

50TH ANNUAL MEETING AT GUELPH, AUGUST 27TH TO 29TH

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MAYFLY NYMPHS (CLEMENS).

On Friday, the 29th, the visitors will be taken to Grimsby and given an opportunity of seeing the results of economic work in the Niagara fruit district. As the Toronto National Exhibition will be going on that week, reduced railway fares will be available from many points to that city.—C. J. S. B.

NEW SPECIES AND NEW LIFE HISTORIES OF EPHEMERIDÆ OR MAYFLIES.

BY W. A. CLEMENS, TORONTO, ONT.

While at the Go Home Bay Biological Station on Georgian Bay, during the summer of 1912, I made a special study of the Ephemeridæ of that district, under the direction of Dr. E. M. Walker, to whom I am much indebted for advice and kindly criticism. A full account of the investigations will appear in the report of the Marine Biological Stations of Canada, this paper being confined chiefly to new species and new additions to the life-histories of several forms.

The work was carried on from May 25 to September 10, and consisted chiefly in the collecting and rearing of nymphs or larvæ. Collections were made in as varied localities as possible, as there are nymphs for almost every condition of fresh water. The nymphs were taken to the laboratory in jars or bottles of water, where they were examined under the binocular microscope and the species separated. A number of each species were then transferred to breeding jars, which consisted of glass vessels, fitted up as nearly as possible to the conditions in which the nymphs were found, and supplied with running water. Over the jars, wire cages were placed to catch the subimagos as they emerged. As the subimagos appeared, they were transferred to other vessels, where they were kept until the final moult, which usually took place in a day or two. The imagos were killed with potassium cyanide and then preserved dry or in alcohol. The subimago exuvial and final nymph sloughs were also preserved for future reference. In this way about 180 specimens were bred out during the summer. The following is a list of the forms taken:

August, 1913

- Subfamily: Ephemerinæ 1. *Hexagenia bilineata* Say.
2. *Ephemerella simulans* Walker.
- Subfamily: Heptageninæ 1. *Heptagenia flavescens* Walsh.
2. " *lutea* sp. nov.
3. " *fusca* sp. nov.
4. " *tripunctata* Banks
5. " *rubromaculata* sp.
nov.
6. " *luridipennis* Burm.
7. " *canadensis* Walker
8. " *frontalis* Banks.
9. " sp. ? (nymphs only).
10. *Ecdyurus maculipennis* Walsh.
11. " *lucidipennis* sp. nov.
12. " *grandis* sp. nov.
- Subfamily: Baetinae 1. *Baetisca obesa* Walsh.
2. *Leptophlebia*, sp. ? (nymph only).
3. *Blasturus cupidus* Say.
4. *Blasturus nebulosus* Say.
5. *Choroterpes* (?) *basalis* Banks.
6. *Ephemerella lutulenta* sp. nov.
7. *Ephemerella lineata* sp. nov.
8. *Ephemerella bicolor* sp. nov.
9. *Drunella* sp. ? (nymph only).
10. *Cænis diminuta* Walker.
11. *Tricorythus allectus* Needham.
12. *Chirotenetes albomanicatus* Needham.
13. *Siphylurus flexus* sp. nov.
14. *Baetis propinquus* Walsh.
15. *Cleon dubium* Walsh.
16. *Callibaetis ferrugineus* Walsh.

DESCRIPTIONS AND NOTES.

Genus HEPTAGENIA

Special attention was given to this genus on account of its abundance and the comparatively large number of species. The

nymphs of eight species were taken and imagos reared, three of which are new species and the nymphs of the other five have not previously been described. The Heptagenia nymphs were the dominant forms in the swift waters and along the exposed shore. Their bodies are very much flattened, legs spreading, femora flattened, claws pectinated, gills placed dorsally in an overlapping series, and eyes on dorsal surface of head, and so are adapted to a life in the swiftest water. They are able to cling very tightly, for when they are lifted from a stone, quite a resistance can be felt. The clinging habit is very strong, for if a number are placed in a vessel of water without anything else to cling to, they begin clinging to each other and are soon all in a mass. They are quite active and are able to scurry over the surface of a stone, even going sideways and backwards. Their food consists of the various algal forms on the stones to which they cling.

A Heptagenia probably completes its life cycle in a year. It spends all its life in the water except for four or five days as subimago and imago. The egg hatches in about 40 days. This calculation is based upon the fact that about two months after the appearance of the imagos of *H. tripunctata* the small nymphs of the next generation were found, and this is the time required for the eggs of *Hexagenia bilineata*. The nymphs moult about once every two weeks, and as the time of emergence approaches, they probably migrate into quieter water. I have not observed the emergence of a Heptagenia subimago in the open, but in the laboratory the nymphs would crawl up the sticks placed in the jars for the purpose and transform just above the water level. The subimago stage usually lasts a day, but occasionally only a few hours and in the early part of the season it frequently lasted three or four days. Temperature and humidity seemed to be important factors. The imagos commenced their flight shortly after sundown along the lake shore, dancing in their rhythmic up and down manner at a height of from 12 to 20 feet. The females deposited their eggs by flying over the surface of the water and brushing off the eggs into the water as they appeared from the openings of the oviducts. Of the eight species the first to appear was *H. tripunctata* about June 1, and the last, *H. luridipennis*, September 2.

