams).

Leptophlebia sp. 2

Adult: (Male)

A shiny dark brown species; legs brown, tarsi pale; C, SC, R1 of forewing yellow, heavy, other veins pale; faint crossveins between M2 and Cu; anterior 1/4 of abdominal tergites 2-7 pale hyaline; tails and forceps pale.

Nymph: Unknown

Distribution: British Columbia

Material Examined:

- 1 Male, British Columbia: Haney, VII.7.48,
- 1 Male, British Columbia: Haney, VII.5.48
- 1 Male, British Columbia: Chilcotin, VI.16.29 (G.J. Spencer)
- 1 Male, British Columbia: Chilcotin, VI.12.31 (G.J. Spencer)
- 1 Male, British Columbia: Departure Bay, VI.10.25 (G.J. Spencer)
- 1 ?, British Columbia: Vancouver, VI.3.34 (J.K. Jacob), 1 subimago
- British Columbia: Quesnel, VI.25.49 (G.J. Spencer), 1 subimago
- British Columbia: Quesnel, VIII.7.48 (G.J. Spencer). 1 ? Kettle Valley, VI.-VIII.35.

GENUS BLASTURUS EATON

Blasturus, Needham, 1935, The Biology of Mayflies, 531 (Bibliography)

Adult:

Large, brown, reddish-brown, or blackish mayflies; fore legs dark, others pale; no bands on femora; knee caps narrowly cross-lined with black; wings subhyaline; may be clouded with brown; usually a little darker toward the costa; numerous irregular and anastomosing stigmatic crossveins; posterior branch of Of of Rs of forewing sags to rearward; hind wing with no costal projection; costal margin slightly concave at middle; abdomen lighter in colour than thorax, especially in middle segments, and paler joinings of segments give abdomen an annulate appearance; tergites with a pale narrow median line, on each side of which is a pair of oblique pale marks in anterior portion of each tergite; forceps 4-jointed occasionally, otherwise 3-jointed; penes long, separated by a U-shaped notch; a small acurvinate spine at tip of each penis; each penis with a large, flattened, curved reflexed spur which reaches to the base of the notch; subanal plate of female prolonged and deeply emarginate; tails three, middle one weaker and shorter than the laterals, usually darker at joinings.

Nymph:

Claws with a double row of denticles; gills on segments 1-7, lamelliform, those of the middle segments with one or two blunt lobes at the bases of the terminal extensions; terminal extensions very long and slender; gill on segment 1 not like the rest, narrow, bifid except at base; gill lamellae wide, margins entire in segments 1 and 7; in rest terminal filament deeply notched on one or both sides;

postero-lateral spines on tergites 8 and 9; tails 3, all much the same in length and thickness.

Genotype: Blasturus cupidus (in Ephemera) Say

BLASTURUS

Key To Adults

1. Brownish cloud extending across outer third of wing tip. Tail joinings dark brown. Middle tail $1/4$ length of lateral tails.....nebulosus (Walker)
No cloud or band on outer portion of forewing. Tail joinings dark brown or obscure. Middle tail not less than $1/3$ length of the lateral tails.....2.
2. Tail joinings whitish, with dark brown joinings.....sp. 1
Tail joinings light or dark, joinings obscure.....3.
3. Tails whitish to light tan. Fore femur red-brown...cupidus (Say)
Tails brown. Fore femur brown.....gravastella (Eaton)

Key To Nymphs

1. Upper portion of 3rd pair of gills with a median extension of main trachea shorter than gill plate proper. Lateral lobes at tip of lower gill of 3rd pair approximately equal in length.....cupidus (Say)
Upper portion of 3rd pair of gills with a median extension of main trachea as long as or longer than gill plate proper. Lateral lobes on lower portion of 3rd pair unequal in length..
.....nebulosus (Walker)

Unknown:

Blasturus gravastella (Eaton)

BLASTURUS CUPIDUS (SAY)

Blasturus cupidus (Say), Needham, 1935, The Biology of Mayflies,
535 (Bibliography)

Adult:

A blackish species; legs brown, fore femora darker red-brown with narrowly black lined knee caps; wings subhyaline, opaque; stigmatic areas stained brown; venation brown, darker in stigmatic area; crossveins in stigmatic area irregular and anastomosing; abdominal tergites dark brown becoming blackish towards the ends; apex of 10th tergite yellowish; pale mid-dorsal line obscure or absent; oblique paired spots crescentic and may be suffused with blackish, spiracles marked by minute black elongate dashes; sternites fawn colour; sternite 9 dark brown; tails 3, middle tail 1/3 the length of the laterals; tail joinings obscurely brown, bands being alternately wide and narrow; penes as in fig. 3.

Nymph:

6-7 large pectinate spines below the crown of the maxilla; legs not banded, or with indistinct bands; upper portion of the third pair of gills with the median extension of the main trachea shorter than the gill plate proper; lateral lobes at the tip of the lower portions of the 3rd pair of gills approximately equal in length; postero-lateral spines on tergite 8 shorter than those on tergite 9, which are blunt, not extending to the center of tergite 10.

Distribution:

New York, Ohio, Massachusetts, British Columbia.
No specimens of this species were examined.

BLASTURUS GRAVASTELLA (EATON)

Blasturus gravastella (Eaton), Needham, 1935, The Biology of Mayflies, 537 (Bibliography)

Adult:

A dark species, legs brown; wings hyaline, a brown stain in the stigmatic area of the forewing; venation yellowish-brown except in basal portion; stigmatic crossveins regular and opaque; abdominal tergites brown, middle segments lighter with paler joinings; mid-dorsal pale line very faint, broadly dilated at posterior margins of middle segments; paired oblique spots obscur, linear, confluent anteriorly with pale joinings; sternites paler, unicoloured; tails 3, middle tail $1/3$ to $1/2$ the length of the laterals; tails brown, obscurely and uniformly tinged with darker brown.

Nymph: Unknown

Distribution: Colorado, British Columbia

No specimens of this species were examined.

BLASTURUS NEBULOSUS (WALKER)

Blasturus nebulosus (Walker), Needham, 1935, The Biology of Mayflies, 538 (Bibliography)

Adult:

A brownish black species; fore legs reddish brown, femora paler; middle and hind legs yellowish; wings hyaline; forewings with a brownish cloud extending across apical $1/3$ of the wing; venation brown; costal crossveins faint except in stigmatic area where they are irregular, crowded, and slightly anastomosing; abdominal tergites brown, darker on segments 1, 2, 8 and 9; pale mid-dorsal line very fine and partly interrupted; oblique mark crescentic, isolated;

joinings of middle segments whitish; sternites paler; tails pale brown or greyish, ringed at joinings with dark brown; tails 3, middle on 1/4 the length of the laterals; lobes of forceps base separated by a sharply V-shaped cleft and with sub-truncate apices; penes separated by a goblet-shaped cleft; reflexed spur strongly bent, dilated at tip, and extending below the level of the cleft.

Nymph:

6-7 pectinate spines below the crown of the maxilla; legs not banded, or with indistinct bands; upper portion of 3rd pair of gills with the media extension of the main trachea as long as or longer than the gill plate proper; lateral lobes of lower portion of 3rd pair of gills unequal in length; postero-lateral spine on tergite 8 shorter than that on tergite 9.

Distribution: Maine, Colorado, Wyoming, New York, Virginia, British Columbia.

Material Examined:

The author has examined 41 specimens, all males, from the following localities: British Columbia: Nicola Lk., V.21.44; Nicola, VI.21.44; Nicola, VI.27.43; Lake La Hache, VI.8.47; Nicola, VI.19.46; Nicola, VI.27.46; Nicola, VI.21.46. All specimens were taken by Mr. G.J. Spencer.

Blasturus sp. 1

Adult: (Female)

Very similar to B. nebulosus; no cloud on wing; fore femur red-brown; tails whitish, tail joinings dark.

Nymph: Unknown

Distribution: British Columbia

Material Examined:

3 Female, British Columbia: Lac La Hache, VI.8.47 (G.J. Spencer)

6 Female, British Columbia: Nicola, VI.27.43 (G.J. Spencer)

5 Female, British Columbia: Nicola, VI.19.46 (G.J. Spencer)

3 Female, British Columbia: Nicola, VI.21.44 (G.J. Spencer)

This is possibly the female of Blasturus nebulosus (Walker).

GENUS PARALEPTOPHLEBIA LESTAGE

Paraleptophlebia, Needham, 1935, The Biology of Mayflies, 510

(Bibliography)

Adult:

A small to medium-sized species, sexes different in colour; males with blackish head, thorax, and tip of abdomen; female reddish or reddish brown; legs yellowish or brownish, without banded femora; posterior branch of Of of Rs of forewing sagged to rearward; no costal projection on hind wing, and costal margin slightly concave in center; median vein forked; no intercalaries in cubital fork, or between cubitus and media; wings hyaline, may be tinted with amber; middle abdominal segments in male dark brown, or whitish, with or without obscure brownish markings; penes with one, usually 2 pairs of appendages, the upper of apical pair shorter and extending laterally, the lower pair longer reflexed spurs extending backwards, often obliquely; penes not separated almost to base; forceps usually 3-jointed, although there may be a 4th joint by the addition of a short basal ring-like joint or a terminal joint; cleft in base of forceps; apical margin of subanal plate of female with a deep median cleft; tails three, equal in length and thickness, slightly longer than the body.

Nymph:

Nymphs slender, compressed, head may be somewhat depressed; mouthparts as in Blasturus and Leptophlebia; labrum much narrower than head, with a shallow indentation on anterior border; 4-6 large pectinate spines below crown of the maxilla; claws slender and pectinate, one row only; gills narrowly lanceolate, tuning fork-shaped or more deeply divided, not fringed on margins; gills not diminished in size to rearward, 1st pair similar to others; spinules present on posterior margins of abdominal tergites 1-10; postero-lateral spines on tergites 8 and 9, or 9 only, those on 9 not more than 1/4 the length of the segment.

Genotype: Paraleptophlebia cincta (in Leptophlebia) Eaton

PARALEPTOPHLEBIA

Key To Adults

1. Penes with reflexed spur on penis tip.....2.
Penes with no reflexed spur on penis tip.....5.
2. Conspicuous lobe on basal joint of forceps.....3.
No conspicuous lobe on basal joint of forceps.....4.
3. Tips of penes with a pair of convergent wide lobes projecting within the apical notch. Wing length 10 mm..bicornhuta (McD)
Tips of penes with no lobes within the apical notch. Wing length 8 mm.....debilis (Walker)
4. Middle abdominal tergites predominantly brown...gregalis (Eaton)
Middle abdominal tergites wholly white.....vaciva (Eaton)
5. Middle abdominal tergites clouded or bordered with black or brown, but predominantly white.....6.
Middle abdominal tergites predominantly brown..rufivenosa (Eaton)

6. Penes with apical teeth.....7.
 Penes with no apical teeth.....heteronea (McD)
7. Black transverse dash in postero-lateral corners of tergites
 2-6, remainder of apical margin pale.....pallipes (Hagen)
 Entire apical margin of each middle abdominal tergite narrowly
 black.....temporalis (McD)

Key To Nymphs

1. Mandible with tusks.....2.
 Mandible with no tusks.....5.
2. Mandible with tusk longer than the head.....3.
 Mandible with tusk not as long as head.....4.
3. Mandibular tusk more than twice the length of the body of the
 mandible.....sp. 3
 Mandibular tusk only slightly longer than the body of the
 mandible.....bicornuta (McD)
4. Antennae with no dark medial band. Legs pale, barred with
 darker brown.....debilis (Walker)
 Antennae with a dark medial band. Legs dark, with pale apical
 transverse bands on femora.....sp. 4
5. Lateral branches on gill tracheae.....6.
 No lateral branches on gill tracheae.....8
6. Fore tibiae not marked with dark margins.....7
 Fore tibiae marked with a dark margin.....sp. 2
7. Occiput dark.....pallipes (Hagen)
 Occiput pale.....sp. 5
8. A few middle abdominal segments pale spotted....gregalis (Eaton)
 All abdominal segments pale spotted.....sp. 1

Unknown:

Paraleptophlebia heteronea (McD)

Paraleptophlebia rufivenosa (Eaton)

Paraleptophlebia temporalis (McD)

Paraleptophlebia vaciva (Eaton)

PARALEPTOPHLEBIA BICORNUTA (McDUNNOUGH)

Paraleptophlebia bicornuta (McDunnough), Needham, 1935, The Biology
of Mayflies, 517 (Bibliography)

Adult:

Head and thorax blackish brown, above, paler beneath; wings hyaline, venation brown; costal crossveins obsolete except in stigmatic area where they are numerous, long, aslant; and may be forked; abdominal tergite 1 dark brown, 2 lighter, 8 to 10 red-brown, 3-7 white with posterior half clouded or bordered with brown or black; sternite 1 brown, 8 and posterior half of 9 bright reddish brown, rest faintly tinged with brown; basal joint of forceps brown, rest white; a conspicuous dorsal lobe on the basal joint of the forceps; penes broadly separated by a very wide U-shaped notch; penes dilated and truncated at tip; a pair of long flat lobes converging by their rounded ends with the notch are attached to the dorsal side of the penes just before their tips; reflexed spur bifid, almost crescentic, attached by back of crescent, outer horn longer; tail pale brown.

