3.11 Heptageniidae

Heptageniidae is one of the largest families of mayflies in North America. The family is distributed throughout the Holarctic and Asia; no species are found in Australia and only a few genera have been reported from Central America. Heptageniidae is the sister group of Arthropleidae and together they form the most derived clade of the suborder Setisura (McCafferty 1991a,1991c; Wang and McCafferty 1995). Twelve of the 14 North American genera occur in Saskatchewan. The most recent key to the genera of North American Heptageniidae is Edmunds and Waltz (1996). Whiting (1985) studied the biogeography of the Heptageniidae in Saskatchewan; as part of his work he reared and examined hundreds of specimens and constructed keys for most of the species. Much of the information I present on the distribution of heptageniids in Saskatchewan is based on his notes, specimens, and unpublished works.

Larvae of Heptageniidae are differentiated from those of all other families occurring in Saskatchewan by the combination of a flattened, prognathous head capsule, maxillary palps that are not extremely elongated, an absence of a long fringe of setae on the ventral edge of the fore legs, and tarsal claws much shorter than the tarsi. Adult males are differentiated from those of other Saskatchewan families by the presence of two pairs of cubital intercalaries in the fore wings, veins MP_1 and MP_2 forming a nearly symmetrical fork in the fore wings, hind legs with five segmented tarsi, and two short terminal segments on the genital forceps. Males of nearly all of the genera and species can be identified by the shape and armature of the penes.

3.11.1 Key to the Genera of Heptageniidae: Larvae

1a. Two caudal filaments present ……..…2

1b. Three caudal filaments present ……..……..…4

2a. Gills on abdominal segments 1 and 2 inserted ventrally; rare, South Saskatchewan River upstream of Lake Diefenbaker …….……...……3

2b. Gills on abdominal segments 1 and 2 inserted laterally, but extend and meet ventrally to form a 'suction cup' (similar to Fig. 216); found in small streams in the western boreal forest and Cypress Hills ……..*Epeorus*

3a. Head and thorax with paired dorsal tubercles (note: the larva of *A. rusticus* is unknown, key is based on larvae of *A. simplex*) ……..……..*Anepeorus*

3b. Head and thorax without paired dorsal tubercles (Fig. 171) ...…….*Acanthomola*

4a. Gills inserted ventrally and mostly filamentous (Fig. 213) ...……*Raptoheptagenia*

4b. Gills inserted laterally, but they may be expanded ventrally, and with large lamellae on at least some segments (Figs. 184, 240, 215, 216) ……...5

5a. Gills on abdominal segments 1 and 7 extend and meet ventrally (Fig. 216) ……..*Rhithrogena*

5b. Gills not as above ……..……..6

6a. Anterior margin of head capsule with a distinct notch on anterior margin (Fig. 172) ……....*Cinygmula*

6b. Anterior margin of head capsule without a distinct notch ……...…….. ……7

7a. Gill 7 minute; body uniform brown (Fig.199) ……...……*Macdunnoa*

7b. Gill 7 large; body usually with a combination of light and dark markings ……8

8a. Gill 7 reduced to a slender filament and pointed (Figs. 218, 222) ……..9

8b. Gill 7 large, similar in shape to preceeding gills ……10

9a. Gills on abdominal segments 1-6 pointed (Fig. 218) ...……..…*Stenacron*

9b. Gills on abdominal segments 1-6 rounded or truncate (Figs. 222, 229) ….*Stenonema*

10a. Gill 7 with a filamentous portion, tarsal claws with a single large tooth (Fig. 192)

……...……..……..*Heptagenia*

10b. Gill 7 lacking a filamentous portion, tarsal claws with small denticles (Fig. 196)11

11a. Anterior margin of head with numerous dark spots (Fig. 194); head wider than pronotum; caudal filaments without long setae …….……...….*Leucrocuta*

11b. Anterior margin of head usually without numerous dark spots; pronotum as wide or wider than head; caudal filaments with long setae …….……....*Nixe*

3.11.2 Key to the Genera of Heptageniidae: Adult Males (modified from Edmunds and Waltz 1996)

1a. Male fore tarsi shorter than tibiae…….*Anepeorus*

1b. Male fore tarsi longer than tibiae…….……2

2a. Genitalia similar to Fig. 189 but posterolateral corner without a definite hook; undisturbed portions of Saskatchewan River System ……..*Raptoheptagenia*

2b. Genitalia not as above; if similar than a definite hook present on posterolateral corners (Fig. 189) ……..3

3a. Femora with a distinct dark longitudinal streak (Fig. 217), first segment of fore tarsus 1/3 to 1/5 length of second segment …….*Rhithrogena*

3b. Femora without a distinct dark longitudinal streak……..4

4a. First segment of fore tarsi longer than second segment; a black dot present on femora (similar to Fig. 174) ……..…….*Epeorus*

4b. First segment of fore tarsi shorter than second segment; no black dot present on femora ...……5

5a. Penes lobes separated to base (Fig. 173); first segment of fore tarsi only slightly shorter than second segment; western Saskatchewan ..……..*Cinygmula*

5b. Penes lobes fused at base; first segment of fore tarsi much shorter than second segment ...……..6

6a. Penes with a shape similar to Figs. 220, 226 …...…….……..7

6b. Penes not as above…….……..8

7a. Penes with numerous lateral spines (Fig. 220); fore wing with some cross veins between R_1 and R_2 connected by black staining. (Fig. 219) ……..*Stenacron*

7b. Penes without lateral spines (Fig. 226); no black spot as above …..……..*Stenonema*

8a. Eyes large and meeting or nearly meeting at vertex of head (Fig. 201) ……....*Nixe*

8b. Eyes separated by a distance greater than diameter of median ocellus ……...9

9a. Eyes separated by a distance equal to width of lateral ocellus ……...*Heptagenia*

9b. Eyes widely separated……..*Leucrocuta*

3.11.3 Acanthomola Whiting and Lehmkuhl

Acanthomola is composed of a single, rare, and highly distinctive species. Larvae are only known from undisturbed portions of the South Saskatchewan River, Saskatchewan and the Athabasca River in northern Alberta. Unlike most heptageniids, larvae are likely predatory based on mouthpart morphology; however, no animal remains were found in their gut contents (Whiting and Lehmkuhl 1987a). It is possible that *Acanthomola* is actually the undescribed larval stage of *Anepeorus* McDunnough. When the adult males of *Acanthomola* are discovered the taxonomic status of the genus should be clarified.

Larvae of *Acanthomola* are differentiated from all other Saskatchewan genera of Heptageniidae by the presence of only two caudal filaments, the gills on abdominal segments 1 and 2 inserted ventrally, and the absence of paired dorsal tubercles on the thorax. Additionally, the shape and armature of the mouthparts is unique. The adult stage is unknown.

Acanthomola pubescens Whiting & Lehmkuhl, 1987

Fig. 171

Distribution Map: Fig. 334

Descriptions: Adult: N/A

Larva: Whiting and Lehmkuhl (1987a)

Diagnostic Characters:

The diagnostic characters are the same as those provided in the genus treatment.

Distribution and Biology:

Acanthomola pubescens is known only from the South Saskatchewan River at Lemsford Ferry and the Athabasca River in northern Alberta. The Saskatchewan specimens were collected from an area with fast current and high silt load (Whiting and Lehmkuhl 1987a). Too few specimens have been collected to determine its life history, but it is likely that larvae hatch in May and adults emerge from July until September like many of the other large river specialist mayflies. Despite intensive efforts, no specimens of *A. pubescens* have been collected for nearly 20 years. DM Lehmkuhl may have encountered a single specimen at Lemsford Ferry in 2001 (pers. comm.).

Material Examined: 1 larva

South Saskatchewan River at Lemsford Ferry, 9 VIII 1970 DML.

3.11.4 Anepeorus McDunnough

Two species are included in *Anepeorus*; *A. rusticus* McDunnough from western North America, and *A.simplex* (Walsh) from eastern North America. Both occur in large rivers, and

both are rare and probably endangered. Burks (1953) described larvae which he tentatively associated with *Anepeorus*, and this description of the genus was widely accepted until these larvae were reared and found to not actually belong to *Anepeorus*, but to a new genus *Raptoheptagenia* Whiting and Lehmkuhl (Whiting and Lehmkuhl 1987b). The actual larvae of *Anepeorus* were described as *Spinadis wallacei* Edmunds and Jenson, but that species synonymy with *Anepeorus simplex* was realized by McCafferty and Provonsha (1988). The larva of *A. rusticus* remains unknown, but it is likely that *Acanthomola pubescens* (of which the adult male is unknown) is synonymous with *A. rusticus* (Whiting and Lehmkuhl 1987a; McCafferty and Provonsha 1988), but this cannot be proven until larvae of *Ac. pubescens* are reared.