There are two distinct groups. In the first, consisting of *H. tripunctata*, *H. luridipennis*, *H. flavescens*, *H. lutea*, *H. fusca*, *H. rubromaculata*, the nymphs are characterized by having the lamellæ of the gills oblong, claws usually pectinated, distal segment of maxillary palpus thickest about its middle and with a small tuft of bristles near its distal end. The body is much flattened and the colour olive brown or greenish yellow. The male imagos have the penis lobes rather L-shaped and the second and third tarsal segments of the fore legs are equal, while the fourth is about four-fifths the length of the second. In the other group, consisting of *H. canadensis*, *H. frontalis*, and a third undetermined species represented by the nymph only, the nymphs have the lamellæ of the gills oval and produced distally into a sharp point; the claws are not pectinated, the distal segment of the maxillary palpus thickest towards the distal end and the tuft of bristles larger than in group 1. The body is less flattened, more reddish or yellowish, and has the appearance of being striped longitudinally on dorsal surface of abdomen. The male imagos have the penis lobes oblong instead of L-shaped and the second and third tarsal segments are not quite equal, while the fourth segment is about half the length of the second.

The following keys will serve to separate these eight species:

Key to Male Imagos:

- A. No black spots or bands on face below antennæ. Group 1.
 - B. Very pale species.
 - C. Notum ferruginous, stigmal dots distinct..... *H. flavescens*.
 - CC. Notum lighter, no stigmal dots..... *H. lutea*.
 - BB. Dark species.
 - D. Large, entirely brown species.
 - E. Thorax with a broad dark median stripe or two narrow stripes close together..... *H. verticis*.
 - EE. Thorax without dark median stripe..... *H. fusca*.
 - DD. Not entirely brown.

- F. Two very small dots on median carina between antennæ.....*H. tripunctata*.
- FF. No dots on median carina; thorax and top of abdomen dark.
- G. Reddish area in pterostigmatic space of wing...*H. rubromaculata*.
- GG. Without reddish area in wing....*H. luridipennis*.
- AA. Two black spots or bands on face below antennæ. Group 2.
- H. A black band on face below antennæ, a dark dash in wing, abdomen dark...*H. canadensis*.
- HH. A black spot on face below antennæ, no dash in wing, abdomen lighter...*H. frontalis*.

Key to Nymphs:

- A. Gills oblong. Group 1.
- B. Nymphs entirely brown, without a distinct dorsal colour pattern.
- C. An inverted dark U-shaped mark on ventral surface of 9th segment and a dark spot on ventral surface of the 8th. Dorsal surface of body has a smooth appearance.....*H. flavescens*.
- CC. A row of dark mushroom-shaped marks along ventral surface and a rectangular dark mark on 9th. Dorsal surface has a rather granular appearance and lateral margins of body quite hairy.....*H. rubromaculata*.
- BB. Nymphs not entirely dark brown and have a distinct colour pattern.
- D. Ventral surface of abdominal segments banded with dark bands along posterior margins.
- E. Broad dark bands at posterior margin of each segment on dorsal surface.....*H. fusca*.

- EE. Dark bands at posterior margins of segments 7, 8, 9 and 10; not as broad as preceding species and a more elaborate colour pattern.....*H. lutea*.
- DD. Ventral surface not banded.
- F. Two rows of black dots along ventral surface of abdomen.....*H. tripunctata*.
- FF. No dots.....*H. luridipennis*.
- AA. Gills oval and pointed.
- Group 2.
- G. Two light longitudinal stripes on dorsal surface of abdomen close to median line.
- H. Stripes fairly uniform for entire length. Reddish species
.....*H. canadensis*.
- HH. The stripes not of uniform width, very wide on 8th segment, very narrow on 5, 6 and 7, so that darker intermediate parts have oval shapes. Lighter species *H. frontalis*.
- GG. Dorsal surface of abdomen has appearance of three longitudinal dark stripes. Colour greenish yellow. *H.*, sp. undetermined.

Mr. Nathan Banks kindly identified the imagos for me and loaned me specimens of *Heptagenia verticis*, *H. luridipennis* and *H. terminata*, for comparison.

Heptagenia flavescens, Walsh.

Nymph.