Nymph:

Mandible with a forward projecting tusk that is longer than the head, and only slightly longer than the body of the mandible; gill tracheae with no or a few lateral branches.

Ecology:

This species was taken from the middle and edges of various

locations on the Alouette River, usually at a depth of 1 to 2 feet although they have also been taken at a depth of 5 feet. The stream bed varied from mud, through sand, gravel, rocks, boulders, to bedrock. The current varied from slow and quiet to ripples. All specimens were collected during the months of July, August, and September.

Distribution: Alberta, Montana, British Columbia

Material Examined:

3 Nymphs, British Columbia: Alouette River (Haney), VIII.11.59
(N.J. Filmer).

PARALEPTOPHLEBIA DEBILIS (WALKER)

Paraleptophlebia debilis (Walker), Needham, 1935, The Biology of
Mayflies, 519 (Bibliography)

Adult:

Head and thorax a deep rich brown; wings hyaline; venation pale; costal crossveins obsolete except in stigmatic area where they are numerous, simple, curved, aslant, and obsolescent at subcostal ends; abdominal tergites 1 and 8-10 deep rich brown; tergites 3-7 white, with posterior margins broadly bordered with brownish purple; spiracles marked with a brown point and a round brown spot anterior to each above the lateral margin of the tergites; ganglia marked with yellow; basal joint of forceps with a large, ventral, lobe-like dilation; penes separated by a U-shaped notch; tips of penes with no lobe within the apical notch, but penes dilated at tips, and on the outer side of each tip there is a recurved lateral tooth; reflexed spur twice as long as the depth of the notch, arcuate, outcurving and acute at tip; tails white.

Nymph:

Head brown dorsally with a dark vertex; antennae with no dark medial band; mandibles small, only a small portion visible dorsally, tips not extending beyond head; no mandibular tusk; maxillary palp 3-jointed, the 1st joint equal in length to the other two together; legs pale, banded with darker brown; middle abdominal tergites pale spotted; gill tracheae without conspicuous lateral branches; postero-lateral spines on tergites 8 and 9.

Distribution:

New York, Pennsylvania, Ohio, Alberta, Washington, British Columbia.

Material Examined:

2 Nymphs, British Columbia: Nicola Creek (G.G.E. Scudder).

PARALEPTOPHLEBIA GREGALIS (EATON)

Paraleptophlebia gregalis (Eaton), Spieth, 1941, Ann. Ent. Soc. Amer.

34:94 (Bibliography)

Adult:

A reddish brown mayfly; thorax blackish dorsally; wings hyaline; venation pale, with longitudinal veins and stigmatic crossveins tinged with brown; stigmatic crossveins 12 to 16 in number, somewhat branching, irregular; all abdominal tergites brown, darker at joinings of middle segments; basal joint of forceps with no basal dilation or lobe or short basal subjoint, but is conical basally, then parallel sided for half its length, then slowly tapering to apex; 2nd joint twice as long as the 3rd joint; penes separated by a broad U-shaped notch which is almost closed by a pair of hyaline, oblong, broad, flat, obliquely converging lobes extending for most of their length

beyond the chitinized tip, giving the notch a flask shape; apex of each penis is obliquely truncate, the short external angle ending in a sharp backward tooth; reflexed spur is hyaline, semi-elliptical with a straightish external margin and a convex internal margin, widest near base and gradually tapering towards the acute apex, its greatest width not more than $1/3$ its length, a little longer than the depth of the notch; lobes of the divided 10th sternite broadly triangular with rounded ends; tails dingy whitish, ferruginous basally.

Nymph:

Head marked with a white spot; no mandibular tusks; fore tibiae marked with dark margins; a few middle abdominal tergites pale spotted; gill tracheae with no lateral branches; postero-lateral spines on tergites 8 and 9.

Distribution: California, British Columbia

No specimens of this species were examined.

PARALEPTOPHLEBIA HETERONEA (McDUNNOUGH)

Paraleptophlebia heteronea (McDunnough), Needham, 1935, The Biology
Mayflies, 523 (Bibliography)

Adult:

Head and thorax rich reddish brown dorsally; wings whitish; no costal crossveins, except for a few irregular ones in the stigmatic area; basal abdominal tergites and tergites 8-10 brown, rest whitish in anterior portions and brown or blackish posteriorly, posterior band being widest on segments 4 and 5 and disappearing on 7; spiracles black and connected by a black broken line; basal joint of forceps with no lobe, but broad basally, parallel sided to middle, then

tapering strongly; 3rd joint nearly as long as the 2nd, but much more slender; penes separated by a V-shaped notch; penes notched on inner and outer margins near apex; no apical teeth or reflexed spurs.

Nymph: Unknown.

Distribution: Colorado, Alberta, British Columbia.

No specimens of this species were examined.

PARALEPTOPHLEBIA PALLIPES (HAGEN)

Paraleptophlebia pallipes (Hagen), Needham, 1935, The Biology of Mayflies, 527 (Bibliography)

Adult:

Head and thorax black dorsally; wings whitish, milky along costal area; especially in stigmatic area; stigmatic crossveins few in number, obscure, straight, unbranched; extreme wing base tinged with brown; abdominal tergite 2 pale brown, 3-6 white with touches of brown on posterior borders, labial spiracles, and also on spiracles; tergites 2-6 with black transverse dashes in postero-lateral corners; tergites 7-10 brown; ganglia yellow; basal forceps joint with no lobe, but is irregularly tapered to its apical 4th and then slightly widened; 3rd joint almost as long as the 2nd but much more slender; penes separated by a goblet-shaped notch; penes consist of long slender tubes behind each of which is a long, sharp posteriorly directed, curving spine on the outer side of each, its length more than half the depth of the notch; penes with apical teeth but no reflexed spurs.

Nymph:

Head marked with a dark occiput; no mandibular tusks; fore tibiae not marked with dark margins; gill tracheae with lateral branches; middle abdominal tergites pale spotted.

Distribution: Oregon, Colorado, California, British Columbia

No specimens of this species were examined.

PARALEPTOPHLEBIA RUFIVENOSA (EATON)

Paraleptophlebia rufivenosa (Eaton), Spieth, 1941, Ann. Ent. Soc.

Amer., 34:96 (Bibliography)

Adult:

Head and thorax dark brown; wings subhyaline; venation reddish, crossveins paler except in basal 1/3; stigmatic crossveins strongly tinged, crowded, oblique, some forked; middle abdominal segments pale brown, apical segments dark brown; no pattern on tergites; sternite 9 narrowly divided by a V-shaped notch; basal forceps joint with no conspicuous lobe, no basal dilation, and not marked off by a short basal subjoint, but tapers regularly to apex, slightly corrugated internally; 3rd segment as large as the 2nd; penes separated in their apical halves by a rounded V-shaped notch; margins of penes parallel almost to tip where there is a laterally projecting triangular tooth on each; no apical teeth or reflexed spurs on penes; tails pale brown.

Nymph: Unknown

Distribution: Idaho, British Columbia

No specimens of this species were examined.

PARALEPTOPHLEBIA TEMPORALIS (McDUNNOUGH)

Paraleptophlebia temporalis (McDunnough), Needham, 1935, The Biology

of Mayflies, 529 (Bibliography)

Adult:

Head and thorax brown dorsally; wings subhyaline; venation pale brown; costal crossveins nearly obsolete; stigmatic crossveins single, straight, well spaced apart; abdominal tergites 2-7 white with

diffuse and ill-defined narrow brownish or blackish posterior margins, darker on 2 and 7; spiracles marked with a black R-shaped mark extending back over the posterior-lateral corner; basal joint of forceps with no conspicuous lobe, but tapered to $3/4$ its length; penes divided by a wide V-shaped notch; penes consist of long, straight tubes on the outside of which is a long spirally twisted spine, lying in the same plane and as long as the penes; penes with apical teeth but no reflexed spurs.

Nymph: Unknown

Distribution: Oregon, British Columbia

No specimens of this species were examined.

PARALEPTOPHLEBIA VACIVA (EATON)

Paraleptophlebia vaciva (Eaton), Spieth, 1941, Ann. Ent. Soc. Amer.

34:96

Adult:

Head and thorax shining brownish black; wings subhyaline, faintly tinged; venation pale, but costal longitudinal veins and stigmatic crossveins pale; stigmatic crossveins regular and widely spaced; abdominal segment 1 black, 2-7 translucent white with faint mid-dorsal clouds which are darker on tergite 6 and spread diffusely over more than half of tergite 7; tergites 8-10 blackish; ganglia marked with brown, sternites 8-10 brownish, no dark marks on spiracles; basal forceps joint with no conspicuous lobe; penes long, separated by a narrow cleft; penes tapered in basal half, then irregularly cylindrical; on outer margin of each penis is a visor-like backward-directed reflexed spur half their own length from the tip; tails whitish.

Nymph: Unknown

Distribution: Oregon, British Columbia

No specimens of this species were examined.

Paraleptophlebia sp. 1

Adult: Unknown

Nymph:

A short, wide species; no mandibular tusks; each abdominal tergite with a pair of sublateral dark dots; gills very long, tuning-fork shaped; no lateral branches on gill tracheae; postero-lateral spines on tergite 9 $1\frac{1}{4}$ the length of the segment; all abdominal tergites pale spotted.

Ecology:

This species was collected from many localities on the Alouette River, both from the middle and edges. They have been found at depths of 1 foot to 5 feet, although generally at 1 foot. The stream bed varied from mud, through sand, gravel, rocks and boulders, to bedrock, and the current from slow, quiet water to swift ripples and rapids. All specimens were taken from June to the following February.

Distribution: British Columbia

Material Examined:

3 Nymphs, British Columbia: Alouette River (Haney), VIII.5.59
(N.J. Filmer)

Paraleptophlebia sp. 2

Adult: Unknown

Nymph:

Longer and narrower than Paraleptophlebia sp. 1; no mandibular

tusks; long tuning-fork shaped gills; lateral branches on gill tracheae; no spots on tergites; postero-lateral spines on tergite 9 $1\frac{1}{4}$ the length of the segment; fore tibiae marked with a dark margin.

Ecology:

These nymphs were found in situations identical to those in which Paraleptophlebia sp. 1 were found, and were just as common. They were collected, however, only during May, June, July, and October to February.

Distribution: British Columbia

Material Examined:

3 Nymphs, British Columbia: Alouette River (Haney), VI.16.59
(N.J. Filmer)

Paraleptophlebia sp. 3

Adult: Unknown

Nymph:

Mandibular tusk longer than the head, and more than twice the length of the body of the mandible; femora each with a pale apical transverse band; gill tracheae with no lateral branches.

Distribution: British Columbia

Material Examined:

13 Nymphs, British Columbia: Nicola Creek (G.G.E. Scudder)

Paraleptophlebia sp. 4

Adult: Unknown

Nymph:

Mandibular tusk not as long as the head, about as long as the body of the mandible; antennae with a dark medial band; legs dark,

femora each with a pale apical transverse band; no visible tracheae in gills.

Distribution: British Columbia

Material Examined:

4 Nymphs, British Columbia: Nicola Creek (G.G.E. Scudder)

Paraleptophlebia sp. 5

Adult: Unknown

Nymph:

Occiput pale; pale spot between antennal bases and one lateral to each ocellus; no mandibular tusks; mandible not visible dorsally; fore tibiae not marked with dark margins; gill tracheae with lateral branches.

Distribution: British Columbia

Material Examined:

12 Nymphs, British Columbia: Loon Creek (Clinton), V.19.59

(G.G.E. Scudder); 5 Nymphs, British Columbia: Loon Creek (Clinton)

VI.13.? (H. Lorz).