Based on the larvae of *A. simplex*, larvae of *Anepeorus* can be differentiated from those of other heptageniids occurring in Saskatchewan by the presence of two caudal filaments, ventrally inserted gills on segments 1 and 2, and paired dorsal tubercles on the head and thorax. Adult males can be differentiated from those of other Saskatchewan heptageniids by the very short fore tarsi.

Anepeorus rusticus McDunnough, 1925

Descriptions: Adult: McDunnough (1925b), McCafferty and Provonsha (1985)

Larva: N/A

Diagnostic Characters:

The diagnostic characters are the same as those provided in the genus treatment.

Distribution and Biology:

Anepeorus rusticus is known only from three males from Saskatchewan, a male and possibly a female from Alberta, and parts of a male from Utah. The Saskatchewan specimens were collected from the South Saskatchewan River in September. No specimens of this distinctive species have been collected for nearly 80 years.

3.11.5 Cinygmula McDunnough

Cinygmula larvae are very common in swiftly flowing streams in western North America and a single species occurs in eastern North America. Adult males can usually be identified using the keys provided in Traver (1935) but larvae are generally not identifiable. Whiting (1985) reported collecting *C. mimus* (Eaton) from a small stream in northwestern Saskatchewan. However, Whiting's unpublished key to the heptageniids of Saskatchewan states the species is *C. reticulata* McDunnough. I was unable to locate Whiting's specimens and thus at this time I will only refer to these specimens as *C. sp*. I collected an additional larva of a *Cinygmula sp*. in a large, warm river in northwestern Saskatchewan which may be of the same species as Whiting's. Until adult males are obtained the specific identification of any *Cinygmula sp*. collected in Saskatchewan remains impossible.

Larvae of *Cinygmula* are differentiated from those of all other Saskatchewan Heptageniidae by the small, 'U' shaped notch in the anterior margin of the head capsule, the slightly laterally protruding maxillary palps, and the absence or reduction of the fibrilliform portion of the abdominal gills. Adults are differentiated from those of all other Saskatchewan Heptageniidae by the absence of a dark spot or longitudinal streak on the fore femora and the nearly completely separated lobes of the penes.

Figs. 172, 173

Distribution Map: Fig. 335

Material Examined: 1 larva

Beaver River at Hwy 4, 10 VI 2001 JMW and MSP.

3.11.6 Epeorus Eaton

Larvae of Epeorus are common inhabitants of cold, swift streams in mountainous areas in both eastern and western North America. The genus occurs in the Palearctic, Oriental, and Neotropical regions as well. There are 20 North American species currently recognized and one of these occurs in Saskatchewan. There are no up to date keys to the species of the larvae for North America; adults may be identified using Traver (1935) if species described subsequently are incorporated. *Epeorus albertae* (McDunnough) was reported from western Manitoba (Flannagan et al. 1990) and if the record is accurate then likely the species will be found in Saskatchewan. Larvae of *E. albertae* are differentiated from those of the other Saskatchewan species, *E. longimanus* (Eaton) by the absence of a black dot on the femora; adult males are differentiated by the shape of the penes and the absence of a black dot on the femora (see figures in Edmunds and Allen 1964).

Larvae are differentiated from those of other Saskatchewan Heptageniidae by the presence of only two caudal filaments and gills that extend beneath the abdomen. Adults are differentiated from those of all other Saskatchewan heptageniids by the presence of a black dot on the femora. Not all species of *Epeorus* possess the black dot on the femora; those species without them are differentiated from those of other Saskatchewan heptageniids by having the first segment of the fore tarsi longer than the second.

Epeorus longimanus (Eaton), 1885

Figs. 174, 175

Distribution Map: Fig. 336

Iron longimanus Eaton, 1885

Iron proprius Traver, 1935

Descriptions: Adult: Edmunds and Allen (1964)

Larva: Edmunds and Allen (1964)

Diagnostic Characters:

The diagnostic characters are the same as those provided in the genus treatment.

Distribution and Biology:

Epeorus longimanus is found in nearly every western state and province. In Saskatchewan larvae were collected in small tributaries of Battle Creek in the Cypress Hill and from a small stream in northwestern Saskatchewan. Mature larvae and adults were collected in late-June. Eggs hatch in late-fall (Whiting 1985).

Material Examined: 17 larvae, 1 imago.

Benson Creek at Battle Creek Road, West Block Cypress Hills Prov. Park, 25 V 2000 JMW, 25 VI 2000 JMW; Stream at mile 140 of Hwy 155, 12 VI 1981 ERW.

3.11.7 Heptagenia Walsh

Heptagenia is distributed throughout the Holarctic and Oriental regions and occurs in the northern parts of the Neotropical realm. In North America there are 12 species, five of which occur in Saskatchewan. Several species groups were recognized by Traver (1935); the *maculipennis* group and the *lucidipennis-simplicoides* group were put into their own genera,

Leucrocuta Flowers and *Nixe* Flowers, respectively, by Flowers (1980a). *Heptagenia sensu stricto* corresponds to Traver's *flavescens-pulla-elegantula* group. Adult males can be keyed to species using Traver (1935) if the new generic arrangements and new species are taken into consideration. There are no reliable keys to the larvae, but the keys of Flowers and Hilsenhoff (1975) can be used for some eastern species.

Lehmkuhl (1976b) reported *H. solitaria* McDunnough from Saskatchewan. However, no specimens I have examined fit the description of *H. solitaria* and the late Eric Whiting did not make any mention of that species being present in Saskatchewan in any of his notes or publications on Saskatchewan Heptageniidae. Saskatchewan specimens labeled as *H. solitaria* in Lehkmuhl's collections are in fact *H. pulla* (Clemens); based on this I feel that *H. solitaria* does not occur in Saskatchewan and therefore the species is not included in the keys.

Larvae of *Heptagenia* are differentiated from those of other Saskatchewan heptageniids by the presence of three well-developed caudal filaments, seven similarly shaped and sized abdominal gills which do not extend ventrally under the abdomen, a lack of an indentation on the anterior margin of the head capsule, and the absence of small denticles on the tarsal claws. Adult males are differentiated from those of other Saskatchewan heptageniids by the shape of the penes, the absence of a black streak or dot on the femora, and by having the eyes separated by a distance subequal to the width of the laterall ocelli.

Key to the species of *Heptagenia*: larvae

1a. Lateral margin of head capsule with a narrow (<1/5th length of head capsule) pale streak (Fig. 190); anteromedian white marking on head capsule absent *H. pulla*

1b. Lateral margin of head capsule with a wide pale streak (>1/5th length of head capsule) (Fig. 176); anteromedian white marking usually present on head capsule…….……..……..2

2a. Round white spot present on anteromedian margin of head capsule (Fig. 190) ….....3

2b. Anteromedian margin of head capsule with either a pale narrow streak or without a mark……..…..……4

3a. Tergum 4 with a pair of subdorsal white rectangular markings; tergum 5 with paired subdorsal spots ovate to circular (Fig. 188)……..……..*H. flavescens*

3b. Tergum 4 with extensive white markings (Fig. 177), occasionally coalescing to form 2 large subdorsal white rectangular markings; if tergum 4 with pale rectangular markings then tergum 5 with paired subdorsal markings crescent shaped, much longer than wide (Fig. 177)……...…….*H. adaequata*

4a. Anteromedian white marking absent on head capsule; if mark is present then posteromedian pale markings on abdominal terga 5 and 6 completely separated (Fig. 181) …..…….……..*H. diabasia*

4b. Anteromedian margin of head capsule with a pale streak or triangle; posteromedian pale markings on abdominal terga 5 and 6 joined mesally with a pale line (Fig. 184) ……...…….*H. elegantula*