Measurements: Body 8-9 mm.; setæ 10-13 mm. Head brown, very slightly covered with light dots; a light spot above each ocellus; a small light dot on each side of median ocellus; an irregular light area anterior and lateral to each eye. Pronotum brown, with two light spots on each side. Mesothorax similar in colour to prothorax. Abdomen of a uniform brown colour dorsally, having a smooth appearance; lighter ventrally, with a semicircular brown band on 9th segment and a median brown spot on 8th. Spines of lateral edge short. Setæ banded, usually three segments dark and one light, sparsely fringed, usually only at base of light segment. Femora much flattened, brown and dotted with light spots, and having three irregular light bands; covered dorsally with small spines and posterior margin fringed with hairs and spines. Tibia with median and distal light bands. Tarsus tipped with white. Claws with two pectinations.

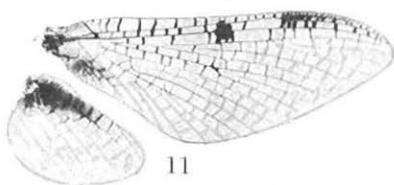
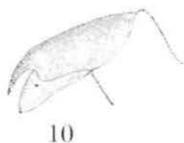
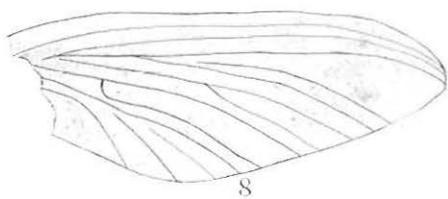
The nymphs of this species were taken up the Go-Home River on June 16, 1912, immediately above Flat Rock Falls, where the water was flowing swiftly but smoothly. They were clinging to stones in water one to one-and-a-half feet deep not far from the shore. On the same date they were found just below Sandy Gray Falls, two miles farther up the river. Here the water was swift and rough. I was successful in rearing only two specimens, the dates being June 27 and July 3.

Heptagenia lutea, sp. nov.

Male imago.

Measurements: Body, 9-10.5 mm.; wing, 10.5 mm.; setæ, 20; fore leg, 10.

This is a light-coloured species, slightly reddish on face below antennæ; reddish brown between ocelli and eyes. Thorax almost whitish yellow dorsally, light yellowish brown laterally; a dark area on each side of pronotum, slight red and brown markings below bases of fore and hind wings. Each abdominal segment 1-8 banded dorsally at posterior margin, remaining part of these segments being almost white; segments 9 and 10 entirely reddish brown; stigmal dots not marked; wings clouded in pterostigmatic



MAYFLY NYMPHS (CLEMENS).

space, a few cells reddish. Femora with median and apical bands; tibia-tarsal and tarsal joints black; fifth tarsus and ungues dark.

Female imago.

Measurements: Body, 11 mm.; wing, 12; setæ, 22; abdomen more yellowish than male.

Nymph.

Measurements: Body, 10 mm.; setæ, 13-16 mm. Head, light brown in colour and dotted with light dots; light areas over ocelli; another at posterior margin of head in median line and a larger one lateral to each eye. Pronotum with a broad, colourless lateral margin; remainder light brown, with numerous irregular light spots. Abdomen darker dorsally and with a rather complicated colour pattern. First segment light, with two brown areas at side; second with a narrow brown band along posterior margin and five brown areas and four light ones placed alternately; third almost entirely dark, with a few light dots; fourth with two dark spots in posterior lateral angles of segment, also a large dark area in centre of segment with a light area within it; fifth with a dark spot in each posterior lateral angle as in preceding segment, a dark band along posterior margin, two light areas surrounded with brown and a dark spot in centre of each; sixth almost entirely brown except for two light areas in anterior lateral angles; seventh with two large light areas, with a brown dot in each toward inner side; eighth an irregularly light and dark coloured segment; ninth has a narrow brown band along posterior margin and a dark longitudinal stripe in median line; tenth almost entirely dark. Ventrally, the lateral and posterior margins of segments 2-8 dark; segment nine with two large brown spots. Setæ greenish; basal half well fringed at joints, distal half with each two segments alternately light and dark and few hairs at joinings. Femora with alternately light and dark irregular bands and covered with minute spines dorsally; posterior margins fringed with hairs, anterior margins also fringed, but hairs shorter. Proximal ends of tibiæ dark and have dark bands slightly beyond middle. Tarsi with reddish-brown bands very near proximal ends. Claws with two pectinations.

These nymphs were very abundant along the open shore of Station Island and west of it, my collection dating from June 3 to July 2. A few were taken in a rapid on the Muskosh River on June

30 and several small specimens from Sandy Gray Falls, August 23. Imagos were reared from June 27 to July 3.

Heptagenia fusca, sp. nov.

Male imago.