SUBFAMILY EPHEMERELLINAE

Adult:

Eyes of male not turbinate, but are grooved; tarsi 4-jointed, except the fore tarsus of male which has a short basal joint; all claws dissimilar; venation of forewing similar to that in Blasturus; 2 or more short free intercalaries between the median intercalary and the posterior branch of the M, and also between the latter and Cu1; 2 cubital intercalaries; Of and the posterior branch of the M normal and attached basally; posterior branch of the Of of the Rs

not sagged to rearward; Cu2 strongly angulate before the middle; 1st anal vein ends in the hind margin, but not by a series of veinlets; hind wing well developed; costal projection low; Of of Rs wanting; forceps with a single short terminal joint; tails three.

Nymph:

No mandibular tusks; paired spines often present dorsally on head, thorax, and/or abdomen; forelegs with a sparse row of setae on the inner surfaces; all claws similar; no gill tufts on maxillae or fore coxae; gills exposed, present on segments 3-7 or 4-7; a rudimentary gill is often present on segment 1; gills on segments 3 or 4 may be similar to the following gills, or may be elyteroid or semi-elyteroid; tails three, all fringed on both sides.

GENUS EPHEMERELLA WALSH

Ephemerella, Needham, 1935, The Biology of Mayflies, 562

Edmunds & Allen, 1959, Ann. Ent. Soc. Amer., 52:543-546

(Bibliography)

Adult:

Small to medium sized, usually brownish mayflies; eyes of male divided, smaller lower portion darker than the larger upper portion; eyes usually closely approximated apically; eyes of female smaller, not divided, well set out on the sides of the head; occipital margin straight between the eyes; pronotum usually with a median carina; hind tarsus shorter than the tibia; 2nd and 3rd tarsal joints subequal; hind wing with a slight rounded costal projection, beyond which is a very shallow depression in the costal margin; M of hind wing forked slightly less than halfway from base; forceps 3-jointed,

the 2nd joint being the longest; penes with or without minute spines; apical margin of forceps base entire; apical margin of subanal plate of female usually obtusely rounded, but may be emarginate.

Allen and Edmunds (Edmunds, 1959), in their revision of the genus Ephemerella, have divided this genus into a number of subgenera, of which nine are found in North America. Of these, five are represented to date in British Columbia. Their distinguishing characteristics are as follows:

Subgenus Caudatella Edmunds (Male)

Lateral tails $1/4$ to $3/4$ as long as the median tail.

Genotype: Ephemerella heterocaudata McD

Subgenus Drunella Needham (Male)

Inner margin of 2nd joint of forceps distinctly incurved or strongly bowed; terminal segment of forceps more than twice as long as wide, but less than 4 times as long; all tails subequal.

Genotype: Ephemerella doddsi Needham

Subgenus Serratella Edmunds (Male)

Postero-lateral spines on segments 8 and 9 poorly developed or wanting; terminal joint of forceps less than twice as long as wide; penes either with dorsal or ventral spines or subapical tubercles, the apical notch deep, or penes as wide or wider at apex than at base; penis lobes usually bearing a subapical lateral tubercle on each lobe, if lacking, no tubercle present between forceps bases; all tails subequal.

Genotype: Ephemerella serrata Morgan

Subgenus Timpanoga Needham (Male)

Vestigial gills on abdominal segments 4-7; well-developed postero-lateral spines on tergites 8 and 9; terminal segment of

forceps less than twice as long as broad; all tails subequal in length.

Genotype: Ephemerella hecuba Eaton

Nymph:

There is a great variation in form in these nymphs; some are slender and streamlined, and others are flattened ventrally and convex dorsally, with broad flattened femora; some bear dorsal tubercles or paired spines on the head, thorax, abdomen, and legs; some are smooth, and others densely covered with hairs; labrum is wider than long; no mandibular tusks; maxillae conical at apices, with one or more broad terminal spines; maxillary palpi rudimentary or wanting, at most as long as galea-lacinia; labial palpi short; no gill tufts on maxillae or fore coxae; no setae on antero-lateral angles of the head; forelegs without a dense row of setae on inner surfaces; tarsal claws usually denticulate; abdominal tergites usually have lateral extensions bearing postero-lateral spines; gills exposed, dorsal in position; if gill on segment 4 is fully operculate, there is usually a short gill rudiment on segment 1; tails usually as long as the body, often hairy, or with whorls of spines at the joinings, often held upright or arched over the abdomen; the distinguishing characteristic of the British Columbia subgenera are as follows:

Subgenus Caudatella Edmunds

Gills on abdominal segments 3-7; lateral tails $1/4$ to $3/4$ as long as the median tail.

Subgenus Drunella Needham

Distinct tubercles and/or spines usually present on the anterior

margins of the fore femora; if absent, the abdomen bears an adhesive disc of hairs ventrally, or the head, thorax, and abdomen bear distinct paired dorsal spines; gills on abdominal segments 3-7; all tails subequal in length.

Subgenus Eurylophella Tiensuu

No maxillary palpi; tarsal claws denticulate; paired abdominal tubercles on tergites 1-3 blunt; lamellate gills on abdominal segments 4-7, the gills on segment 4 semi-operculate; rudimentary gills on segment 1; abdominal segment 9 longer than segment 8.

Subgenus Serratella Edmunds

No paired dorsal spines on head and thorax, but they are usually present on the abdomen; distinct tubercles or spines absent on anterior margins of fore femora; abdomen with no adhesive disc; gills on abdominal segments 3-7; gills imbricate; gill on segment 3 not operculate or semi-operculate; tails subequal in length, a whorl of spines or hair-like spines at joinings of the segments of the median tail.

Subgenus Timpanoga Needham

A broad entire frontal shelf on head; each femur prolonged apically into a sharp acute spine; gills on abdominal segments 4 to 7 only, often a rudimentary gill on segment 1; gills on 4th segment operculate; body flat and wide, the width of the 5th abdominal segment being $2/3$ to $3/4$ the length of the entire abdomen.

EPHEMERELLA

Key To Adults

1. Spine-like tooth at apex of fore trochanter...hecuba hecuba Eaton
- No distinct spine on apex of fore trochanter.....2.
2. 3rd joint of forceps at least twice as long as wide.....3.

- 3rd joint of forceps scarcely longer than wide.....8.
3. 2nd joint of forceps strongly bowed, with a deep constriction
near the middle.....doddsi Needham
- 2nd joint of forceps not strongly bowed, and with no deep
constriction near base.....4.
4. Wing venation pale.....flavilinea McD
- Wing venation dark or yellow.....5.
5. Wing venation yellow, crossveins pale.....lodi Mayo
- Wing venation dark.....6.
6. Subgenital plate between bases of forceps not produced and with
only a shallow emargination.....grandis ingens McD
- Subgenital plate between bases of forceps produced and with a
broad V-shaped emargination.....7.
7. Tails brown.....coloradensis Dodds
- Tails black.....spinifera Needham
8. Lateral apical margins of penes projecting forward as distinct
processes, usually several to many spines on the penes...9.
- Lateral apical margins of the penes rounded, and with no forward
projecting processes. Spines, if present, bark-like and
dorso-lateral in position.....13.
9. Lateral apical processes of the penes short, blunt and directed
inwards. The apical notch between the penes relatively
shallow.....10.
- Lateral apical processes of the penes rather long and slender,
directed forward or outward. The apical notch between the
penes deeper.....11.

10. 2nd joint of forceps not distinctly swollen apically.....
inermis Eaton
 2nd joint of forceps distinctly swollen apically...infrequens McD
11. Abdominal sterna uniformly dark brown with pale lateral margins
 on segments 8 and 9.....jacobi McD
 Abdominal sterna each with a shallow dark brown chevron or with
 3 brown longitudinal stripes.....12.
12. Abdominal sterna each with a shallow dark brown chevron.....
hystrix Traver
 Abdominal sterna each with three brown longitudinal stripes.....
heterocaudata McD
13. Thorax blackish. Venation pale grey-brown, crossveins distinct.
 Abdominal segments of male translucent whitish on the
 anterior margins.....tibialis McD
 Thorax chocolate brown. Longitudinal veins light brown, cross-
 veins and intercalaries pale. Abdominal tergites brown...
14.
14. Abdominal tergites uniformly brown.....sp. 1
 Abdominal tergites brown, except the posterior margin of each
 tergite dark brown.....teresa Traver

Key To Nymphs

1. Gills on abdominal segments 4 to 7.....2.
 Gills on abdominal segments 3 to 7.....3.
2. Gill on segment 4 operculate. Dorsal spines obsolescent. No
 gill on segment 1.....hecuba hecuba Eaton
 Gill on segment 4 semi-operculate. Dorsal spines on segment
 1-10, moderately long on segments 1-8, short and blunt on

- segment 9, barely discernible on segment 10. Rudimentary gill on segment 1.....lodi Mayo
3. Dorsal abdominal spines wanting.....4.
Dorsal abdominal spines present.....6.
4. Teeth or spines present on anterior margin of fore femur.....
.....doddsi Needham
No teeth or spines on anterior margin of fore femur.....5.
5. Entire lateral margin of pronotum pale. Lateral extensions of abdominal segments marked with a dark median transverse band. Pale submedian spots present on posterior margins of abdominal tergites. 8 teeth on claws. Pigmentation on upper plate of gill on segment 3 heavy.....inermis Eaton
No distinct pale markings on pronotum. No dark band on lateral extensions of abdominal segments. No pale submedian spots on posterior margins of tergites, 5-6 teeth on claws.
Pigmentation of upper plate of gill on segment 3 none or slight.....infrequens McD
6. Teeth or spines present on anterior margin of fore femur.....7.
Teeth or spines wanting on anterior margin of fore femur.....8.
7. "Thumb" at distal end of fore tibia long and sharp. Femora slender. Dorsal spines on segments 1-9.....
.....coloradensis Dodds
"Thumb" at distal end of fore tibia short and blunt. Femora stout. Dorsal abdominal spines on segment 2-9.....
.....flavilinea McD
8. Lateral cerci $1/4$ to $3/4$ as long as the median terminal filaments.....9.

- Lateral cerci subequal to terminal filaments.....10.
9. Maxillary palp weak. A whorl of spines at each tail joining...
.....heterocaudata McD
- Maxillary palp normally developed. Tails may have whorls of
spines in the basal half, fringed with long hairs in apical
portion.....hystrix Traver
10. Thoracic tubercles present.....11.
No thoracic tubercles.....12.
11. Submedian spine of pronotum, if present, large and blunt, in
groups of 3. Submarginal pronotal spines short and blunt...
.....grandis ingens McD
- Submedian spine of pronotum rather slender, sharp-pointed, 2
in each group. Submarginal pronotal spines sharp at tips,
well developed.....spinifera Needham
12. Dorsal spines on abdominal segments 2 to 9. 7 teeth on claws.
No ventral markings.....tibialis McD
- Dorsal spines on segments 4 to 7. 9-10 teeth on claws.
Abdominal sternal light brown with paired sublateral dark
brown streaks.....teresa Travers
- Unknown: E. jacobi McD

EPHEMERELLA COLORADENSIS DODDS

Ephemerella coloradensis Dodds, Allen and Edmunds, 1962, Misc. Pub.

Ent. Soc. Amer. 3 (5) : 157 (Bibliograph)

Adult:

This species is a member of the subgenus Drunella. A dark brown or blackish mayfly of moderate size; thorax dark brown; no distinct spines on the apices of the fore trochanters; wing venation dark

purplish brown; abdominal tergites uniform dark brown with pale margins; pleural fold pale; sternites dark brown; subgenital plate between bases of forceps produced and with a broad V-shaped emargination; apical margin of forceps base almost straight; 2nd joint of forceps may be strongly bowed, but without a deep constriction, or moderately and regularly curved, but not swollen near apex and thinner in the middle; 3rd joint at least twice as long as wide; penes with a V-shaped apical median cleft; lobes of penes expanded apically; tails brown, darker at base.

Nymph:

- Frontal horns and frontal shelf wanting; mouthparts visible anteriorly, genae not produced into flanges or projections; head roughened, occiput only roughened or bearing low, blunt, inconspicuous tubercles; no spines or tubercles on pronotum or metanotum, only a very short median posterior tubercle on mesonotum; anterior margins of fore femora with teeth or spines; none on middle or hind femora; legs stout, but more slender than in E. flavilinea; femora flattened, the posterior margins with many hairs and a few short spines; "thumb" at distal end of fore tibia long, sharp, and relatively straight; gills on abdominal segments 3-7; no elyteroid gills; pigmentation of the upper portion of gill on segment 3 is heavy and in a well-defined 2 or 3-lobed area; lower portion of this gill has apparently 3 layers of secondary lobes which are broad oval or spatulate; gill on segment 7 is about 1/5 the length of the gill on segment 3; gill on segment 3 overlaps the one following by 1/3 or less of its length; paired dorsal spines on tergites 1-9, longer on tergites 6-8; dorsal spines on these tergites fairly well developed; spines on tergite 9 long and sharp; if occipital tubercles present, spines on tergite 9

more acute; general colour light brown, mottled with paler, especially on the legs; sternites may have sparse hairs, but never an adhesive disc; tails each with two dark and two paler bands.