Key to the species of *Heptagenia*: adult males

1a. Penes of the *flavescens*- type (Fig. 189)……...…….…..……*H. flavescens*

1b. Penes not as above……...……...…….2

2a. Abdominal terga pale with a dark transverse stripe along posterior margins and large reddish brown posterolateral triangles (Fig. 178); penes as in Fig. 179; Saskatchewan River system ……..*H. adaequata*

2b. Abdominal terga not as above; if a dark transverse line is present along posterior margin of terga, then no large posterolateral triangles present ……...….3

3a. Penes of the *elegantula*-type, with a prominent apicomedial hook (Fig. 187) …..….4

3b. Abdominal terga mostly dark reddish-brown, with paired submedian pale markings; widespread throughout the Saskatchewan River and boreal forest …….*H. pulla*

4a. A black transverse streak present on frontal shelf at margins of eyes (Fig.186); median hooks of penes long, basal hooks slender ……...……*H. elengantula*

4b. A small black dot present on frontal shelf at margins of eyes; median hooks of penes short, basal hooks broad near base …….…..…….*H. diabasia*

Heptagenia adaequata McDunnough, 1924

Figs. 176, 177, 178, 179

Distribution Map: Fig. 337

Heptagenia adequata McDunnough, 1924

Descriptions: Adult: McDunnough (1924a)

Larva: Webb et al. (2002)

Diagnostic Characters:

Larvae of *H. adaequata* are differentiated from those of other Saskatchewan *Heptagenia spp.*, except *H. flavescens* (Walsh), by the presence of a round anteromedian white spot on the head capsule. *Heptagenia adaequata* can usually be separated from *H. flavescens* by the 4 large pale markings on tergum 4; *H. flavescens* possesses a single pair of large rectangular marks on tergum 4. Whiting (unpublished) notes that in some specimens of *H. adaequata* the markings on tergum 4 coalesce to form 2 rectangular markings similar to *H. flavescens*; in such specimens the more elongate submedian dorsal markings on tergum 5 will identify *H. adaequata*. Additionally, mature larvae of *H. adaequata* have caudal filaments 1.25 – 2X longer than the body; all other species of *Heptagenia* in Saskatchewan have caudal filaments subequal in length to the body. Bednarik and Edmunds (1980) reported that the larva of *H. adaequata* was nearly indistinguishable from those of *H. solitaria* McDunnough; however, re-examination of their material showed their specimens were in fact *H. solitaria* (Webb et al. 2002).

Adult males of *H. adaequata* are easily identified by the brown, triangular lateral markings. Traver (1935) states *H. adaequata* has penes of the *pulla*- type; however, all material examined has penes more similar to *H. elegantula* (Eaton).

Distribution and Biology:

Heptagenia adaequata is only known from Saskatchewan, Alberta, Idaho, and Oregon. In Saskatchewan, *H. adaequata* is only found in pristine portions of the Saskatchewan River System. Whiting (1985) states the larvae are present year-round and adults emerge from May to September. In the Athabasca River, Alberta larvae were found in fast current over a substrate of impacted cobbles with a thin layer of fine silt (Webb, unpublished data).

Material Examined: 30 larvae, 10 imagos

North Saskatchewan River at Battleford, 30 VI 1975 DML, 25 VI 1975; North Saskatchewan River at Cecil Ferry, 6 VI 2000 JMW; South Saskatchewan River at Chesterfield Bridge, 22 VI 1979 ERW; South Saskatchewan River at Lemsford Ferry, 12 VII 1980 ERW, 6 VI 2001 JMW, 23 V 1998 JMW, 13 VIII 1980 ERW, 1 VII 1984 ERW, 18 VI 1983 ERW, 17 V 2000 JMW, 14 IX 1980 ERW, 17 VI 1980 ERW and Bj.

Heptagenia diabasia Burks, 1946

Figs. 180, 181, 182, 183

Distribution Map: Fig. 338

Description: Adult: Burks (1946)

Larva: Burks (1946)

Diagnostic Characters:

Larvae of *H. diabasia* are differentiated from those of all other Saskatchewan *Heptagenia* by the presence of a wide streak on the lateral margin of the head capsule, and, usually, the absence of a pale anteromedian white marking on the head capsule. The submedian dorsal abdominal markings on the posterior margins of the terga are completely separated, unlike those of larvae of *H. elegantula*. Larvae of *H. diabasia* and *H. elegantula* hybridize in Saskatchewan (Whiting 1985) and not all larvae can confidently be identified to species. Adult males are differentiated from those of other Saskatchewan *Heptagenia* by the shape of the penes and the black dot on the frontal shelf at the margin of the eyes.

Distribution and Biology:

Heptagenia diabasia is a midwestern species found as far west as eastern Colorado. In Saskatchewan larvae are most commonly collected in streams in the eastern boreal forest and the

Saskatchewan River system. It is likely that *H. diabasia* and *H. elegantula* are sister species which differentiated during the last glaciation when the ancestral species was likely separated into an eastern and a western population. Based on the possible hybridization, intergrades between the typical forms, small number of distinguishing characters, and distribution patterns, it is possible that *H. diabasia* is actually the same species as *H. elegantula* or that it is only a subspecies of *H. elegantula*. More material of both species from the rest of North America must be examined to ascertain the specific status of *H. diabasia*.

Material Examined: 12 larvae

Beaver River At Hwy 4, 1 VII 2000 JMW; Green Bush Creek at Hwy 3, 24 VII 1999 JMW; Qu'Appelle R. at Hwy 47, 21 VI 2000 JMW and DWP; Red Earth Creek at Hwy 163, 7 VII 1980 ERW.

Heptagenia elegantula (Eaton), 1885

Figs. 183, 184, 185, 186, 187

Distribution Map: Fig. 339

Heptagenia coxalis Banks, 1914

Heptagenia querula McDunnough, 1924

Rhithrogena elegantula Eaton, 1885

Descriptions: Adult: Traver (1935)

Larva: Bednarik and Edmunds (1980)

Diagnostic Characters:

Larvae of *H. elegantula* are differentiated from those of other Saskatchewan *Heptagenia* by the presence of a wide streak at the lateral margin of the head capsule, a narrow longitudinal

or triangular pale anteromedian streak on the head capsule, and by having the paired dorsal pale markings on the abdominal terga fused with a transverse pale line. As noted in the discussion of *H. diabasia*, not all larvae can be identified with certainty. Adult male *H. elegantula* are differentiated from those of all other Saskatchewan *Heptagenia* by the shape of the penes and the presence of a black streak on the frontal shelf at the margin of the eyes. The male's abdomen is pale with a narrow dark streak on the posterior margin.

Distribution and Biology:

Heptagenia elegantula is a common species found in warm, silty rivers in western North America. In Saskatchewan, larvae were collected in the Saskatchewan River system and other large, warm rivers. A single larva was collected from a small, cold stream in the Cypress Hills. Larvae are present year-round and emergence peaks in June and July (Whiting 1985).

Material Examined: 162 larvae, 8 imagos

Battle River At Hwy 21, 1 VII 2000 JMW; Benson Creek at Battle Creek Road, West Block Cypress Hills Prov. Park, 17 V 2000 JMW; North Saskatchewan River at Borden Bridge, 3 V 2000 JMW; North Saskatchewan River at Cecil Ferry, 6 VI 2000 JMW; South Saskatchewan River at Clarkboro Ferry, 16 VII 2000 JMW, 12 V 2000 JMW; South Saskatchewan River at Lemsford Ferry, 30 VII 1999 JMW, 16 IX 2000 JMW, 9 V 1998 JMW, 25 VI 2000 JMW, 30 VII 2000 JMW, 17 V 2000 JMW, 22 VII 1984 ERW, 3 VI 1986 ERW, 20 VIII 2001 JMW, 3 VII 2001 JMW; South Saskatchewan River at Queen Elizabeth Power Station, 24 IV 2001 JMW, 10 VII 1999 JMW, 2 VI 2000 JMW, 28 IV 2000 JMW; South Saskatchewan River at Saskatoon, 14 VII 1999 JMW; stream on Hwy 55, 53 28' 02"N 102 33' 41"W, 20 VII 2000 JMW.