Measurements: Body, 10 mm.; wing, 13; setæ, 26; No markings on face; ocelli almost in a straight line, the middle one the smallest. Pronotum brown, slightly darker along the median line; mesothorax uniformly brown. Abdomen with posterior one-third of each segment of same brown colour as thorax and projections from this band anteriorly in the median line, almost forming a continuous longitudinal stripe on the abdomen; the band widens laterally also; remaining portions of each segment somewhat light brown; ventrally very slightly banded. Forceps and penis lobes of usual form. Femur banded in middle and at distal end. Wings large; costa, subcosta and radius light in colour, while remainder of longitudinal and the cross veins brown. No cloud in pterostigmatic space.

Female imago.

Measurements: Body, 10-12 mm.; wing, 14 mm.; setæ, 18; Quite similar to male, except that abdomen is considerably darker.

Nymph.

Measurements: Body, 12-14 mm.; setæ, 15-20; antennæ, 3. Head brown, dotted with light spots; usually three light areas at posterior margin between eyes and two lateral to each eye; anterior margin well fringed with hairs. A light longitudinal median line on pronotum; two light areas on each side and lateral margin colourless; remainder of pronotum brown, with small light dots. Posterior one-third of each abdominal segment 6-10 almost black; segments 1-6 brown; the remainder of each segment varying from light brown to greenish yellow; ventrally posterior one-fourth of each segment 2-8 brown; ninth segment has two dark areas laterally. Femur light brown on upper surface, with a few lighter areas and covered with minute spines dorsally; posterior margin fringed with hairs; proximal end of tibia dark brown and its third quarter dark; proximal half of tarsus dark. Setæ well fringed with hairs at the joinings.

While on a canoe trip up the Go-Home River, June 16th, I collected a number of the nymphs of this species just below Sandy

Gray Falls. The only imagos I have are those bred from this collection. The dates of emergence are June 23rd and 24th.

This species is close to *H. verticis*, but lacks the dark median stripe on the thorax, and does not show the slightest trace of a dash in the wing under the bulla.

Heptagenia tripunctata, Banks.

Nymph.

Measurements: Body, 11-14 mm.; setæ, 12-16. Head deep brown, occasionally almost dark dotted with light spots; three light spots; three light areas along anterior margin of head and one at posterior margin between eyes. Pronotum similar in colour to head, with light dots and about five larger light areas on each side; lateral with a light area which extends inwards some distance. A light area in antero-lateral angle of mesothorax. Femur stout, with five irregular light areas; small spines very numerous; posterior margin fringed with hairs. Tibia with two dark and two light areas, arranged alternately. Abdomen similar in colour to head and thorax; a light area on segments 4 and 5 containing a small triangular dark area at anterior margin of segment 5, lateral to which are two dark dots; another light area on segments 7, 8, 9 and 10 containing two dark dots on 8th and two on 9th segments; usually three small dark dots at posterior margin of each segment. Ventrally two longitudinal rows of dark dots, increasing slightly in size toward posterior end; segment 9 usually with two pairs, the anterior pair small, posterior pair larger. Setæ with alternate dark and light areas. Gills have the lamellæ slightly rounded at distal end.

The nymphs of this species were seldom found in swift water, but were everywhere abundant about Go-Home Bay, in quiet bays, along open shores and in quiet streams. They could be found at any time during the summer. The first bred specimens emerged May 31, but the first capture was not made until June 11. On this date a small swarm of about 20 individuals was discovered about 8.15 p.m. flying from 10 to 20 feet high along the shore of Station Island, facing north. One female and several males were taken. Soon after this they became very abundant and remained so until about July 5th. The last bred specimen is dated Aug. 13.

Heptagenia rubromaculata, sp. nov.

Male imago.

Measurements: Body 8 mm.; wing 8; setæ 17; fore leg 7. No markings on face; darker spot at posterior margin of head between eyes. Thorax dark; median longitudinal dark stripe on pronotum; dark brown stripe on coxa of fore leg and extending up the side of prothorax. Abdominal segments 1-7 light; 8-10 dark, similar to thorax; each segment banded at posterior margin; stigmal dots distinct; wing has a reddish area in pterostigmatic space.