Distribution: Colorado, Montana, Wyoming, Utah, British Columbia
No specimens of this species were examined.

EPHEMERELLA DODDSI NEEDHAM

Ephemerella doddsi Needham, Allen and Edmunds, 1962, Misc. Pub. Ent. Soc. Amer. 3 (5) : 163 (Bibliography)

Adult:

This species is placed in the subgenus Drunella; head and thorax dark reddish-brown; fore femora dark purplish brown, rest of leg paler; middle and hind legs yellowish, femora shaded with brown with no dark apical bands; the three basal tarsal joints shaded with purplish black; no distinct spine on apex of fore trochanter; wings hyaline; venation dark brown; abdominal tergites each with a broad median transverse dark brown band, paler on dorsal areas; anterior and posterior margins widely pale; pleural fold pale; sternites dark; 2nd joint of forceps strongly bowed with a deep constriction near the middle; 3rd forceps joint at least twice as long as wide; lobes of penes constricted apically; tails dark brown basally, becoming pale apically.

Nymph:

A yellowish to tan species; darker on eyes, gills, wing pads and bases of tails and tarsi; no frontal horns; a broad frontal shelf, notched to receive the bases of the antennae; occipital tubercles wanting; no thoracic spines or tubercles; teeth or spines

present on anterior margins of fore femora; smaller spines on posterior margins of fore femora and both margins of other femora; all femora flattened; tibial "thumb" on foreleg $1/3$ as long as the tarsus, strong, sharp at tip, and directed outwardly; no dorsal abdominal spines; abdominal tergites shaded with brown; gills on abdominal segments 3-7; gill on segment 3 overlaps the one following by $1/3$ its length or less, but not elytriod; upper portion of gill on segment 3 is heavily pigmented in a well-defined 2 or 3-lobed area; secondary lobes of lower portion of gill on segment 3 with 2 layers, broad oval or spatulate; gill on segment 7 about $1/5$ the length of the gill on segment 3; venter of the abdomen bearing an adhesive disc of long hairs on its outer margin and short hairs in inner space, extending from sternites 1 to 9; tails yellowish, darker basally, light brown apically, short.

Ecology:

Nymphs of this species were taken from the middle of four locations on the Alouette River, at depths of 1 to 3 feet. The substrate consisted of sand, gravel, rocks, boulders, and bedrock. The current, except in one case of quiet ripples, was rapid. They were collected the year round.

Distribution: Utah, Washington, Montana, Colorado, California,
New Mexico, Wyoming, British Columbia.

Material Examined:

2 Nymphs, British Columbia: Alouette River (Haney), VI.2.59
(N.J. Filmer), 26 Nymphs, British Columbia: Loon Creek (Clinton),
VI.16.56 (H. Lorz), 19 Nymphs, British Columbia: Loon Cr. (Clinton)
VI.13.? (H. Lorz).

EPHEMERELLA FLAVILINEA McDUNNOUGH

Ephemerella flavilinea McDunnough, Allen and Edmunds, 1962, Misc. Pub.

Ent. Soc. Amer., 3 (5) : 159

(Bibliography)

Adult:

This species belongs to the subgenus Drunella; a small mayfly; head and thorax deep ruddy brown; fore femora and tibiae deep blackish brown, tarsi whitish; middle and hind legs dull yellowish, a reddish brown apical patch on inner surface of each femur; no black dots on femora; no distinct spine on apex of fore trochanter; wings hyaline; venation pale; abdominal tergites deep ruddy brown; pleural fold marked by a yellowish line extending upwards in each segment, especially in the apical segments; sternites more reddish; subgenital plate between forceps bases not produced and with only a shallow emargination; 2nd forceps joint slightly bowed, or may be strongly bowed, with a deep constriction near the apex; tip of forceps bent inward; 3rd joint of forceps at least twice as long as wide; apical lateral margins and lobes of penes expanded apically; tails black basally, paler apically.

Nymph:

A light to dark brown nymph, if light they are distinctly mottled; frontal horns wanting; no frontal shelf, the mouthparts visible anteriorly, and the genae not produced into flanges or projections; paired occipital tubercles usually short and blunt, but may be moderately long and sharp; no thoracic spines or tubercles; legs stouter, fore tibiae slender; anterior margin of fore femora with teeth or spines; other femora lacking such spines or tubercles; tibial "thumbs" at apex of fore tibiae short and blunt; femora with three pale indistinct areas; tibiae with distinct pale bands at each end; tarsi banded in

the middle; dorsal abdominal spines on segments 2-9, very small on tergite 9; if occipital tubercles long and sharp, abdominal spines on segment 9 moderately long and sharp; abdominal spines short; gills on abdominal segments 3-7; gill on segment 3 overlaps the following one $1/3$ its length or less, not elyteroid; pigmentation of upper portion of gill on segment 3 is heavy and is of 1 lobe; secondary lobes of lower portion of gill on segment 3 are elliptical to spatulate with no basal thumb-like lobe; gill on segment 7 is $1/5$ the length of that on segment 3; tails pale; with narrow blackish bands beyond the middle and at the tips.

Ecology:

Nymphs of this species were taken from the middle and edges of many locations on the Alouette River, always at a depth of 1 to 2 feet. The stream bed varied from silt, through mud, sand, gravel, rocks, boulders, to bedrock; the current varied from quiet water to rapids and falls. They were collected during the entire year.

Distribution: Montana, Wyoming, Alberta, British Columbia.

Material Examined:

1 Nymph, British Columbia: Alouette River (Haney), VI.19.59 (N.J. Filmer), 2 Nymphs, British Columbia: Alouette River (Haney) V.26.59 (N.J. Filmer, 12 Nymphs, British Columbia: nr Hell's Gate, VI.19.59 (G.G.E. Scudder)

EPHEMERELLA GRANDIS INGENS McDUNNOUGH

Ephemerella grandis ingens McDunnough, Allen and Edmunds, 1962,

Misc. Pub. Ent. Soc. Amer.

Adult:

3 (5) : 175 (Bibliography)

A blackish mayfly belonging to the subgenus Drunella; head and thorax black, lateral and posterior margins of mesonotum shaded slightly with brown, and a slight yellow shading on the median area of the

metanotum; forelegs blackish, with the margins of the femora near bases tinged with a pale smoky yellow; femora of middle and hind legs blackish tinged with yellowish at bases and on margins, rest yellowish; no distinct spine on apex of fore trochanter; wings hyaline, the forewing suffused with light amber in basal portion; venation black brown; stigmatic crossveins indistinct; posterior fork of M not fused with Cul; abdominal tergites smoky yellow or yellow-brown, each of tergites 2-7 with a large median quadrate black or deep purplish brown patch and lateral circular patches of the same colour; in apical segments the dark patches more or less coalesce; sternites with broad light yellow-brown posterior margins, remainder blackish with a reddish tinge and faint traces of small oblique submedian pale streaks on the anterior margins; subgenital plate between the forceps bases not produced and with only a shallow emargination; 2nd forceps joint not bowed and constricted, but is irregularly swollen; 3rd forceps joint at least twice as long as wide; apical lateral margins of penes not expanded, the sides nearly bowed; lobes of penes expanded apically; tails black.

Nymph:

No frontal horns or frontal shelf; occipital tubercles long; submedian spines of pronotum in groups of 3, large and blunt, posterior spine of each group short; submarginal spines of pronotum short and blunt; mesothorax with 1 or 2 submedian pairs of tubercles which are well developed and blunt to sharp, and a single median posterior tubercle; submedian mesothoracic tubercles may be just a pair of submedian ridges; no teeth or spines on anterior margins of fore femora; margins of fore femora with only scattered hairs, not arranged in a marginal row; lateral margins of abdominal tergites distinctly

convex; abdominal dorsal spines in a regular series, fairly close together, those on segments 8 and 9 larger than the others; gills on segments 3-7.

Distribution: British Columbia

Material Examined:

- 1 Nymph, British Columbia: Loon Creek (Clinton), VI.16.56 (H. Lorz)
- 2 Nymphs, British Columbia: Loon Creek (Clinton), VI.13.? (H. Lorz)

EPHEMERELLA HECUBA HECUBA EATON

Ephemerella hecuba hecuba Eaton, Edmunds and Allen, 1959, Can. Ent.

91:54 (Bibliography)

Adult:

This species belongs to the subgenus Timpanoga; head mottled brown with whitish margins; pronotum mottled brown, carinae reddish; anterior median portion of mesonotum brown, posterior portion reddish brown; metanotum light yellow; fore trochanter with a spine-like tooth at its apex; fore femora dark brown with blackish margins; fore tibiae curved, notched basally on the anterior margins; wings semi-hyaline; venation distinct; abdominal tergites 1-4 dark yellow, each with a transverse reddish stripe which widens laterally and posteriorly into a comma-shaped mark; on either side of the median line is a light yellow circular spot which enlarges posteriorly; tergites 5-10 are almost entirely covered by the reddish bands posteriorly and the whitish circular spots anteriorly; persistent respiratory gills are borne on segments 4 to 8; tergites 9 and 10 bear prominent postero-lateral spines; each sternite is marked by a semilunar yellowish posterior margin and reddish anterior and lateral margins; forceps light yellow; 2nd joint of forceps constricted near the apex; 3rd forceps joint short and emarginate posteriorly;

apical portions of the penes are separated by an irregularly V-shaped notch.

Nymph:

Body much flattened and hairy; head comparatively small; head with a broad entire frontal shelf; no frontal horns; pronotum widest at posterior margin, a short tubercle near middle of each lateral margin and a pair of short submedial tubercles near posterior margin; legs hairy; middle coxae each bears a short conical spine or tubercle on its dorsal surface; each femur with an acute spine at the apex, and the traces of two blackish bands; a blackish band near the middle of each tibia; basal half of each tarsus blackish; abdomen stout, flattened, widest at 5th segment; tergites 2-9 extended laterally into sharp saw-tooth-like postero-lateral spines which are pale basally, crossed beyond the bases by wide brownish bands, and reddish brown at tips; tergites 4-6 with obsolescent dorsal spines; a dark brown median line on tergites 3 and 4; tergites 5-9 with faint submedian brownish areas, and reddish lateral streaks next to gills; anterior half and much of lateral portions of each sternite marked with wide reddish to brownish bands, and faint indications of pale submedian oblique marks at anterior margin; gills on segments 4-7; gill on segment 4 elyteroid, covering the next one for $\frac{3}{4}$ of its length; pigmentation of upper portion of gill on segment 4 is light or wanting; tails with one or two narrow blackish bands basally, a wide black band at $\frac{2}{3}$ the distance from the base, and tips narrowly black.

Distribution: Colorado, New Mexico, Utah, California, British Columbia.

No specimens of this species were examined.

EPHEMERELLA HETEROCAUDATA McDUNNOUGH

Ephemerella heterocaudata McDunnough, Allen and Edmunds, 1961,

Ann. Ent. Soc. Amer. 54:603-12

(Bibliography)

Adult:

This species is a member of the subgenus Caudatella; an olive brown mayfly with black markings; thorax dark olive brown, pronotum with considerable black shading; legs deep olive, fore femora and tibiae tinged with black; no spine at apex of fore trochanter; no dark apical markings on middle and hind femora; wings hyaline; longitudinal veins smoky, crossveins pale; abdominal tergites olive brown, with anterior broad black bands on tergites 1-4, and semicircular anterior patches of the same colour on posterior tergites; tergites also with lateral black patches which tend to fuse with the black bands on the anterior tergites; sternites pale olive with three irregular longitudinal black or brown stripes; 3rd forceps joint scarcely longer than wide; penes united, forming an upcurved rod, swollen apically; lateral apical margins of penes rounded, with no forward projecting processes; usually barb-like lateral dorsal spines present on penes, one on each side; tails smoky, ringed, the middle one twice as long as the outer ones.

Nymph:

A dark brown nymph; head and thorax smooth; labrum only slightly emarginate on apical margin; maxillary palpi weak, 3-jointed; no thoracic tubercles; legs short; femora flattened; no teeth or spines on anterior margin of fore femora, although there is a distinct row of marginal hairs; tibiae and tarsi also with a distinct row of hairs; claws with a single row of 7 denticles; legs not banded; abdominal tergites marked as in imago; paired dorsal abdominal spines on segments

2-9, prominent, strong, incurved; abdominal dorsal spines becoming progressively longer and further apart from tergite 2 to 7, but shorter and closer together on tergites 8 and 9; no lateral extensions on postero-lateral spines or tergites; pattern on sternites variable, may be a reddish brown median stripe and a line of brown submedian dashes, or sternites may be unicoloured or with light lateral dots or streaks; middle tail 3 times as long as the outer ones, brownish, joinings darker and with whorls of spines; gills on segment 3-7.