Heptagenia flavescens (Walsh), 1862

Figs. 188, 189

Distribution Map: Fig. 340

Palingenia flavescens Walsh, 1862

Descriptions: Adult: Traver (1935), Burks (1953)

Larva: (Daggy 1945), Burks (1953)

Diagnostic Characters:

The larvae of *H. flavescens* are differentiated from those of all other Saskatchewan *Heptagenia* by the round anteromedial spot on the head capsule and the round paired pale spots on terga 5 and 6. Adult males are differentiated from those of other Saskatchewan *Heptagenia* by the shape of the penes and the pale abdominal coloration with a reddish longitudinal stripe on the midline.

Distribution and Biology:

Heptagenia flavescens is widely distributed throughout the eastern and Midwestern United States. In Canada it occurs in nearly all of the provinces except the Maritimes. All Saskatchewan specimens were collected from the Saskatchewan River system. Larvae were nearly always collected in clean, loose gravel in deep, fast water. *Raptoheptagenia cruentata* Whiting and Lehmkuhl was nearly always found in the same habitat as *H. flavescens*. Like all other *Heptagenia spp*. in Saskatchewan, *H. flavescens* larvae are present year-round.

Material Examined: 51 larvae, 1 subimago.

North Saskatchewan River at Borden Bridge, 3 V 2000 JMW; North Saskatchewan River at Cecil Ferry, 15 VI 1986 ERW, 6 VI 2000 JMW; North Saskatchewan River at Battleford, 25 VI

1975 DML; South Saskatchewan River at Lemsford Ferry, 3 VII 2001 JMW, 30 IV 1998 JMW, 16 IX 2000 JMW, 17 V 2000 JMW, 30 VII 2000 JMW.

Heptagenia pulla (Clemens), 1913

Figs. 190, 191, 192, 193

Distribution Map: Fig. 341

Ecdyonurus pullus (Clemens), 1913

Ecdyurus grandis Clemens, 1913

Ecdyurus pullus Clemens, 1913

Heptagenia pullus Clemens, 1913

Descriptions: Adult: Traver (1935), Burks (1953)

Larva: Burks (1953), Flowers and Hilsenhoff (1975)

Diagnostic Characters:

Larvae of *H. pulla* are differentiated from those of other Saskatchewan *Heptagenia* by the narrow pale lateral streak on the head capsule, or the absence of a pale streak. Adult males are differentiated from those of other Saskatchewan *Heptagenia* by the reddish abdominal terga with paired pale crescent shaped marks on the dorsum. The shape of the penes is also diagnostic.

Distribution and Biology:

Heptagenia pulla is a common eastern and midwestern species. In Saskatchewan it is more widely distributed than any other species of the *Heptagenia*. In most boreal streams it is the only species present, except in the eastern parts of the province where *H. diabasia* also occurs. Larvae are present year round and adult emergence occurs throughout the ice-free seasons but the peak of emergence occurs in June and July (Whiting 1985).

Material Examined: 138 larvae, 4 imagos, 2 subimagos

Archibald River, near S shore of L. Athabasca, 18 VI 1986 LD and DWP; Benson Creek at Battle Creek Road, West Block Cypress Hills Prov. Park, 17 V 2000 JMW; Cole Creek at Hwy 903, 10 VI 2001 JMW and MSP; Dennis Creek DFB 1999-03, 7 X 1999 NC; Fredette River at Uranium City, 21 VI 1986 LD and DWP; Green Bush Creek at Hwy 3, 19 VII 2000 JMW; Low Creek at Hwy 904, 1 VII 2000 JMW; McFarlane R, 59-09N, 107-54W, 19 VI 1980 JC; Meeyomoot River at Hwy 165, 13 VI 2000 JMW; Montreal River at Hwy 2, 8 VIII 2000 JMW; North Saskatchewan River at Borden Bridge, 3 V 2000 JMW; North Saskatchewan River at Cecil Ferry, 6 VI 2000 JMW, 8 V 2001 JMW and DWP; North Saskatchewan River at Lacolle Falls, 30 V 1984 ERW; North Shore of Lake Athabasca, 19 VI 1986 LD and DWP; Otosquen Creek at Hwy 99 VII 2001 JMW, 24 VII 1999 JMW; Overflowing River at Hwy 9, 17 VII 1999 JMW, 9 VII 2001 JMW, 19 VII 2000 JMW; Saskatoon, 26 V 2001 JMW; South Saskatchewan River at Clarkboro Ferry, 12 V 2000 JMW; South Saskatchewan River at Lemsford Ferry, 22 VII 1984 ERW, 17 V 2000 JMW, 6 VI 2001 JMW; South Saskatchewan River at Queen Elizabeth Power Station, 28 IV 2000 JMW; stream at km 105 of Hwy905, 13 VI 2000 JMW; stream at km 135 of Hwy 102, near N end of Mclennan Lake, 18 VI 1982 ERW; stream at km 150 of Hwy 905, 13 VI 2000 JMW; stream at km 165 of Hwy 903 55 24' 55"N 108 43' 06"W, 10 VI 2001 JMW and MSP; stream on Hwy 3, 52 50' 32"N 102 44' 20"W, 19 VII 2000 JMW; stream on Hwy 905, 57 15'07"N 103 59'54"W, 8 VIII 2000 JMW; Torch River at Hwy 35, 2 VII 1986 VK, 27 V 1986 ERW, 8 VII 1986 VK, 22 VII 1986 ERW; Torch River N of Hwy 35, 9 VII 2001 JMW, 22 VII 2001 JMW, 8 V 2001 JMW and DWP; Umpherville River At Hwy 905, 8 VIII 2000 JMW; Waskesiu River at Hwy 2, 6 VII 2000 JMW; Waskwei River At Hwy 9, 23 VII

2001 JMW; Weyakwin River at Hwy 2, 12 VI 2000 JMW, 7 VII 2000 JMW; Whitefox River at Hwy 35, 2 VII 1986 VK.

3.11.8 Leucrocuta Flowers

Leucrocuta was erected by Flowers (1980a) to include the *maculipennis* group of Traver (1935). Most species of *Leucrocuta* are found in eastern North America, but a few species occur in the west. Of the 10 North American species, two occur in Saskatchewan. The adults of *Leucrocuta* can be identified using a combination of Burks (1953), Traver (1935) and Allen (1966). There are no reliable keys to the species of larva.

Larvae are differentiated from those of all other Saskatchewan Heptageniidae by the presence of seven pairs similarly shaped gills, small denticles on the tarsal claws, and numerous black dots on the head capsule. *Nixe inconspicua* (McDunnough) shares these characters, but it has numerous long setae on the caudal filaments which all Saskatchewan *Leucrocuta* lack. Adult male *Leucrocuta* are differentiated from those of other Saskatchewan Heptageniidae by the shape of the penes and the widely separated eyes.

Key to the species of *Leucrocuta*: larvae

1a. Body mostly dark coloured (Fig. 194); widespread in the boreal forest and Cypress Hills ……...……..*L. hebe*

1b. Colour pattern with more extensive pale areas (Fig. 197); South Saskatchewan River system upstream of Lake Diefenbaker ……..*L. maculipennis*

Key to the species of *Leucrocuta*: adult males

1a. Abdominal terga predominantly white; South Saskatchewan River upstream of L. Diefenbaker …..……*L. maculipennis*

1b. Abdominal terga predominantly dark, with median pale markings; widespread in boreal forest ..……..……*L. hebe*

Leucrocuta hebe (McDunnough), 1924

Figs. 194, 195, 196

Distribution Map: Fig. 342

Ecdyonurus hebe (McDunnough), 1924

Heptagenia hebe McDunnough, 1924

Descriptions: Adult: Traver (1935), Burks (1953)

Larva: Traver (1935), Burks (1953)

Diagnostic Characters:

Larvae of *L. hebe* are differentiated from those of *L. maculipennis* (Walsh) by the much darker colour and the boreal distribution. Adult males are differentiated by their dark abdominal terga with pale submedian spots.

Distribution and Biology:

Leucrocuta hebe is common throughout the eastern and midwestern United States. Although it has not yet been reported from Alberta, *L. hebe* likely occurs throughout the boreal forest east of the Rocky Mountains in Canada. In Saskatchewan collections were from the eastern regions of the boreal forest and the Cypress Hills. Whiting (1985) reported specimens

from western portions of the province. Larvae are present in early-spring and emergence appears to last from mid-June until mid-August.