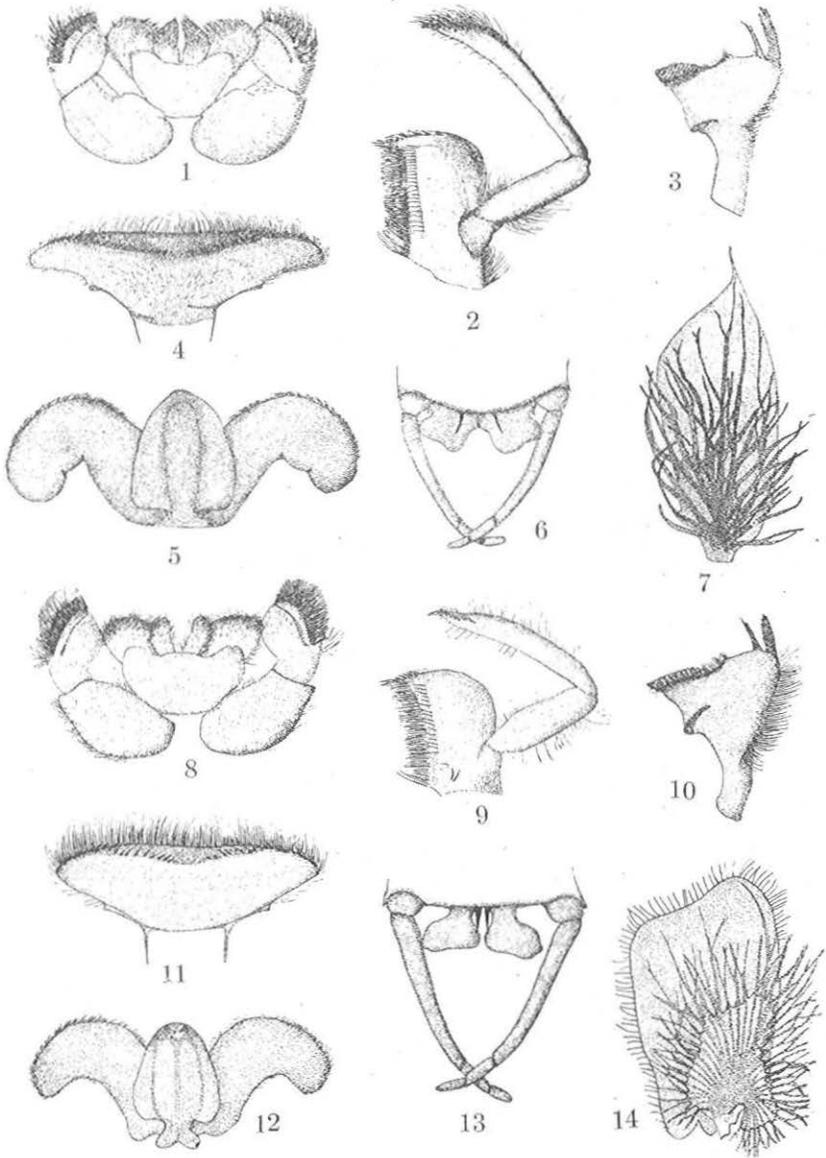
Female imago.

Measurements: Body 9-9.5 mm.; wing 13-14; setæ 15-22; often slightly reddish on face beneath antennæ. Dark brown on dorsal surface of head behind ocelli. Abdomen varies from reddish to a yellowish colour in dried specimens.

Nymph.

Measurements: Body 9-10 mm.; setæ 10. Head dark brown, dotted with minute light spots. Pronotum similar in colour to head; two light areas on each side, the outer one sometimes joined to the light margin. Abdomen dark brown, with a granular appearance; sometimes a faint, broad, dark, longitudinal streak can be made out with two dots on each side of it on each segment excepting 9 and 10; ventral surface lighter, with a median row of irregular dark spots and lateral rows of small dots or lines; the median dots are sometimes broken up so that only four or five small dots remain in its place; on segment 9 the markings are usually joined, forming roughly three sides of a square. Femur with four irregular dark bands; both posterior and anterior margins very hairy; claws pectinated. A very hairy species, having anterior margin of head, sides of thorax and abdomen very hairy.

This nymph was first taken on June 15 in what is commonly called the Narrows, near the mouth of the Go-Home River. The water here had a well-marked current, but not swift. On June 30 I found them very numerous in the very swift water of a rapids near the mouth of the Muskosh River. Nearly a month after this, on July 20th and 22nd, I discovered mature nymphs at an old lumber chute on the Go-Home River in fairly swift water. Imagos were bred from the nymphs taken at the Narrows on June 22nd and



MAYFLY STRUCTURE (CLEMENS).

25th; in the Muskosh Rapids from July 3rd to 5th, and at the Chutes, July 24-29th.

Heptagenia luridipennis, Burm.

Nymph.