Distribution: Wyoming, British Columbia

No specimens of this species were examined.

EPHEMERELLA HYSTRIX TRAVER

Ephemerella hystrix Traver, Allen and Edmunds, 1961, Ann. Ent. Soc.

Amer. 54:603-12 (Bibliography).

Adult:

A member of the subgenus Caudatella; no distinct spine at the apex of the fore trochanter; each abdominal sternite marked with a shallow dark brown chevron; 3rd forceps joint scarcely longer than wide; penes united, swollen apically; lateral apical margins of penes projecting forward as distinct processes; lateral apical processes of penes long and slender, directed forward or outward; deep apical notch between penes; usually several to many spines on penes.

Nymph:

A light reddish brown species; head and thorax smooth; no occipital tubercles on frontal shelf; labrum only slightly emarginate on apical margin; maxillary palpi normally developed, 3-jointed; femora slightly flattened; no teeth or spines on anterior margins of fore femora; short, inconspicuous spines on posterior margins of femora; usually no spines on the upper surfaces of the fore femora, but if present,

they are generally distributed and not in a transverse apical band; tibiae and tarsi without a distinct row of hairs; claws with a single row of 7-8 denticles; legs unbanded, but joinings of legs, apices of tarsi, and claws dark reddish brown; paired dorsal abdominal spines on segments 1-9 or 2-9, curved near tips, and each bearing a series of spinules on anterior margin near tip; spines on segment 2 short, close together, and becoming progressively longer and further apart posteriorly, longest on segments 6 and 7, which are subequal; spines on segments 8 and 9 shorter, slightly convergent; spines on middle segments curve outward; abdominal tergites with short lateral extensions bearing short postero-lateral spines on segments 4-7, these being rounded and incurved on segments 8 and 9; basal tergites pale reddish brown, becoming darker posteriorly, with no pale dorsal stripe, but traces of a dark median line on segments 7 and 8, and dark submedian streaks on the preceding tergites, and with large dark lateral patches on tergites 8 and 9, and beneath gills on other segments; abdominal sternites variable, may be unicoloured, or with pale lateral dots or streaks, or marked with dark chevron-shaped markings, or each sternite with two broad lateral dark reddish brown triangles which are connected on the anterior margin; ganglionic areas of sternites 1-6 pale, of 7-8 dark brown; tails unbanded; fringed with long hairs in apical portion, may have whorls of spines at joinings in basal half; gills on segments 3-7.

Ecology:

Nymphs of this species have been taken from the middle and edge of one location on the Alouette River, at a depth of 1-2 feet. The stream-bed consisted of mud, gravel, rocks, and boulders. The current was rapid in the middle, and quiet on the edge. They were collected in June.

Distribution: Montana, British Columbia

Material Examined:

2 Nymphs, British Columbia: Alouette River (Haney), VI.23.59
(N.J. Filmer).

EPHEMERELLA INERMIS EATON

Ephemerella inermis Eaton, Needham, 1935, The Biology of Mayflies,
604 (Bibliography)

Adult:

A very dark species; thoracic notum polished deep blackish brown; fore leg dull greenish grey; femora light yellowish amber in all legs; tarsi dirty whitish; wings hyaline, a blackish brown spot at the extreme base of the forewing; venation pale, yellowish to hyaline; no spine at apex of fore trochanter; abdominal tergites dark reddish brown to blackish brown, the last three yellowish to reddish, lateral margins light yellowish, joinings opaque; sternites paler; 2nd forceps joint not swollen apically; 3rd forceps joint scarcely longer than wide; penes united, somewhat swollen apically; apical notch between penes shallow; lateral apical margins of penes projecting forward as short, blunt, and inwardly directed processes; no apical spines on penes; but there are 4-5 lateral spines some distance from the apex on each side; tails greyish white, joinings opaque.

Nymph:

A dark reddish brown nymph; head and thorax irregularly mottled light and dark; lateral margins of pronotum pale; legs blackish brown, the femora with 3 large pale areas, tibiae pale at bases and apices, tarsi pale at apices; long spines along posterior margins of the femora; and on the upper surfaces of the fore femora are long spines arranged in an irregular transverse apical band; no teeth or spines

on the anterior margins of the fore femora; claws with 8 teeth each; no dorsal abdominal spines; well developed lateral extensions of abdominal tergites present; tergites each with a pair of submedial large pale spots on posterior margin; on middle segments, especially 5 and 6, the median line is often pale and on these tergites there are often large pale patches just above the gills; lateral extensions marked by dark median transverse bands; postero-lateral spines on segments 6-8 shorter than wide, on the others, the width equals the length; sternites yellowish-brown, apical sternites and the lateral margins of the middle ones blackish brown; may be traces of dark submedian oblique dashes on the anterior margins and of dark dots near the center of the sternite; gills on segments 3-7; no gill elyteroid, the gill on segment 3 overlaps the following one $\frac{1}{3}$ or less of its length; heavy pigmentation on upper portion of gill on segment 3 is in 3 lobes, although the side lobes may be small; lower portion of gill on segment 3 is cleft for $\frac{1}{2}$ its length at most; gill on segment 7 is minute; tails yellowish brown usually with many median and apical bands but may be unbanded, fringed with long hairs in the apical portions, and never with whorls of spines at joinings in the basal portions.

Ecology:

Nymphs of this species have been collected from the middle and edges of many locations on the Alouette River, usually from depth of 1 to 2 feet, and occasionally deeper. The stream bed included silt, mud, sand, gravel, rocks, boulders, and bedrock, and the current varied from quiet water to rapids. The nymphs were taken during the entire year.

Distribution: Colorado, Wyoming, Montana, Utah, Nevada, New Mexico, Oregon, British Columbia.

Material Examined:

3 Nymphs, British Columbia: Alouette River (Haney), V.26.59 (N.J. Filmer), 4 Nymphs, British Columbia: Alouette River (Haney), XI.8.59, (N.J. Filmer), 1 Nymph, British Columbia: Alouette River (Haney), IX.26.59 (N.J. Filmer).

EPHEMERELLA INFREQUENS McDUNNOUGH

Ephemerella infrequens McDunnough, Needham, 1935, The Biology of Mayflies, 605 (Bibliography)

Adult:

A reddish brown mayfly; eyes of male light orange; head light brown; pronotum and anterior lateral margins of mesonotum purplish brown; rest of mesonotum deep olive brown, reddish brown posteriorly with 2 slightly raised blackish lines anterior to the scutellum; legs light yellow; wings hyaline, bases tinged with yellowish brown; venation pale; crossveins indistinct, especially in basal costal space; no spines on apex of fore trochanter; abdominal tergites light reddish brown, the posterior margins smoky; pleural fold narrowly yellowish; sternites dull purplish brown, apical sternites yellowish brown, and middle sternites with traces of pale semi transparent areas on anterior margins; 2nd forceps joint distinctly swollen apically; 3rd forceps joint scarcely longer than wide; penes united, somewhat swollen apically; apical notch between penes shallow; lateral apical margins of penes projecting forward as distinct short, blunt, inwardly directed processes; penes each with 2-4 apical spines, and 4-5 others, in 2 groups, further down; tails yellowish basally, whitish apically, with joinings narrowly ringed with dark brown.

Nymph:

A dark reddish to blackish brown species; vertex, lateral portions of pronotum, and anterior portion of mesonotum indistinctly mottled with dark brown; no distinct pale markings on pronotum; legs reddish brown, femora irregularly blotched with yellowish, tibiae and tarsi pale banded basally and apically; no teeth or spines on anterior margins of fore femora; long spines on posterior margins of all femora, and also on upper surface in a transverse apical band; claws with 5-6 denticles; no dorsal abdominal spines; lateral extensions of tergites less developed than in E. inermis; no dark transverse band on these lateral extensions; abdominal tergites usually with a pale mid-dorsal line; no pale spots on posterior margins of tergites or pale lateral areas above gills; sternites unmarked; gills on segments 3-7; no elyteroid gills; gill on segment 3 overlaps the following one $1/3$ or less of its length; pigmentation on upper portion of gill on segment 3 is none or slight; upper portion of gill on segment 3 with a lobed base, this portion is longer than the lower portion by $1/4$; gill on segment 7 is less than $1/3$ the length of the gill on segment 3; tails reddish brown, with several yellowish bands, fringed with long hairs in apical portion; and never with whorls of spines at the joinings of the basal portion.

Distribution: California, Utah, Montana, Wyoming, Alberta, British Columbia.

No specimens of this species were examined.

EPHEMERELLA JACOBI McDUNNOUGH

Ephemerella jacobii McDunnough, Allen and Edmunds, 1961, Ann. Ent. Soc.

Amer. 54:603-612 (Bibliography)

Adult:

This species is a member of the subgenus Caudatella; thorax deep brown; eyes blackish with a reddish tinge; no spine on apex of fore trochanter; wings narrow, hyaline; longitudinal veins in costal half pale brownish; crossveins pale and inconspicuous; abdominal tergites blackish, posterior margins brownish, producing a ringed appearance; sternites uniformly dark brown; lateral margins of sternites 8 and 9 pale; penes short and broad; apical notch between penes deep; lateral apical margins of penes project forward as short, blunt, inwardly directed processes; usually spines on penes; 3rd forceps joint scarcely longer than wide; tails of female blackish at base, paling apically, and distinctly dark ringed.

Nymph: Unknown

Distribution: British Columbia

No specimens of this species were examined.

EPHEMERELLA LODI MAYO

Ephemerella lodi Mayo, Allen and Edmunds, 1963, Can. Ent. 95:621

(Bibliography)

Adult: (Male)

This species has been placed in the subgenus Eurylophella; pronotum yellowish brown tinged with red; rest of thorax reddish brown; wings slightly amber-tinged; venation yellow, crossveins pale; stigmatic crossveins anastomosed; wings of female with reddish colouring at the bases of the Sc and R; abdomen lighter than the thorax; tergites 1-3 are reddish brown, with wide brown bands on the posterior margins; tergites 4-10 yellowish with reddish brown posterior margins; tergites 8 and 9 with a reddish streak near the pleural fold; laterally each

tergite is marked with a black oblique streak near the pleural fold, and with blackish spots or streaks on each side of the midline; the female is lighter, the dorsal markings being a mottled red, and a wide mottled middorsal streak; tails yellow, the joinings a dark reddish brown; 2nd forceps joint not strongly bowed or constricted; 3rd forceps joint at least twice as long as wide.

Nymph:

A dark brown nymph, often with a pale median stripe on the head, thorax, and abdomen, and with scattered pale spots and maculae; female with paired occipital tubercles, male without; claws with 7-10 denticles; dorsal abdominal spines on tergites 1-10, decreasing in size posteriorly; moderately long on tergites 1-8, short and blunt on 9, barely discernable on 10, widest apart on segments 2-4; postero-lateral spines well developed on segments 2 and 3; tergites rich brown with 3-4 pale dots between tubercles; tergites 2-4 often with wide pale sublateral stripes and 9-10 with narrow pale submedian stripes; tails alternately banded with narrow light brown and wide dark brown bands; gills on segments 4-7; rudimentary gill on segment 1; gill on segment 4 semi-operculate.

Ecology:

This species has been taken from the edges of two locations on the Alouette River, at depths of 1 to 2 feet. The stream bed consisted of silt, mud, and rocks. The current was still and quiet. They were taken in June. In one case, however, one nymph was taken in November from the middle of the river, from a substrate of rocks, gravel, and boulders, in a rippling current.

Distribution: British Columbia.

Material Examined:

2 Nymphs, British Columbia: Alouette River (Haney), VI.9.59

(N.J. Filmer)

EPHEMERELLA SPINIFERA NEEDHAM

Ephemerella spinifera Needham, Allen and Edmunds, 1963, Misc. Pub. Ent.

Soc. Amer. 3 (5) : 176 (Bibliography)

Adult:

This species is a member of the subgenus Drunella; no spine at apex of fore trochanter; wings hyaline; venation dark brown; abdominal tergites 2-6 black or deep purplish brown with paler margins; sternites with dark markings; 2nd forceps joint not bowed or constricted, considerably wider at base than at apex; 3rd forceps joint at least twice as long as wide; subgenital plate between the forceps bases produced and with a broad V-shaped emargination; penes with a U-shaped apical median cleft; lobes of penes expanded apically; tails black.