Material Examined: 125 larvae, 4 imagos

Battle Creek at Ranger Station, Cypress Hills Prov. Park, W Block, 30 VII 2000 JMW; Carrot River at Hwy 55, 23 VII 2001 JMW; Crean River at Hwy 2, 6 VII 2000 JMW; Frenchman River at Ravenscrag, 22km west of Eastend, 23 VI 2000 JMW, 29 VII 2000 JMW; McVey Creek at Hwy55, 20 VII 2000 JMW; Montreal River at Hwy 2, 8 VIII 2000 JMW; North Saskatchewan River at Borden Bridge, 9 VII 2001 JMW; Otosquen Creek at Hwy 9, 9 VII 2001 JMW; Overflowing River at Hwy 9, 9 VII 2001 JMW; Red Deer River at Hudson Bay Regional Park, 19 VII 2000; Torch River at Hwy 35, 2 VII 1986 VK, 8 VII 1986 VK, 22 VII 1986 ERW; Torch River N of Hwy 35, 9 VII 2001 JMW, 22 VII 2001 JMW; Whitefox River at Hwy 35, 2 VII 1986 VK.

Leucrocuta maculipennis (Walsh), 1863

Figs. 197, 198

Distribution Map: Fig. 343

Ecdyonurus maculipennis (Walsh), 1863

Ecdyurus maculipennis (Walsh), 1863

Heptagenia maculipennis Walsh, 1863

Descriptions: Adult: Traver (1935), Burks (1953)

Larva: Traver (1935), Burks (1953)

Diagnostic Characters:

Larvae of *L. maculipennis* are differentiated from those of *L. hebe* by the paler colour and the distribution. Adult males are differentiated by the pale abdominal terga.

Distribution and Biology:

Leucrocuta maculipennis has a wider distribution than any other species of *Leucrocuta*. It is found throughout the eastern and midwestern United States and eastern Canada. In Saskatchewan larvae were collected only from the South Saskatchewan River upstream of Lake Diefenbaker. Oddly, this species has not previously been reported from Saskatchewan despite intense collecting efforts in the South Saskatchewan River. This species is now one of the most abundant (based on qualitative observation) heptageniids in late-July and August. It is unknown why it has not previously been collected in Saskatchewan. Mature larvae were collected between June and early-September, but it appears that most individuals mature in August. Winter is likely spent as diapausing eggs.

Material Examined: 20 larvae, 4 imagos

South Saskatchewan River at Lemsford Ferry, 30 VII 2000 JMW, 16 IX 2000 JMW, 3 VII 2001 JMW, 6 VI 2001 JMW, 20 VIII 2001 JMW.

3.9.11 Macdunnoa Lehmkuhl

Macdunnoa was described based on larvae and female imagos collected from the Saskatchewan River system. The larvae are highly unusual in that they possess a minute gill 7. Flowers (1982) reared male imagos of a new species of *Macdunnoa* and transferred another

species to the genus. Keys to the species of *Macdunnoa* are provided by Flowers (1982). *Macdunnoa* appears to be most closely related to *Stenonema* Traver (Flowers 1982).

Larvae are differentiated from those of all other Saskatchewan heptageniids by the minute gill on abdominal segment 7. The plain dark brown colouration is a good field characteristic. Adult males are differentiated from those of all other Saskatchewan Heptageniidae by the shape of the penes and the thick and abruptly narrowed titillators of the penes.

Macdunnoa nipawinia Lehmkuhl, 1979

Fig. 199

Distribution Map: Fig. 344

Heptagenia nipawinia (Lehmkuhl), 1979

Descriptions: Adult: Lehmkuhl (1979 female imago only, male not described)

Larva: Lehmkuhl (1979), see also Flowers (1982)

Diagnostic Characters:

The diagnostic characters for the larva are the same as those provided in the genus treatment. The adult male has not been described, but an imago and a subimago reared by the late Eric Whiting show that the male, like those of *M. brunnea* Flowers, lack minute spines on the lateral margins of the penes. The description of *M. brunnea* is vague, and I have not examined any specimens of that species, but it appears that the shape of the penes of males of *M. nipawinia* differ slightly from those of *M. brunnea*; however, the shape of penes of heptageniids can vary depending on how much pressure was applied when making the slide and on what the condition of the specimens was when it was killed. Until further specimens are reared the only

way males of *M. nipawinia* and *M. brunnea* can be separated is by their distribution (*M. brunnea* is known only from the southeastern United States).

Distribution and Biology:

Macdunnoa nipawinia has only been reported from the Saskatchewan River system in Saskatchewan. I have collected specimens from the Milk River in Montana, and it likely occurs in the same river in Alberta. All the larvae I collected were found on snags in fast current. Lehmkuhl (1979) similarly stated that larvae prefer woody substrates. Emergence occurs from late-June until late-July or early-August, and larvae first hatch in early spring (Lehmkuhl 1979).

Material Examined: 15 larvae, 1 imago, 2 subimagos, 1 slide mount of male genitalia (no associated specimen)

South Saskatchewan River at Lemsford Ferry, 18 VI 1983 ERW, 20 VII 2000 JMW, 17 VI 1983 ERW, 1 VII 1984 ERW.

3.11.10 Nixe Flowers

Flowers (1980a) erected *Nixe* to include the *lucidipennis-simplicoides* group of *Heptagenia sensu lato*. Thirteen species are distributed throughout North America except for the far north. There are four species in Saskatchewan. Whiting (1985), in his study on the biogeography of Saskatchewan Heptageniidae, found that there is distinct habitat partitioning among the species of *Nixe* in the stream along the Manitoba escarpment.

Larvae of *Nixe* are differentiated from those of other Saskatchewan Heptageniidae by having three caudal filaments, seven similarly sized and shaped gills, no indentation in the anterior margin of the head capsule, denticles on the tarsal claws, and long setae on the caudal filaments. Adult males are differentiated from those of other Saskatchewan Heptageniidae by

the shape of the penes and by having the eyes touching or nearly touching on the vertex of the head.

Key to the species of *Nixe*: larvae

1a. Anterior margin of head capsule with numerous dark dots; fibrilliform portion of abdominal gill 6 absent ……..*N. inconspicua*

1b. Anterior margin of head capsule without dark dots; fibrilliform portion of gill 6 usually present ……2

2a. Abdominal tergum 4 with a pair of large, rectangular white marks, remaining abdominal terga usually dark with a lateral white mark (Fig. 209); anterior margin of head capsule with a pair of white marks separated by a distance subequal to the distance between the antennal bases (Fig. 210) *N. simplicoides*

2b. Abdominal tergum 4 not as above, a median white mark usually present in addition to at least one pair of lateral white markings …..……..……3

3a. Abdominal terga with two pairs of white lateral marks (Fig. 202), one anterior and one posterior; galea-lacinia with less than 13 spine-like setae ….*N. lucidipennis*

3b. Abdominal terga with a single pair of white lateral marks on posterior margin (Fig. 204); galea-lacinia with more than 13 spine-like setae……..…*N. rusticalis*

Key to species of *Nixe*: adult males

1a. Abdominal terga completely pale (Fig. 211); penes as in Fig. 212 …*N. simplicoides*

1b. Abdominal terga usually with dark markings; if pale, genitalia not as above ...…..2

2a. Abdominal terga uniformly pale orange-tan (Fig. 201); penes similar to Fig. 208

……..*N. inconspicua*

2b. Abdominal terga brown with conspicuous white markings ……..……..3

3a. Apex of each penis lobe expanded, projecting posteriorly (Fig. 203) *N. lucidipennis*

3b. Apex of each penis lobe not expanded posteriorly (Fig. 208) ……..…*N. rusticalis*

Nixe inconspicua (McDunnough), 1924

Figs. 200, 201

Distribution Map: Fig. 345

Ecdyonurus inconspicuus (McDunnough), 1924

Heptagenia inconspicua McDunnough, 1924

Descriptions: Adult: McDunnough (1924a), Traver (1935)

Larva: McCafferty (1977b)

Diagnostic Characters:

Larvae of *N. inconspicua* are differentiated from those of other Saskatchewan *Nixe* by the presence of dark spots on the anterior half of the head capsule and the lack of a fibrilliform tufts on gill 6. Adult males are differentiated from those of other Saskatchewan *Nixe* by the uniformly orangey-brown abdominal terga and the shape of the penes.

Distribution and Biology:

Nixe inconspicua is a common species in eastern and midwestern North America. In Saskatchewan larvae were collected from warm, low gradient streams near the Manitoba Escarpment. Larvae first hatch in spring and emergence is concentrated in late-June and early-July (Whiting 1985).