Measurements: Body 7-8.5 mm.; setæ 10-14. Head brown, with light dots; anterior margin fringed with hairs. Prothorax similar in colour to head; on pronotum a light spot on each side of median line; lateral to this another larger one, and lateral to this another which extends to the lateral margin. Abdomen similar in colour to prothorax; a row of black dots on each side corresponding to the stigmal dots of imago; segment 3 for the most part light, with a round brown spot in the median line and with two short projections laterally; segment 4 with a small triangular brown spot in median line with base to anterior margin, while apex meets a large brown area, leaving a small light area on each side of triangle; lateral to the brown area is a light one, and lateral to this again is a triangular dark spot in the posterior angle of the segment; segment 5 much like the 4th; segment 6 entirely dark, except for two small spots at anterior margin and two toward lateral margin; segment 7 with a triangular dark spot in median line, with base to anterior margin and apex reaching about middle of segment; on each side of triangle two dark spots; segment 8 similar to the 6th; segment 9 irregularly marked; roughly, it is dark, with a darker median longitudinal line, two light spots on each side and another at lateral margin; segment 10 entirely dark; ventrally there are two dark spots at lateral margins of 9th segment, just beside the lateral spines of that segment; sometimes a triangular spot in median line also. Setæ with basal half fringed with hairs.

This was the last species to be taken. On August 23rd I found them in a rapid just above Sandy Gray Falls, where the river flows through a small gorge. I was successful in rearing quite a number of imagos, dating from August 28th to September 1st. These are slightly smaller than those Mr. Banks sent me and considerably smaller than the measurements given in various descriptions.

Heptagenia canadensis, Walker.

Nymph.

Measurements: Body 11 mm.; setæ 15; antennæ 3.5. Head reddish brown in colour; a small dark area immediately in front of

each antenna, and another about the same size in front of each eye, a black dot behind each lateral ocellus; a light area in front of median ocellus, and a larger light area between each lateral ocellus and eye; another lateral to each eye along margin of head. Mouth parts of the type belonging to group 2. Pronotum reddish brown, with a dark and an approximate light area in each lateral half; margin colourless. Abdomen darker than thorax; each segment with four light longitudinal streaks, two near median line and the other two near lateral margin; black dots, corresponding to the stigmal dots just inside the lateral light streaks. Ventrally the abdomen is almost white, each segment has two light brown lateral streaks, while the 9th has its lateral and posterior margins margined with light brown. Short lateral spines at posterior lateral angles of segments 8 and 9. Setæ of equal length; light brown in colour; joinings fringed with hair. Gills oval and pointed. Femur of fore leg light brown, with four light areas; two small ones toward anterior margin and two large ones toward posterior; distal end light coloured. Femora of hind legs with fewer pale markings. Tibiæ alternately banded with brown and white; tarsi have very broad median bands; legs slightly hairy along posterior margin.

This species was very abundant at Go-Home Bay, being next in numbers to *H. tripunctata*. The nymphs were taken from May 25th to July 10th in various localities, but never in swift water, the usual place being quiet bays. Small nymphs of the next generation were found on September 5th. The first bred specimen is dated June 1st and the last July 4th. Imagos were most abundant at Station Island from June 25th to July 15th.

Heptagenia frontalis, Banks.

Nymph.

Measurements: Body 9-10 mm.; setæ 9-10; Head yellowish brown in colour; three almost round light spots along anterior margin of head; usually a light area in front of each ocellus, and another along median line between eyes and two smaller ones lateral to this along posterior margin of head. A black dot below each antenna, in front of each eye and near inner margin of each eye. Thorax lighter in colour than head; on each side of pronotum, near median line, is a small light spot; just lateral to this is a

triangular dark spot, and lateral to this again is another light area; in anterior angle of pronotum is an oval light spot; along posterior margin extending some distance on either side of median line is a broad light band, which is connected by a light longitudinal stripe along median line of mesonotum to a large irregular light area on the mesonotum. Abdomen usually a light yellowish brown; the colour pattern roughly has the appearance of a broad light band along median line, in which in segments 5, 6 and 7 are oval dark areas; in 8, a narrow stripe, and in 9 a round, dark area in each segment; on either side of this broad light band is a short light stripe; ventral surface almost white, with two lateral light brown longitudinal stripes on segments 1-9; a broad band across 9th along posterior margin, joining the two lateral stripes. Segments of setæ alternately light and brown. Legs pale, colour pattern similar to *H. canadensis*.

This species was not nearly so abundant as *H. canadensis*. The nymphs were taken in similar localities, but were not so widespread or plentiful. They were found from July 15th to July 2nd and imago were reared from June 26th to July 4th.

Heptagenia? (undetermined).

Nymph.

Measurements: Body, 10-11 mm.; setæ, 12-13.; head, light brown; sometimes three light areas along anterior margin, but frequently the middle one is lacking and the two lateral ones are connected with the light margins lateral to the eyes. An almost black spot in centre of each half of pronotum; around this is an irregular light area, exterior to which is a brown area. Abdomen whitish yellow, with five longitudinal yellowish brown stripes in each segment 1-8. Setæ light greenish yellow; joints abundantly fringed with hairs. Legs yellowish brown in colour; pattern similar to the two preceding species.