Nymph:

No frontal horns or frontal shelf; prominent occipital tubercles; pronotum with well-developed, sharp-pointed submarginal spines, and 2 pairs of slender, sharp pointed submedial spines, the interior spine in each pair being twice as high as the posterior one, mesonotum with a pair of submedian tubercles on the anterior margin, two pairs of submedian spines, the posterior pair being the larger, and a median tubercle on the posterior margin; prosternum with a median tubercle; no teeth or spines on fore femora with only scattered hairs, not arranged in a marginal row; tibial "thumb" slender, sharp pointed, not reaching to middle of tarsus; dorsal abdominal spines prominent, those on segments 2-7 subequal, those on 8 and 9 four times as long as the preceding ones; spines on segment 8 may be strongly bent

backward or downward; tergites pale brownish to reddish brown, sternites yellowish, with indistinct darker dashes on each side; gills on abdominal segments 3-7; no gill elyteroid, gill on segment 3 overlaps the following one by $1/3$ or less of its length; upper portion of gill on segment 3 $2/3$ or more longer than the lower portion, pigmentation in this portion is heavy and general, showing no lobing; lower portion of gill on segment 3 of only 2 layers, the secondary lobes not close together; gill on segment 7 minute; tails yellowish, banded, whorls of spines at joinings.

Ecology:

Nymphs of this species were taken from the middle of 3 locations on the Alouette River, at depths of 1 to 5 feet. The stream bed consisted of sand, gravel, rocks, and boulders, and the current varied from quiet ripples to rapids. They were also found from the edge of one of these locations, in quiet water. They were collected in June and November.

Distribution: Montana, Utah, British Columbia.

Material Examined: 2 Nymphs, British Columbia: Alouette River (Haney)
VI.23.59 (N.J. Filmer)

EPHEMERELLA TERESA TRAVER

Ephemerella teresa Traver, Allen and Edmunds, 1963, Ann. Ent. Soc. Amer.

56 (5) : 583-600

Adult:

This species belongs to the subgenus Serratella; head brown; thorax chocolate brown; legs light brown; wings hyaline; longitudinal veins light brown, others pale; no spine on apex of fore trochanter; abdominal tergites brown, posterior margins darker; sternites light brown; 3rd forceps joint scarcely longer than wide; penes not constricted

near the base, the sides nearly parallel, and the inner margin of each penis lobe is without a subapical notch; penis lobes without lateral subapical projections; tails pale, ringed with dark brown at joinings.

Nymph:

Head and thorax smooth; maxillary palpi very small, apparently wanting; median line of pronotum elevated anteriorly, depressed posteriorly, with carinae on laterals margin; no teeth on anterior margins of fore femora, and no spines; legs pale brown, apices of joints reddish brown; claws with 9-10 denticles; wing pads with a costal margin purplish; dorsal abdominal spines on segments 4-7 only, short and far apart on 4, longer and closer together on the rest; lateral extension and postero-lateral spines on abdominal tergites moderately developed; tergites pale reddish brown with darker lateral patches on tergites 4-8 and dark dots on tergite 9; sternites yellowish with a row of dark lateral dashes; ganglionic areas often darkened; gills on segments 3-7; tails pale yellowish, each joining with a whorl of dark reddish brown spines, may be dark in distal half.

Ecology:

These nymphs were collected from the middle of several locations of the Alouette River, from a depth of 1 to 2 feet. The substrate consisted of gravel, rocks, boulders, and bedrock. In all cases the current was rapid. All specimens were taken during June and July.

Distribution: California, British Columbia

Material Examined:

1 Nymph, British Columbia: Alouette River (Haney), VI.2.59
(N.J. Filmer), 2 Nymphs, British Columbia: Alouette River (Haney),
VI.23.59 (N.J. Filmer).

EPHEMERELLA TIBIALIS McDUNNOUGH

Ephemerella tibialis McDunnough, Allen and Edmunds, 1963, Ann. Ent.

Soc. Amer. 56 (5) : 583-600

Adult:

This species has been placed in the subgenus Serratella; males deep purplish brown; thorax blackish dorsally; legs yellowish; fore tibiae deep smoky, middle and hind tibiae with reddish apical bands; fore tibiae twice as long as the femora; no spines at apex of fore trochanter; wings vitreous; venation pale grey-brown; crossveins distinct; abdominal tergites 3-8 with narrow whitish translucent anterior margins; sternites with slightly darkened ganglionic areas; 3rd forceps joint scarcely longer than wide; penes blackish; united, swollen apically; penes constricted near base, inner margin of each lobe with a subapical notch; penis lobes rounded on lateral apical margins, without a subapical projection; usually with barb-like dorso-lateral spines, one on each side of each penis; middle tail not noticeably longer than the outer ones; tails smoky, darker at joinings.

Nymph:

Head and thorax smooth, without hairs or tubercles; maxillary palpi moderately long; thorax and abdomen slender and blackish, sometimes with a narrow mid-dorsal pale line; legs short; no teeth or spines on anterior margins of fore femora; no conspicuous hairs on legs; legs purplish brown, red, or fuscious with a small pale spot basally and a pale apical band and incomplete subapical mark on each femur; tibiae and tarsi each with basal and apical pale bands; claws with 5-7 denticles; dorsal abdominal spines on segments 2-9, narrow and acute; posterior margins of tergites straight; tubercles may be

swollen on segments 2 and 8; lateral extensions of abdominal tergites not prominent; postero-lateral spine on segment 9 not extending beyond the margin of segment 10; sternites unmarked; gills on segments 3-7; tails approximately equal in length, alternately banded brown and pale; whorls of spines at each joining.

Ecology:

Nymphs of this species were taken from many locations on the Alouette River, usually at depths of from 1 to 2 feet. The stream bed varied from mud, through sand, gravel and rocks, to boulders. The current was usually rippling, but occasionally was quiet or rapid. They were collected during the whole year, except during the winter months of October to January.

Distribution: Wyoming, California, British Columbia.

Material Examined:

1 Nymph, British Columbia: Alouette River (Haney), VI.16.59, (N.J. Filmer); 1 Nymph, British Columbia: Alouette River (Haney) VIII.26.59 (N.J. Filmer).

Ephemerella sp. 1

Adult:

This adult closely resembles E.teresa, the only difference being the lack of a dark margin on each abdominal tergite. Further investigation may place this specimen in that species.

Nymph: Unknown

Distribution: British Columbia

Material Examined:

1 Male, British Columbia: Quesnel, VI.31.48 (H.R. McCarthy)

SUBFAMILY LEPTOHYPHINAE

Genus Tricorythodes Ulmer

Tricorythodes, Needham, 1935, The Biology of Mayflies, 630 (Bibliography)

Adult:

Small to moderate sized mayflies, usually blackish or dark brown, females paler; eyes widely separated; fore leg of male slender, almost or as long as the body; fore femur $2/5$ as long as the tibia, which is $1-1/2$ times as long as the tarsus; tarsi 5-jointed, 2nd joint may be as long as femur; middle and hind femora longer than tibiae, and $2-1/2$ times as long as tarsi; terminal tarsal joint the longest; claws of male fore tarsus similar, blunt, all others dissimilar; posterior branch of M of forewing and the long intercalary between the branches of the M, shorter than the anterior branch, not extending to the base; crossveins numerous; Sc and R usually purplish black except at apex; forceps 3-jointed, 2nd joint with an ovoid swelling at base of inner margin, rest long, slender, and tapering, 3rd joint short, ovoid; forceps base entire, apical margin deeply excavated medially; penes united for $3/4$ of their length, forming a conical structure; distal portions separated by a rounded or V-shaped notch; posterior margin of subanal plate of female entire or slightly obtuse; tails three.

Nymph:

Apical margin of labrum deeply notched medially; inner canines of mandibles as long as outer ones; maxillary palpi reduced; labial palpi 3-jointed, small; claws not pectinate; no gill rudiment on abdominal segment 1; gills on segments 2-6 double, argins of each

plate entire, not fringed; upper plate of gill on segment 2 large, elyteroid, triangular, lower plate bifid, smaller, consisting of a long slender portion and an ovoid one; tails three, with a whorl of spines at each joining.

Genotype: Tricorythodes explicatus (in Tricorythus) Eaton

TRICORYTHODES MINUTUS TRAYER

Tricorythodes minutus Trayer, Needham, 1935, The Biology of Mayflies, 636 (Bibliography)

Adult:

A small reddish brown mayfly; head of male bright reddish with a blackish posterior margin; thorax red-brown, pronotum shaded with black medially and laterally, mesonotum deeper in colour; legs light reddish-brown, except fore tibiae and tarsi which are whitish, wings hyaline, whitish; venation, except for the purplish Sc and R, pale; abdomen reddish brown; tergites 1, 2, 8, and 9 largely blackish; middle tergites with a red-brown median line on each side of which is heavy blackish shading, bearing a pair of large black lateral triangles on sternite 9; forceps base shallowly excavated.

Nymph: Unknown

Distribution: British Columbia, Utah

No specimens of this species were examined.

Tricorythodes sp. 1

Adult: Unknown

Nymph:

Abdominal tergites with black markings and a pale narrow median line; operculate gills bordered with black on the medial and posterior edges.

Distribution: British Columbia

Material Examined:

60 Nymphs, British Columbia, Nicola Creek (G.G.E. Scudder)

SUPERFAMILY CAENOIDEA

FAMILY CAENIDAE

SUBFAMILY CAENINAE

Adult:

Small mayflies; eyes of male simple, not grooved or divided, far apart; lateral ocelli usually large and prominent; tarsi 4-jointed, except for an additional short basal joint on fore tarsus of the male; forewing well developed, especially in the cubito-anal region; wings often semi-opaque; usually C and Sc tinged with purplish except at the tip; outer and posterior margins setaceous; Of of Rs very deep; no marginal intercalaries; 2 long cubital intercalaries; crossveins few; hind wing absent; tails three; forceps base entire, excavated on apical margin, or with a median and two lateral projections on its apical margin.

Nymph:

Nymphs sprawling, tapered posteriorly, densely covered with fine hairs; all claws similar; lateral margins of abdominal tergites 2-9 produced into flat extensions bearing postero-lateral spines; gills on segments 1-6; gills on segment 1 rudimentary filaments; gills on segment 2 elyteroid, almost completely covering all of the remainder; tails three, fringed evenly on both sides.

GENUS CAENIS STEPHENS

Caenis, Needham, 1935, The Biology of Mayflies, 643 (Bibliography)

Adult:

Second joint of antenna not more than twice as long as the basal

joint; pronotum deeply excavated posteriorly in the median area; prosternum two or three times longer than broad, so that the fore coxae are close together; fore leg of male as long as the body, claws as in Tricorythodes; posterior branch of M and the long intercalary between the branches of the M as long as the anterior branch, extending to the base of the wing; crossveins arranged singly, usually no intercalary space with more than 1 crossvein; 2 or 3 crossveins only in radial region; tails three, often 3 times the length of the body in the male, the middle tail may be slightly longer; abdomen usually pale yellowish white, tergites often suffused with blackish; forceps base entire, apical margin slightly convex; forceps 1-jointed, sharp-pointed; posterior margin of subanal plate of female entire; penes united, broad and plate-like.

Nymph:

Head and pronotum narrower than the mesonotum, no tubercles on the head; apical margin of labrum slightly concave; mandibular canines as in Tricorythodes; maxillary palpi 3-jointed, twice as long as the galea-lacinia; glossae and paraglossae not fused as in Tricorythodes; labial palpi 3-jointed; claws slender, curved apically, not pectinate; gills on abdominal segments 1-6; gills on segment 1 well developed filamentous rudiments; gills on segment 2 operculate, large, and quadrate, their outer margins rounded; gills on segments 3-6 fringed on outer 2/3 of their entire margins; all gills single; postero-lateral spines on tergites more prominent than in Tricorythodes not upcurved; tails three, a whorl of spines on each joining.

Genotype: Caenis macrura Stephens

CAENIS

Key To Nymphs

1. Legs and tails banded.....2.
Legs palely banded. Tails unbanded.....sp. 2
2. Anterior corners of pronotum rounded.....sp. 1
Anterior corners of pronotum sharp.....3.
3. Mesonotal wing pads with dark lateral margins, each bearing
three dark lobes. No pattern on mesothorax.....sp. 3
Mesonotal wing pads unicoloured. Mesothorax with a faint V-
shaped mark, open anteriorly.....sp. 4

Caenis sp. 1

Adult: Unknown

Nymph:

Anterior corners of the pronotum rounded; pale spots at bases of wing pads; legs banded alternately light and dark; tails alternately banded light and dark.