Material Examined: 10 larvae, 8 imagos and subimagos

Fir River at Hudson Bay Regional Park, 23 VII 2001 JMW; Red Deer River At Rendek Elm Forest, 9 VII 2001 JMW; Torch River at Hwy 35, 8 VII 1986, 22 VII 1986 ERW; Torch River N of Hwy 35, 9 VII 2001 JMW; Whitefox River at Hwy 35, 2 VII 1986 VK.

Nixe lucidipennis (Clemens), 1913

Figs. 202, 203

Distribution Map: Fig. 346

Ecdyonurus lucidipennis (Clemens), 1913

Ecdyurus lucidipennis Clemens, 1913

Heptagenia lucidipennis (Clemens), 1913

Descriptions: Adult: Traver (1935), Burks (1953)

Larva: Clemens (1913), Burks (1953)

Diagnostic Characters:

Larvae of *N. lucidipennis* can be differentiated from those of other Saskatchewan *Nixe* by the abdominal colour pattern and the small number of spine-like setae on the crown of the galea-lacinia. Adult males are differentiated from those of other Saskatchewan *Nixe* by the shape of the penes and brown and white abdominal colouration.

Distribution and Biology:

Nixe lucidipennis is found in the northeastern United States, Ontario, Quebec and Saskatchewan. In Saskatchewan larvae are found in cold, low gradient streams (Whiting 1985). Larvae were collected in June and early-July. Adults emerge in June and July (Whiting 1985).

Material Examined: 6 larvae

Fir River at Hudson Bay Regional Park, 8 VI 1980 ERW; Whitefox River at Hwy 35, 2 VII 1986 VK.

Nixe rusticalis (McDunnough), 1931

Figs. 204, 205, 206, 207, 208

Distribution Map: Fig. 347

Ecdyonurus rusticalis (McDunnough), 1931

Heptagenia rusticalis McDunnough, 1931

Descriptions: Adult: McDunnough 1931b, Traver (1935), Burks (1953)

Larva: N/A

Diagnostic Characters:

Larvae of *N. rusticalis* are differentiated from those of other Saskatchewan *Nixe* by the colour pattern of the head capsule and the abdominal terga. Some larvae in the ultimate instar become almost entirely brown and resemble larvae of *N. simplicoides* (McDunnough). The two species can be differentiated by the distance between the two medial pale spots on the anterior margin of the head capsule; those of *N. simplicoides* are separated by a distance subequal to the distance between the bases of the antennae, whereas those of *N. rusticalis* are slightly closer together than the bases of the antennae. Adult males are differentiated from those of other Saskatchewan *Nixe* by the shape of the penes and the brown and white abdominal terga.

Distribution and Biology:

Nixe rusticalis has only rarely been reported. It is known from Quebec, New York, Ohio, and Iowa. In Saskatchewan, larvae were collected from cold, high-gradient streams along the Manitoba Escarpment. Larvae were often sympatric with *N. simplicoides*. Adults were collected in July. Like other species of *Nixe*, winter is spent in the egg stage and larvae hatch out in the early-spring.

Material Examined: 13 larvae, 3 imagos

creek at km 65 of Hwy 9, 23 VII 2001; Otosquen Creek at Hwy 9, 9 VII 2001 JMW; Pasquia River at Hwy 9, 17 VII 1999 JMW; Waskwei River At Hwy 9, 23 VII 2001 JMW.

Nixe simplicioides (McDunnough), 1924

Figs. 209, 210, 211, 212

Distribution Map: Fig. 348

Ecdyonurus rodocki (Traver), 1935

Ecdyonurus simplicioides (McDunnough), 1924

Ecdyonurus werestschagini (Tshernova), 1952

Heptagenia rodocki Traver, 1935

Heptagenia simplicioides McDunnough, 1924

Heptagenia werestschagini Tshernova, 1952

Nixe rodocki (Traver), 1935

Rhithrogena imanica Bajkova, 1972

Descriptions: Adult: (McDunnough 1924a), Traver (1935)

Larva: Bednarik and Edmunds (1980)

Diagnostic Characters:

The larvae of *N. simplicoides* are differentiated from those of other Saskatchewan *Nixe* by the presence of two rectangular white patches on abdominal tergum 4 and by having the median-most pair of the white spots on the anterior margin of the head capsule separated by a distance greater than the distance between the bases of the antennae. Adult males are differentiated from those of other Saskatchewan *Nixe* by the pale abdominal terga and the shape of the penes.

Distribution and Biology:

Nixe simplicoides is widespread throughout western North America and it has also been reported from eastern Asia (Flowers 1986). In Saskatchewan, *N. simplicoides* has a wider distribution than any other species of *Nixe*, being found in the eastern boreal forest, the Cypress Hills and occasionally in the South Saskatchewan River. *Nixe simplicoides* has a life cycle similar to other Saskatchewan species of *Nixe*.

Material Examined: 100 larvae, 1 imago

Battle Creek at Ranger Station, Cypress Hills Prov. Park, W Block, 25 VI 2000 JMW; creek at km 65 of Hwy 9, 23 VII 2001 JMW, 20 VII 2000 JMW; Fir River at Hudson Bay Regional Park, 8 VI 1980 ERW; Otosquen Creek at Hwy 9, 9 VII 2001 JMW; Pasquia River at Hwy 9, 20 VII 2000 JMW, 17 VII 1999 JMW; South Saskatchewan River at Lemsford Ferry, 6 VI 2001 JMW; stream on Hwy 55, 53 28' 02"N 102 33' 41"W, 20 VII 2000 JMW; Waskwei River At Hwy 9, 23 VII 2001 JMW.

3.11.11 Raptoheptagenia Whiting and Lehmkuhl

Burks (1953) first described the larva of this distinctive genus and assumed it was *Anepeorus*. Burks' assumption was accepted by most ephemeropterists until Whiting and Lehmkuhl (1987b) reared adult males and found that the larvae were in fact those of *Heptagenia cruentata* Walsh, not *Anepeorus*, and erected a new genus because of the unique nature of the larva. The larvae of *Raptoheptagenia* are predatory and are found in large, warm rivers.

Larvae of *Raptoheptagenia* are differentiated from those of all other Saskatchewan Heptageniidae by the presence of three caudal filaments and the ventral insertion of the filamentous gills. Adult males are differentiated from those of other Saskatchewan Heptageniidae by the shape of the penes.

Raptoheptagenia cruentata (Walsh), 1863

Fig. 213

Distribution Map: Fig. 349

Heptagenia cruentata Walsh, 1863

Heptagenia reversalis McDunnough, 1924

Descriptions: Adult: Traver (1935 as. *H. cruentata*), Burks (1953 as *H. cruentata*)

Larva: Burks (1953 as *Anepeorus*), McCafferty and Provonsha (1986)

Diagnostic Characters:

The diagnostic characters are the same as those provided in the genus treatment.

Distribution and Biology:

Raptoheptagenia cruentata is known from scattered records throughout central North America. In Saskatchewan larvae were collected in pristine portions of the Saskatchewan River system. Whiting & Lehmkuhl (1987) also found *R. cruentata* in the Battle River, a large

tributary of the North Saskatchewan River in western Saskatchewan. In the South Saskatchewan River at Lemsford Ferry (south of Kindersley) larvae were most easily collected from clean, unimpacted gravel in deep, fast water. Based on field observations, it appeared that later instar larvae occur in deeper water than younger larvae. Larvae are present from mid-May until August (Whiting and Lehmkuhl 1987b). Unlike most heptageniids, *R. cruentata* larvae are predatory and feed on Chironomidae.

Material Examined: 16 larvae, 1 imago

North Saskatchewan River at Cecil Ferry, 6 VI 2000 JMW; South Saskatchewan River at Lemsford Ferry, 30 VII 1999 JMW, 18 VI 1983 ERW, 30 VII 2000 JMW, 17 V 2000 JMW, 3 VII 2001 JMW.

3.11.12 Rhithrogena Eaton

Rhithrogena is a relatively large genus found in the Holarctic, Neotropical and Oriental regions. There are 22 North American species, most of which are found in the mountains of the west and in the northeast. The adults can be identified using Traver (1935). There are no reliable keys to the larvae, but Flowers and Hilsenhoff (1975) provide keys to the Wisconsin species. Two species have been reported from Saskatchewan.