These nymphs were collected along the east shore of Manitoulin Island on June 26th, 1912, by Mr. R. P. Wodehouse, who kindly handed them over to me. As imago were not reared, the species cannot be determined at present.

EXPLANATION OF PLATES.

PLATE V.

Photographs of Mayfly Nymphs.

- Fig. 1. *Heptagenia tripunctata* Banks.
 Fig. 2. *Heptagenia lutea* sp. nov.
 Fig. 3. *Heptagenia canadensis* Walker.
 Fig. 4. *Heptagenia* sp. ?
 Fig. 5. *Heptagenia frontalis* Banks.
 Fig. 6. *Heptagenia rubromaculata* sp. nov.
 Fig. 7. *Heptagenia fusca* sp. nov.
 Fig. 8. *Heptagenia flavescens* Walsh.
 Fig. 9. *Heptagenia flavescens* (ventral view).
 Fig. 10. *Ecdyurus pullus* sp. nov.
 Fig. 11. *Ephemerella lineata* sp. nov.

PLATE VI.

- Fig. 1. *Nymph Hexagenia bilineata* Say.
 Fig. 2. *Nymph Heptagenia luridipennis* Burm.
 Fig. 3. *Nymph Ephemerella bicolor* sp. nov.
 Fig. 4. *Ecdyurus maculipennis* Walsh.
 Fig. 5. *Nymph Ecdyurus lucidipennis*, sp. nov.
 Fig. 6. *Nymph Bætis propinquus* Walsh.
 Fig. 7. *Nymph Cloeon dubium* Walsh.
 Fig. 8. Venation of wing pad of nymph of *Siphylurus flexus*
 sp. nov.
 Fig. 9. Fore claw of nymph of *S. flexus* sp. nov.
 Fig. 10. Fore claws of imago of *S. flexus* sp. nov.
 Fig. 11. Wings of *Siphylurus flexus* sp. nov.

PLATE VII.

Mouth parts, gills and genitalia of *Heptagenia canadensis* and
H. tripunctata.

- Fig. 1. Labium and 2nd maxilla, *H. canadensis*.
 Fig. 2. First maxilla, *H. canadensis*.
 Fig. 3. Mandible, *H. canadensis*.
 Fig. 4. Labrum, *H. canadensis*.
 Fig. 5. Hypopharynx, *H. canadensis*.
 Fig. 6. Genitalia, *H. canadensis*.

- Fig. 7. Gill, *H. canadensis*.
Fig. 8. Labium and 2nd maxilla, *H. tripunctata*.
Fig. 9. First maxilla, *H. tripunctata*.
Fig. 10. Mandible, *H. tripunctata*.
Fig. 11. Labrum, *H. tripunctata*.
Fig. 12. *Hypopharynx*, *H. tripunctata*.
Fig. 13. Genitalia, *H. tripunctata*.
Fig. 14. Gill, *H. tripunctata*.

(TO BE CONTINUED.)

A JUMPING MAGGOT WHICH LIVES IN CACTUS
BLOOMS (*ACUCULA SALTANS*, GEN.
ET SP. NOV.).

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On January 25, 1913, the writer was exploring a rocky draw among the bare hills in the western base of the Andes, above Santa Ana ranch house, about forty miles inland from Lima, and at about 4,000 feet elevation above sea. In this draw a columnar cactus was found growing in bunches, probably *Cereus* sp., which at that date showed few blooms opened, but many unopened buds. One large bud evidently past opening time, and in reality a bloom whose opening had been prevented by the shrivelling of the petals which effectually closed it, was cut open and disclosed five maggots that possess the power of jumping six or eight inches high from a hard surface. The cactus buds were all numerously attended by a large brown ant, specimens of which have been sent to Dr. Wheeler for determination, and the closed bloom containing the maggots was simply massed with the ants on the outside, much more so than the buds in general, yet no entrance had been effected by them into this bloom. The bloom was cut open with the idea that the ants were inhabiting it, and thus the discovery of the maggots was purely accidental. The maggots were found to be boring among the clotted mass of stamens and anthers. Fermentation of the mass was evident from the sour odour, but no actual putrefaction had taken place. The maggots had not penetrated the septum covering the

August, 1913

NEW SPECIES AND NEW LIFE HISTORIES OF
EPHEMERIDÆ OR MAYFLIES.

BY WILBERT A CLEMENS, TORONTO, ONT.

(Continued from page 262.)

Subfamily—*Heptageninæ*.*Ecdyurus maculipennis* Walsh. (Pl. VI, fig. 4, Nymph.)

Only a few imagos of this species were taken, although the nymphs were abundant along open stony shores and in rapids. My collections of nymphs date from July 2nd to August 23rd, and rearings from July 6th to August 30th.

Ecdyurus lucidipennis sp. nov.

This was not a very abundant species, but nymphs were collected July 1st and 14th, and imagos reared July 4th and 17th, respectively.