Distribution: British Columbia

Material Examined:

The author has examined many nymphs of this species, taken by Dr. G.G.E. Scudder from VI.17.61 to V.26.63, from the following locations: British Columbia: Bortano Lake, Canim Lake, Springhouse Lake, White Lake, Felker Lake, Green Lake, Williams Lake.

Caenis sp. 2

Adult: Unknown

Nymph:

A smaller pale nymph; anterior pronotal corners sharp; pronotum with 2 pale spots; mesonotum with 2 medial and 2 lateral pale spots, in the form of a diamond, or unicolourous; legs alternately banded

with pale and light brown; tails unbanded.

Distribution: British Columbia

Material Examined:

11 Nymphs, British Columbia: Boitano Lake, V.19.62 (G.G.E. Scudder);
13 Nymphs, British Columbia: Springhouse Lake, VI.2.62 (G.G.E.
Scudder); 1 Nymph, British Columbia: Rock Lake, IX.21.63
(G.G.E. Scudder), 1 Nymph, British Columbia: Williams Lake,
VI.24.61 (G.G.E. Scudder).

Caenis sp. 3

Adult: Unknown

Nymph:

Anterior pronotal corners sharp; no pattern on mesonotum;
mesonotal wing pads with dark lateral margins, the inner edges of
these dark margins with 3 pale indentations each; legs alternately
banded light and dark; tails alternately banded light and dark, the
dark bands may be paler.

Distribution: British Columbia

Material Examined:

4 Nymphs, British Columbia: Springhouse Lake, VI.18.61 (G.G.E. Scudder)
3 Nymphs, British Columbia: Boitano Lake, VI.17.61 (G.G.E. Scudder)
2 Nymphs, British Columbia: Felker Lake, VI.25.61 (G.G.E. Scudder)
1 Nymph, British Columbia: Pavilion, VI.30.61 (G.G.E. Scudder)
21 Nymphs, British Columbia: Green Lake, VI.26.61 (G.G.E. Scudder)
1 Nymph, British Columbia: Williams Lake, VI.24.61 (G.G.E. Scudder)

Caenis sp. 4

Adult: Unknown

Nymph:

Anterior pronotal corners sharp; mesonotum with a faint V-shaped mark, the apex directed posteriorly; no markings on the mesonotal wing pads; legs and tails alternately banded light and dark.

Distribution: British Columbia

Material Examined:

- 1 Nymph, British Columbia: Westwick, V.27.63 (G.G.E. Scudder)
- 6 Nymphs, British Columbia: Felker Lake, VI.25.61 (G.G.E. Scudder)
- 5 Nymphs, British Columbia: Brunson Lake, VI.25.61 (G.G.E. Scudder)
- 1 Nymph, British Columbia: Springhouse Lake, VI.18.61 (G.G.E. Scudder)
- 2 Nymphs, British Columbia: Williams Lake, VI.24.61 (G.G.E. Scudder)

SUPERFAMILY EPHEMEROIDEA

FAMILY EPHEMERIDAE

SUBFAMILY EPHEMERINAE

Adult:

Usually large mayflies; eyes of male moderate to large, approximated apically; legs rather weak; tarsi 4-jointed, except the fore tarsus of the male, which is 5-jointed; claws dissimilar, except the claws on the male fore tarsi; which are dissimilar and blunt; wings hyaline; veins M and Cu1 strongly divergent at bases; M2 strongly bent toward the Cu basally; stigmatic area often narrowed; no sag in the costal margin; crossveins numerous; costal crossveins well developed; marginal intercalaries irregular; cubital intercalaries resemble marginal veinlets, consisting of 2 to 4 forks decurvent from the anterior branch of the cubitus; costal projection of the hind wing low; Of of hind wing absent; forceps 4-jointed.

Nymph:

These are fossorial, burrowing nymphs; head with a conspicuous

frontal process between the bases of the antennae; mandibles with external tusks projecting forward and visible dorsally; tusks curve upwards apically when viewed laterally, and divergent at tips when viewed dorsally; upper surfaces of tusks bear hairs or spines, but not any tubercles; fore tibiae fossorial; gills dorsal, curving up over the abdomen, and with fringed margins.

SUBFAMILY EPHEMERINAE

Key To Adults

1. Crossveins somewhat crowded at and below bulla. Wings with a variable pattern of dark spots.....Ephemera Linnaeus
- Crossveins not crowded at bulla. Wings with no distinct pattern of dark spots, or with four small dots at or below bulla.....2.
2. Penes tube-like, tips not incurved.....Pentagenia Walsh
- Penes broader at base than at apex, tips more or less incurved...
.....Hexagenia Walsh

Key To Nymphs

1. Frontal process of head bifid.....Ephemera Linnaeus
- Frontal process of head entire and truncate, conical, or rounded..
.....Hexagenia Walsh

GENUS EPHEMERA LINNAEUS

Ephemera, Needham, 1935, The Biology of Mayflies, 246 (Bibliography)

Adult:

Moderate sized mayflies; eyes of male small, separated apically by a distance at least as great as the diameter of the eyes; fore leg of male almost as long as the body; femur 1/2 or less the length of the tibia which is equal to or slightly less than the length of the tarsus; 2nd tarsal joint the longest; in hind leg of both sexes

femur $3/4$ the length of the tibia; forewings with crossveins crowded at and below the bulla; dark band on forewing from bulla to M; variable clouds in both wings; in hind wing, M2 often detached from M1 at base, and directed toward the Cu; 2nd forceps joint strongly bowed, bearing a basal extension on the inner margin; penes irregularly rod-like, separated near base, almost parallel, with a long spine on the inner margin of each division; apical margin of the subanal plate of the female with a V-shaped median cleft; tails three, equal in length.

Nymph:

Frontal process of head bifid; mandibular tusks slender, the margins smooth; maxillary palpi 3-jointed, slender, long, 2nd and 3rd joints fringed with long hairs; galea-lacinia slender and pointed apically; labial palpi 3-jointed, the apical joint widened apically with the margin truncate.

Genotype: Ephemera vulgata L.

EPHEMERA SIMULANS WALKER

Ephemera simulans Walker, Needham, 1935, The Biology of Mayflies,
252 (Bibliography)

Adult:

A dark brown mayfly; head and thorax deep blackish brown; some pale markings on pronotum and mesonotum; legs reddish brown, joinings darker; forewing tinged with brown, but not heavily blotched or appearing blackish; stripe at bulla deep brown; in apical third of wing are two dark brown clouds, one at the fork of the Rs and the other at the fork in the space below, nearer the margin; a cloud toward the margin from the inner end of the bulla stripe, and another at the base of the long intercalary of the M; also a small cloud between this cloud and the bulla stripe; longitudinal veins dark brown;

crossveins blackish; those in the costal, subcostal, and radial spaces widely margined except at the apices of the Sc and R; many crossveins in the disc and near the outer margin widely margined; hind wing venation dark brown; veins in basal subcostal space and the disc dark-margined, forming a number of small dark spots in the disc; outer margin widely tinged with light brown; abdominal tergites pale brown, markings blackish brown; a large irregular black is on each lateral area of each tergite, based on the anterior margin, the lateral and posterior edges deeply emarginate, the lateral edges black; the posterior margins of the basal and middle tergites narrowly pale brown; pale brown median areas widest on middle tergites; tergites 7-9 each with a pair of black submedian streaks, short on 7; sternites 1-6 each with dark lateral triangles which are widest posteriorly; sternites 7-9 with dark lateral longitudinal streaks; each sternite with a pair of small dark submedian spots and a pair of short dark oblique submedian streaks from the anterior margin; middle of the sternite 9 pale; tails deep yellow to reddish brown, joinings darker.

Nymph:

The frontal notch regularly rounded; the mandibular tusks project beyond the frontal process almost twice its length, the outer curves, in dorsal view, visible outside the antennae; gills purplish grey.

Distribution: New York, Michigan, Minnesota, Ontario, Montana, Alberta, Illinois, Ohio, Pennsylvania, Idaho, Wyoming, North Carolina, British Columbia.

Material Examined:

17 Nymphs, British Columbia: Nicola Creek (G.G.E. Scudder)

GENUS HEXAGENIA WALSH

Hexagenia, Needham, 1935, The Biology of Mayflies, 258 (Bibliography)

Adult:

Moderate sized to large mayflies; eyes of male moderate to large, approximated apically or separated by less than the diameter of one eye; in both sexes, upper and lower portions of the eye of different colours; anterior margin of pronotum tends to cover the posterior margin of the head; fore leg of male shorter than the body; fore femur of male slightly less than $1/2$ the length of the tibia, which is $3/4$ the length of the tarsus; 2nd tarsal joint the longest, almost $1/2$ the length of the tibia; hind leg of male with femur slightly shorter than the tibia; in female, the joints are subequal; crossveins of forewing not crowded at or before the bulla; crossveins in disc of one or both wings may be dark-margined; no distinct pattern of dark spots on wings; penes usually separated near base, broader at base than at apex, tips incurved; subanal plate of female only slightly produced apically; tails two.

Nymphs:

Frontal process of head entire, its margin truncate, curved, conical, or rounded; mandibular tusks long, slender, smooth, with no rasp-like teeth, upcurved, tips divergent; labial palpi 2-jointed; maxillary palpi and galea-lacinia as in Ephemera.

Genotype: Hexagenia bilineata (in Baetis) Say

HEXAGENIA LIMBATA (GUERIN)

Hexagenia limbata (Guerin) Burks, 1953, Bull. Nat. Hist. Surv. Ill.

Hunt, 1953, Bull. Inst. Fish. Res. No. 4, Mich.

Dept. of Conservation (Bibliography.)

Adult:

A pale yellow mayfly; thorax reddish brown; pronotum with lateral blackish stripes; legs yellow, fore femur and tibia blackish; wings hyaline; not tinged with pale brownish grey; costal margin of the forewing almost as transparent as the area behind it; no spots on wings; outer margin of hind wing brown; abdominal tergites yellow with a wide dark, brown mid-dorsal line; each tergite with brown lateral stripes beginning at the anterior corners and extending back to meet the median stripe at the posterior margin; penes hook-like; tail segments pale yellowish basally, dark brown distally.

Nymph:

Frontal process of head dome shaped; each portion of 1st pair of gills composed of 2 or more filaments.

Distribution: British Columbia

No specimens of this species were examined.

GENUS PENTAGENIA WALSH

Pentagenia, Needham, 1935, The Biology of Mayflies, 255 (Bibliography)

Adult:

Large mayflies; eyes of male large, approximated apically; fore leg of male only slightly longer than the head and thorax combined; fore femur $2/3$ to $3/4$ the length of the tibia; tarsus slightly longer

than the tibia; hind leg very similar to foreleg; wing venation much as in Hexagenia; cells in the costal projection of the hind wing may be divided by a cross line into two series; penes simple, rod-like, united only at base, divergent apically; subanal plate of female with a V-shaped median notch on the apical margin, and a short projection directed outward and backward at each outer corner; tails three, middle one very short.

Nymph:

Frontal process of head bifid; mandibular tusks stout, crevate on upper margin; maxillary palpi 3-jointed, stout, the 2nd and 3rd joints fringed with long hairs; galea-lacinia wide and conical; labial palpi 2-jointed, the distal joint long, clavate, covered densely with long hairs and several long spines near the tips.

Genotype: Pentagenia vittigera (in Palingenia) Walsh

Pentagenia sp. 1

Adult:

A very large yellowish brown mayfly; eyes reddish in the dorsal 1/4, black in the ventral 3/4; forelegs dark brown; wings hyaline; no spots on wings; venation dark brown; posterior margins of hind wings dark; abdominal tergites yellow with a dark median stripe; each tergite with an oblique brown stripe from the antero-lateral corners to the posterior border; each sternite with a brown median stripe, widening anteriorly; tails, forceps dark brown.

Nymph: Unknown

Distribution: British Columbia

Material Examined:

1 Male, British Columbia, Summerland, VI.20.58 (K. Taylor),

1 Male, British Columbia: Vernon, IX.6.48 (D. Evans), 1 Male,
British Columbia: Summerland, VIII.?.57, 1 Male, British Columbia:
Okanagan Lake, VIII.8.35 (J.L. McHugh)

D I S C U S S I O N _ A N D _ C O N C L U S I O N S

This thesis encompasses a taxonomic investigation of the Ephemeroptera of British Columbia, a group of insects which has been completely neglected in this province. The considerable structural variation among the higher ranks of the Ephemeroptera and the constancy of taxonomic criteria within each species provide the taxonomist with a rewarding order for study.