Larvae are differentiated from those of other Saskatchewan heptageniids by the ventrally extended gills on abdominal segments 1 and 7, and by having three caudal filaments. Adults are

differentiated from those of other Saskatchewan heptageniids by the shape of the penes, the dark longitudinal streak on the fore femora, and the very short first segment of the fore tarsi.

Key to the species of *Rhithrogena*: larvae

1a. Dorsal margin of abdominal gills 2-6 with a small, finger-like lobe ……..*R. undulata*

1b. Dorsal margin of abdominal gills 2-6 smooth, without a lobe ……...……*R. jejuna*

Key to the species of *Rhithrogena*: adult males

1a. Lobes of penes distinctly narrowed apically (Fig. 214); styliger plate with a distinct notch ……...……..*R. jejuna*

1b. Lobes of penes not narrowed apically; styliger plate undulate …..……*R. undulata*

Rhithrogena jejuna Eaton, 1885

Fig. 214

Baetis fusca Walker, 1853

Heptagenia fusca (Walker), 1853

Rhithrogena fusca (Walker), 1853

Descriptions: Adult: Traver (1935)

Larva: Flowers and Hilsenhoff (1975)

Diagnostic Characters:

Larvae of *R. jejuna* are differentiated from those of *R. undulata* (Banks) by the lack of a finger-like lobe on the dorsal margin of the gills on abdominal segments 2-6. Adult males are differentiated from those of *R. undulata* by the narrowed apices of the penes lobes.

Distribution and Biology:

Rhithrogena jejuna is known from throughout Canada and the eastern United States. This species was first reported in Saskatchewan by Walley (1927), and Mason and Lehmkuhl (1983) reported specimens from the Saskatchewan River. I have not examined any specimens of this species. In Wisconsin larvae were present year-round in shallow gravel riffles of medium sized streams (Flowers and Hilsenhoff 1975).

Rhithrogena undulata (Banks), 1924

Figs. 215, 216

Distribution Map: Fig. 350

Epeorus undulata Banks, 1924

Epeorus undulatus Banks, 1924

Descriptions: Adult: Traver (1935)

Larva: Edmunds (1952), see also Flowers and Hilsenhoff (1975)

Diagnostic Characters:

Larvae are differentiated from those of *R. jejuna* by the presence of a finger-like lobe on the dorsal margin of the gills 2-6. The penes of adult males do not narrow distally as those of *R. jejuna* do.

Distribution and Biology:

Rhithrogena undulata is widespread in western North America and has been reported as far east as Wisconsin. In Saskatchewan larvae have only been reported from the South

Saskatchewan River upstream of Lake Diefenbaker (Whiting 1985). Adults emerge in May and June and the larvae reappear in August. I have not collected this species in Saskatchewan despite intense collecting efforts.

Material Examined:

South Saskatchewan River at Lemsford Ferry, 13 VIII 1980 ERW, 22 V 1980 ERW.

3.11.13 Stenacron Jenson

Stenacron is a genus closely related to *Stenonema* and until recently it was actually considered to be part of that genus. The genus is only found in eastern and central North America. There are seven species; one occurs in Saskatchewan. Larvae and adults can be identified to species using Lewis (1974).

Larvae are differentiated from those of all other Saskatchewan Heptageniidae by the filament-like gill 7 and the pointed apices of gills 2-6. Adult males are differentiated from those of other Saskatchewan Heptageniidae by the shape of the penes, the well-developed cluster of spines on the lateral margins of the penes, and the small, dark spot on the fore wings.

Stenacron interpunctatum (Say), 1839

Figs. 218, 219, 220

Distribution Map: Fig. 351

Baetis canadensis Walker, 1853

Baetis interpunctata Say, 1839

Ecdyonurus canadensis (Walker), 1853

Ecdyonurus frontalis (Banks), 1910

Ecdyonurus heterotarsalis McDunnough, 1933

Ecdyurus canadensis (Walker), 1853

Heptagenia canadensis (Walker), 1853

Heptagenia frontalis Banks, 1910

Heptagenia interpunctata (Say), 1839

Palingenia interpunctata (Say), 1839

Stenacron areion (Burks), 1953

Stenacron canadense (Walker), 1853

Stenacron frontale (Banks), 1910

Stenacron heterotarsale (McDunnough), 1933

Stenonema areion Burks, 1953

Stenonema affine Traver, 1933

Stenonema canadense (Walker), 1853

Stenonema conjunctum Traver, 1935

Stenonema frontale (Banks), 1910

Stenonema heterotarsale (McDunnough), 1933

Stenonema interpunctatum (Say), 1839

Stenonema majus Traver, 1935

Stenonema ohioense Traver, 1935

Stenonema proximum Traver, 1935

Descriptions: Adult: Lewis (1974)

Larva: Lewis (1974)

Diagnostic Characters:

The diagnostic characters are the same as those provided in the genus treatment.

Distribution and Biology:

Stenacron interpunctatum has been reported from most states and provinces east of the Rocky Mountains. In Saskatchewan *S. interpunctatum* is widespread in the boreal forest and in the Saskatchewan River system. No specimens have been collected in the South Saskatchewan River upstream of Lake Diefenbaker, however. Larvae are present year-round and adults emerge from May until August (Whiting 1985). Numerous subspecies of *S. interpunctatum* have been described but it was shown that the temperature during larval development played a role in the production of the different phenotypes and the subspecific rank was no longer recognized (McCafferty and Pereira 1984).

Material Examined: 66 larvae, 2 imagos

Crean River at Hwy 2, 6 VII 2000 JMW; Fir River at Hudson Bay Regional Park, 23 VII 2001 JMW; Giekie River at hwy 905, 12 VI 2000 JMW; Montreal River at Hwy 2, 8 VIII 2000 JMW; Red Deer River at Hudson Bay Regional Park, 19 VII 2000 JMW; Red Deer River At Rendek Elm Forest, 8 VII 2001 JMW; South Saskatchewan River at Clarkboro Ferry, 10 V 1998 JMW, 12 V 2000 JMW, 16 VII 2000 JMW; South Saskatchewan River at Queen Elizabeth Power Station, 245 IV 2001 JMW; South Saskatchewan River at Saskatoon, 16 III 2001 JMW; Spruce River, 24 VIII 1986 VK; stream on Hwy 3, 52 50' 32"N 102 44' 20"W, 19 VII 2000 JMW; stream on Hwy 9, S of Hudson Bay 52 40'03"N 102 22'19"W, 24 V 2001 JMW; Torch River at Hwy 35, 22 VII 1986 ERW; Waskesiu River at Hwy 2, 6 VII 2000 JMW, 19 VI 1982 ERW; Whitefox River at Hwy 35, 9 V 2001 JMW and DWP, 2 VII 1986 VK.

3.11.14 Stenonema Traver

Stenonema is found in eastern North America and Central America south to Panama (Edmunds et al. 1976). This genus is the best known of Heptageniidae in North America due to the works of Lewis (1974) and Bednarik and McCafferty (1979), both of whom provide keys to the species for both larvae and adults. Bednarik and McCafferty (1979) erected two subgenera: *S. Stenonema*, which includes only *S. S. femoratum*, and *S. Maccaffertium*, which includes the remaining 14 species. Three species occur in Saskatchewan.

Larvae are differentiated from those of other Saskatchewan Heptageniidae by the pointed, thread-like gill 7 and the rounded or truncate gills on segments 1-6. Adults are differentiated from those of other Saskatchewan Heptageniidae by the shape of the penes.

Key to the species of *Stenonema*: larvae

1a. Apices of abdominal gill lamellae rounded (Fig. 222); some abdominal sterna with a pair of dark, circular sublateral spots (Fig. 221)……..…..….*S. femoratum*

1b. Apices of abdominal gill lamellae truncate (Fig. 229) ….……...……2

2a. Posterior margins of abdominal sterna with a dark transverse band (Fig. 228); lateral projections present anterior to segment 6 ……..…...……*S. vicarium*

2b. Abdominal sterna not as above, often immaculate or with lateral, longitudinal dark stripes; lateral projections absent anterior to segment 7……...…….*S. terminatum*

Key to the species of *Stenonema*: adult males

1a. Posterior margin of abdominal terga 3-8 with 3 transverse dark dashes (Fig. 223) ……..……..……..*S. femoratum*

1b. Posterior margin of abdominal terga not as above……...……2

2a. Compound eyes separated by a distance greater than width of lateral ocellus; posterior margin of abdominal terga with a transverse stripe(Fig. 225) ……...*S. terminatum*

2b. Compound eyes separated by a distance equal to or less than width of lateral ocellus; abdominal terga with a median longitudinal stripe (Fig. 230) ….…….*S. vicarium*

Stenonema femoratum (Say), 1823

Figs. 221, 222, 223

Distribution Map: Fig. 352

Baetis femorata Say, 1823

Ecdyonurus femoratus (Say), 1823

Ecdyonurus tripunctatus (Banks), 1910

Heptagenia femorata (Say), 1823

Heptagenia tripunctata Banks, 1910

Siphlurus femoratus (Say), 1823

Stenonema birdi Traver, 1935

Stenonema scitulum Traver, 1935

Stenonema tripunctatum (Banks), 1910

Descriptions: Adult: Lewis (1974), Bednarik and McCafferty (1979)

Larva: Lewis (1974), Bednarik and McCafferty (1979)

Diagnostic Characters:

Larvae are differentiated from those of other Saskatchewan *Stenonema* by the truncate apices of the abdominal gills and the pair of sublateral, circular spots on some of the abdominal sterna (the sterna which have the spots varies). Adult males are differentiated from those of other Saskatchewan *Stenonema* by the presence of 3 transverse, dark dashes on the abdominal terga.

Distribution and Biology:

Stenonema femoratum is widely distributed in eastern and midwestern North America. In Canada it is reported from most provinces west of Saskatchewan, and although not yet reported from Alberta, it likely occurs there. Unlike most other Heptageniidae, *S. femoratum* is found primarily in lentic habitats. Parthogenesis often occurs in this species (McCafferty and Huff 1974).

Material Examined: 9 larvae, 1 imago

Courtney Lake at Hwy 905, 8 VIII 2000 JMW; Giekie River at hwy 905, 12 VI 2000 JMW; North Shore of Lake Athabasca, 19 VI 1986 LD and DWP; stream at mile 107 (km171) of Hwy 955, 9 VI 1981 ERW; Torch River At Hwy 120, 8 VIII 2001 DWP and Jhal; Weyakwin River at Hwy 2, 12 IX 1993 SN.

Stenonema terminatum terminatum (Walsh), 1862

Figs. 224, 225, 226, 227

Distribution Map: Fig. 353

Ecdyonurus bipunctatus McDunnough, 1926

Ecdyonurus terminatus (Walsh), 1862

Heptagenia terminata (Walsh), 1862

Heptagenia terminata terminata (Walsh), 1862

Palingenia terminata Walsh, 1862

Stenonema ares Burks, 1953

Stenonema bipunctatum (McDunnough), 1926

Stenonema lepton Burks, 1946

Stenonema terminatum (Walsh), 1862

Descriptions: Adult: Lewis (1974), Bednarik and McCafferty (1979)

Larva: Lewis (1974), Bednarik and McCafferty (1979)

Diagnostic Characters:

Larvae of *S. terminatum* are differentiated from those of other Saskatchewan *Stenonema* by the absence of lateral projections anterior to abdominal segment 7. Adult males are differentiated from those of the other Saskatchewan *Stenonema* by the mostly pale abdominal terga with a thin, dark transverse stripe on the posterior margin.

Distribution and Biology:

Unlike the other Saskatchewan *Stenonema*, the colour pattern of the abdominal sterna is quite variable and can be immaculate or have sublateral longitudinal dashes or triangles. In Saskatchewan this species was easily commonly collected from the Saskatchewan River system but it was also collected from the Cypress Hills and some larger rivers in the southern boreal forest. Bednarik and McCafferty (1979) described two subspecies of *S. terminatum*; *S. t. terminatum* and *S. t. placitum* (Banks). There are only slight differences in colour and in the shape of the penes. *Stenonema t. placitum* is only found in the eastern United States.

Material Examined: 216 larvae, 5 imagos

Battle Creek at Hwy 615, 19 V 2000 JMW; Battle Creek at Ranger Station, Cypress Hills Prov. Park, W Block, 30 VII 2000 JMW, 19 V 2000 JMW, 25 VI 2000 JMW; Carrot River at Hwy 55,

25 V 2000 JMW and DWP; Frenchman River at Ravenscrag, 22km west of Eastend, 19 V 2000 JMW; North Saskatchewan River at Borden Bridge, 3 V 2000 JMW; North Saskatchewan River at Cecil Ferry, 8 V 2001 JMW and DWP, 6 VI 2000 JMW; South Saskatchewan River at Clarkboro Ferry, 10 V 1998 JMW, 30 V 1998 JMW, 12 V 2000 JMW, 16 VII 2000 JMW; South Saskatchewan River at Lemsford Ferry, 1 VII 1984 ERW, 23 V 1998 JMW, 6 VI 1998 JMW, 5 VII 1998 JMW, 25 VI 2000 JMW, 30 VII 2000 JMW, 17 V 2000 JMW, 16 X 1999 JMW and Bpol, 1 VII 1984 ERW, 30 IV 1998 JMW, 16 IX 2000 JMW; South Saskatchewan River at Queen Elizabeth Power Station, 28 IV 2000 JMW; South Saskatchewan River at Saskatoon, 13 VIII 2000 JMW; Torch River at Hwy 35, 27 V 1986 ERW, 22 VII 1986 ERW.

Stenonema vicarium (Walker), 1853

Figs. 228, 229, 230

Distribution Map: Fig. 354

Baetis tessellata Walker, 1853

Baetis vicaria Walker, 1853

Ecdyonurus fusca (Clemens), 1913

Ecdyonurus fuscum (Clemens), 1913

Ecdyonurus fuscus (Clemens), 1913

Ecdyonurus rivulicolus McDunnough, 1933

Ecdyonurus vicarius (Walker), 1853

Ecdyurus vicarius (Walker), 1853

Heptagenia fusca Clemens, 1913

Heptagenia vicaria (Walker), 1853

Stenonema fuscum (Clemens), 1913

Stenonema rivulicolum (McDunnough), 1933

Stenonema tessellata (Walker), 1853

Descriptions: Adult: Lewis (1974), Bednarik and McCafferty (1979)

Larva: Lewis (1974), Bednarik and McCafferty (1979)

Diagnostic Characters:

Larvae of *S. vicarium* are differentiated from those of other Saskatchewan *Stenonema* by the dark, transverse markings on the abdominal sterna. Adult males are differentiated from those of other Saskatchewan *Stenonema* by the dark, longitudinal median stripe on the abdominal terga.

Distribution and Biology:

Stenonema vicarium is widely distributed in the eastern half of North America north of Kentucky. In Canada it is present throughout the boreal forest east of the Rocky Mountains. Saskatchewan specimens were all collected from streams throughout the boreal forest. Larvae are present year round and emergence occurs May, June and July (Whiting 1985).

Material Examined: 99 larvae, 9 imagos

Broad Creek at Hwy 904, 1 VII 2000 JMW; Fir River at Hudson Bay Regional Park, 23 VII 2001 JMW; Meeyomoot River at Hwy 165, 13 VI 2000 JMW; Overflowing River at Hwy 9, 19 VII 2000 JMW, 9 VII 2001 JMW, 8 V 2001 JMW and DWP, 23 IV 1980 ERW, 17 VII 1999 JMW; stream at km 135 of Hwy 102, near N end of Mclennan Lake, 18 VI 1982 ERW; stream at km 150 of Hwy 905, 13 VI 2000 JMW; stream at km 165 of Hwy 903 55 24' 55"N 108 43' 06"W, 10 VI 2001 JMW and MSP; stream on Hwy 9, S of Hudson Bay 52 40'03"N 102 22'19"W, 24 V 2001 JMW; Torch River at Hwy 35, 27 V 1986 ERW; Torch River N of Hwy 35,

22 VII 2001 JMW, 25 V 2000 JMW and DWP, 9 VII 2001 JMW, 8 V 2001 JMW and DWP; Umpherville River At Hwy 905, 8 VIII 2000 JMW; Waskesiu River at Hwy 2, 6 VII 2000 JMW, 19 VI 1982 ERW.