In the adults, particularly useful criteria include the distinct and easily identifiable wing venation, the structure of the compound eyes, the morphology of the legs, the shape of the male genitalia, and the colour pattern of the body. Identification is facilitated if specimens of both sexes are available for study, as all of these characteristics exhibit some sexual dimorphism in a number of species. The position of the ocelli, the wing colour, the length of the tails, the form of the antennae, and the general colour of the insect are less valuable taxonomic features.

The primary taxonomic characteristics of the nymphs are the shape of the body, the modifications of the mouthparts, and the type of gills. The denticulation and shape of the claws, the number, colour pattern, and vestiture of the tails, and the colour pattern of the tergites are also especially useful for identification. The structure of the compound eyes, ocelli, antennae, and legs are of limited value.

Included in this paper is a checklist of all species reported or collected in British Columbia, consisting of 146 species in 23 genera; keys to adults and nymphs; descriptions of taxonomically

pertinent criteria of the adults and nymphs; and some account of the ecology of those specimens collected by the author on the Alouette River.

Although the ecology of the mayflies has not been extensively investigated during this study, certain facts and trends have been observed. No preference on the part of the nymphs for either the middle or edges of the river was determined. However, since the Alouette River is generally narrow, between twenty and forty feet in width, there is in most places little variation in current or composition of the stream bed between the middle and the edges. At the widest part of the river, near the mouth, sampling was successful only at the edges, so that no comparison with the middle was possible.

Because of the sampling methods, a clear indication of the preference of various nymphs for particle size of the material of the stream bed was not obtainable. In most locations mud, sand, fine and coarse gravel, and rocks of all sizes were present, and at many sampling stations there were also boulders and bedrock. The use of the dip net precluded the possibility of observing the exact ecological niche of the nymphs collected. Most species taken in the Alouette River were found in locations containing all types of stream bed from mud to bedrock. However, Epeorus sp. 2, Epeorus sp. 4, Ephemerella teresa and Ephemerella doddsi were never found in mud or sand. Caenis sp. 1, Siphonurus sp. 1, Callibaetis sp. 1, and Centroptilum sp. 2 were found predominantly in mud and silt, in locations where there was occasional sand, gravel, or rocks.

Heptagenia sp. 3 was never found in sand. Ephemerella lodi was usually taken in quiet water from mud and silt, although in one case some nymphs were collected from a ripply stream, amongst gravel, rocks and boulders. Four species: Neocloeon sp. 1, Ephemerella inermis, Paraleptophlebia sp. 1 and Paraleptophlebia sp. 2 were taken, among other places, from a quiet, clay-bottomed pool.

Most of the species of nymphs taken in the Alouette River were found in all currents, from quiet water to turbulent rapids. Four species, however: Ephemerella teresa, Ephemerella doddsi, Epeorus sp. 2, and Epeorus sp. 4, were found only in a rapid, turbulent current. Three species: Caenis sp. 1, Siphonurus sp. 1 and Centroptilum sp. 2 were taken only in quiet, slow water. On the other hand, Neocloeon sp. 1, Ephemerella lodi, Callibaetis sp. 1, Paraleptophlebia bicornuta, Heptagenia sp. 3 and Baetis sp. 1 were never found in rapid water, and Ephemerella spinifera, Epeorus sp. 3 and Baetis sp. 1 were never taken in quiet or slow water.

Burks (1953) states that Hexagenia limbata prefers large slow rivers and moderately sized fairly rapid rivers; Stenonema sp. and Heptagenia sp. prefer moderately sized, fairly rapid rivers and small rapid rivers or creeks; Ephemera simulans prefers small rapid rivers or creeks and large lakes; and Leptophlebia nebulosa, L. cupida and Tricorythodes sp. prefer temporary ponds, usually along the margins of streams, with a reduced current or none.

Some species of nymphs were taken during the entire year, while others were taken only during periods ranging from one to

seven months. This is probably not significant, as this situation could too easily be due to chance. There is a possibility that some species become more active during certain times of the year, but as those species (except for Ephemerella flavilinea) collected during a limited part of the year were taken during the summer months, it was quite probably due to the increased activity of the collector.

Almost all of the specimens were taken at depths of one to three feet. This, however, is again not significant, as the use of a Surber Sampler or dip net is not feasible at depths much greater than this.

Dr. G.G.E. Scudder has collected extensively in the lakes of the Chilcotin, Cariboo and Nicola Valley regions. He determined the pH and the salinity of each location from which he sampled. All the lakes were neutral or alkaline, ranging from a pH of 6.84 to 10.55, the majority ranging up from pH 7.53. No correlation was found in the present study between the species collected and the pH of the environment, or between the species collected and the salinity of the lake.

The amount of material available for study was limited, and therefore this paper does not provide a complete account of the Ephemeroptera of British Columbia. Rather, it is intended as a basis for further work. Firstly, more complete search of the literature and examination of type material may provide identities to some of the 62 unknown species recorded herein. The rearing of unidentified nymphs to adults may determine the identity of others. This may be achieved by submerging cages of the nymphs in streams, or with more difficulty, rearing them in artificial

streams in the laboratory. Those specimens remaining unidentified should then be more completely described and named. Secondly, a great deal of additional collecting is necessary to complete our knowledge of this group in this province.

Little is known, as yet, of the biology and ecology of many species. Further work in these fields would be illuminating. The "preference" of the various species for lakes and rivers, rate of current, degree of temperature, salinity and pH of the environment is largely unknown. C.H. Eriksen (1963a, 1963b) has continued the research of J.P. Linduska (1942) on the preference of some nymphs for particle size of the substrate. Collecting techniques make it difficult to study this aspect in the field, and therefore his experimental approach is of great value. A continuation and expansion of this to other species would be beneficial. The diversity among body forms of the nymphs would make a study of the relationship between body form and environment of value. Research along this line has already been introduced by G.S. Dodds and F.L. Hisaw (1924a, 1924b). The minute differences between some species (?) affords an opportunity to study the possibility of geographic variation within this order of insects.

S U M M A R Y

1. This paper was undertaken to amalgamate the existing knowledge of the Ephemeroptera of British Columbia and to contribute to it, to clarify the taxonomy consistent with the newer ideas of classification of this group, and to provide a basis for further investigation.
2. Whereas the taxonomy of the order has been well studied in the United States, it has been largely neglected in Canada, and particularly in British Columbia.
3. The Ephemeroptera provide a satisfying group with which to work as they exhibit distinct and consistent taxonomic criteria, although a considerable degree of sexual dimorphism makes the construction of keys difficult.
4. The system of classification proposed by Edmunds and Traver (1954) in which the three families Heptageniidae, Ephemeridae, and Baetidae are replaced by the five superfamilies Heptagenioidea, Leptophlebioidea, Caenoidea, Ephemeroidea, and Prosoptomatoidea, is employed. All but the last are represented in this province.
5. 146 species in 23 genera have been recorded from British Columbia. Of these, 62 species are as yet not identified by the author and have been designated by number.
6. A checklist, keys, and descriptions of taxonomically pertinent criteria of all recorded species and higher ranks are included herein.
7. A cursory investigation of the ecology of the nymphs involved regular collections from 20 locations, chosen to provide all

types of substrate and rates of current flow, on the Alouette River, near Haney.

8. No "preference" for the middle or edges of the river was exhibited by the nymphs.
9. Most species were taken from all types of stream bed. This, however, is not significant, as the use of a dip net does not lend itself to an accurate determination of particle size "preference". The experimental approach to this problem of C.H. Eriksen (1963) is of more value than field observations.
10. There is no correlation between the species of nymphs and the pH or the salinity of the environment.
11. In order to extend our knowledge of the Ephemeroptera of British Columbia, it would be desirable to collect in hitherto untouched regions of the province, and to further investigate the identities of the 62 unidentified species by further research into the literature, examination of type material, and rearing of nymphs. New species should then be described and named. Further study of the ecology and biology of members of this order would be rewarding.

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PLATE I

- Fig. 1. A diagram of the main topographic features of a mayfly wing (based on a fore wing of Ironopsis permagnus), crossveins of the middle field mostly omitted. The numerals 1, 2, and 3 designate successive forks in the triple triad of the radial sector; forks 2 and 3 are not present in the hind wing of recent mayflies. Of, outer fork of Rs. (after Needham, Traver, and Hsu, 1935).
- Fig. 2. Representative mouthparts of the mayfly nymph. A, right mandible of Blasturus sp.; B, maxilla of Leptophlebia sp.; C, labium of Siphonurus sp. (after Spieth, 1933).

PLATE I.

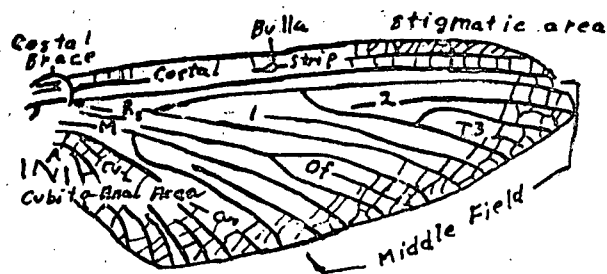


Fig. 1.

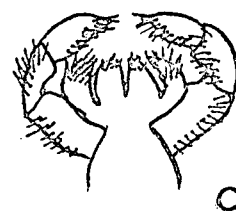
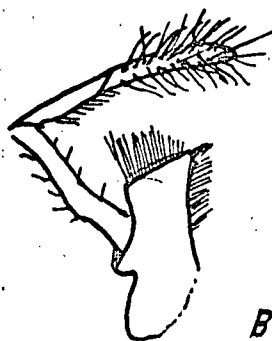
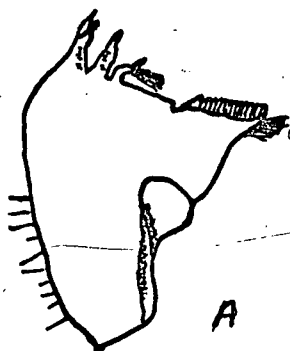


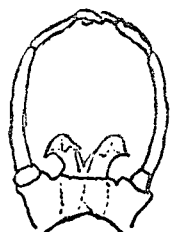
Fig. 2.

PLATE II

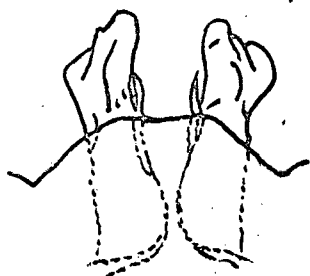
Fig. 3. Male genitalia of some Heptagenine and
Baetid mayflies. (not drawn to scale).
(after Needham, Traver, and Hsu, 1935).

PLATE II.

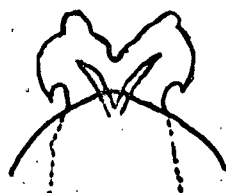
Epeorus



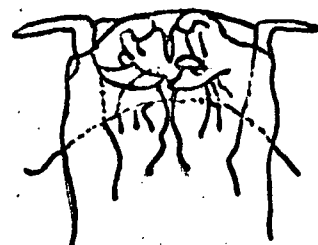
albertae



deceptivus

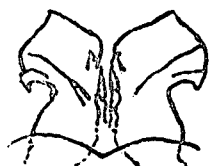


longimanus

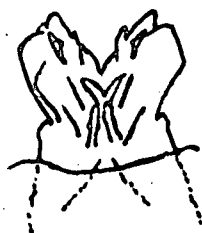


pleuralis

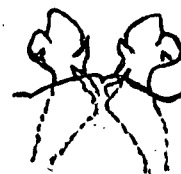
Heptagenia



pulla

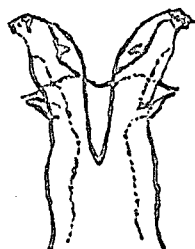


simplicoides

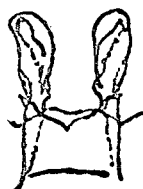


elegantula

Rithrogena



morrisoni

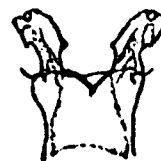


daddsi

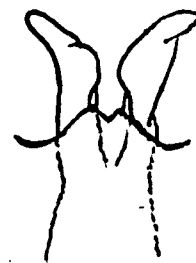
Stenonema



robusta



virilis

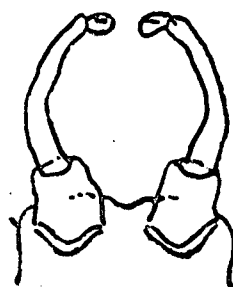


jejuna

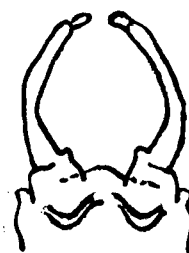
Baetis



rubrum
(*pukhellum*)



moffati



intercalaris