Male imago:

Measurements—Body 6 mm.; wing 7mm.; fore leg 6.5 mm. Face very slightly obfuscated; dorsal surface of head dark brown or reddish. Notum dark brown; sides of thorax and ventral surface light yellow. Dorsum of abdomen a blackish brown; venter considerably lighter. Penis lobes and bases of forceps yellow; forceps tinged with black. Setæ with basal halves slightly tinged with black and minutely hairy. Fore femora dark, middle and hind yellowish. Wings hyaline; longitudinal veins slightly dusky, especially costa and subcosta; cross-veins entirely colourless.

Female imago:

Measurements—Body 6 mm.; wing 7.5 mm.; fore leg 4 mm. Thorax and abdomen lighter in colour than male.

Nymph: (Pl. VI, fig 5.)

Measurements—Body 7-8 mm.; setæ 3-4 mm. Head brown, with numerous light spots, chief of which are 6 along anterior margin, 2 lateral to each antenna, 4 small, elongated ones between antennæ, and 2 small round spots anterior to these latter. Thorax above lighter brown, with numerous light areas. Anterior part of each abdominal segment brown; four light spots along anterior margin, one large one at each lateral margin, and 3 along posterior margin. Setæ of about equal length and fringed with hairs; middle one slightly smaller in size than lateral ones. Femora flattened,

fringed with spines along anterior margin and with hairs along posterior; rather light in colour, with 2 zigzag brown marks about middle and brown areas at distal and proximal ends. Tibiæ banded about the middle with brown. Tarsi with distal and proximal ends dark.

Ecdyurus pullus, sp. nov.*

This is a large form, compared with the two previous species. The nymphs were found along the very stony, exposed shores of small islands three and four miles out in the open bay. The collections are dated June 23rd and July 6th, and the rearings July 2nd. A few imagos were captured June 27th.

Male imago:

Measurements—Body 10-11 mm.; wing 11 mm.; setæ 22 mm.; fore leg 11-12 mm. Face pale, slightly tinged with brown along the carina. Dark brown on dorsal surface of head between eyes. Pronotum dark brown; mesonotum lighter; a dark brown line on each side of prothorax extending forward from base of fore wing; other dark brown marks at bases of wings and legs. Dorsal surface of abdomen dark brown, somewhat lighter laterally toward anterior margin; ventral surface light in colour. Genitalia of the usual *Ecdyurus* type. Legs light in colour, dark at joints. Tarsi of fore legs in order of increasing lengths, 1, 5, 4 (3 and 2) equal. Wings with longitudinal and cross veins brown and very slightly darkened in apical costal region.

Nymph: (Pl. V, fig. 10.)

Measurements—Body 12 mm.; setæ 15 mm. Head brown, with a colourless area on each side from eye to lateral margin of head, and three light dots between eyes; slightly fringed with hairs along anterior and lateral margins, and a light area about the middle of each half of pronotum. Mesonotum darker, with numerous light spots. Each segment of abdomen brown; 1-8 have six light spots, and 4-8 have the two spots near the median line fused, forming a large rectangular area; segment 9 with only four light spots; segment 10 entirely brown. Gills comparatively small, lamellæ oval. Setæ of about equal size, with each two alternate segments brown; sparsely fringed at joints, and outer

*This species was listed on p. 247 as *Ecdyurus granis*, sp. nov.

margins of lateral ones not fringed. Femora stout and flattened, brown in colour, lighter at distal and proximal ends, and two or three irregular light areas toward middle; covered with minute spines and fringed along posterior margin with hairs. Tibiæ alternately light and dark banded; fringed along both anterior and posterior margins. Tarsi brown, with proximal tips colourless. Ungues double on each leg, the large one well covered, the other small and lateral to the large one.

Subfamily—*Ephemerinae*.

Hexagenia bilineata Say.

This was a very common species at Go-Home Bay. The nymphs were first taken on June 6th, by dredging in water 15 to 45 feet deep. The bottom was very muddy. When the nymphs were placed in jars containing about 4 inches of mud, they immediately began to burrow, and were able to bury themselves in a very short time. At first the gills were left partly exposed, and the position of the nymphs could be detected by the waving motion in the thin mud. Later on they completely buried themselves, and only the round openings of the burrows could be seen. The first of these nymphs to emerge was on July 3rd, and others followed in July and August, while one was still alive in the breeding jar on September 9th, when the Station was closed. On June 13th the first subimago was captured at large, but not till June 28th did imagos appear in large numbers. They would commence their flight shortly after sunset, flying in large swarms about the tree tops. The hum of their wings could be heard up to a distance of 125 feet or more. The females deposited their eggs by flying up and down the shore, brushing off the eggs as they appeared in two small, rather compact columns from the openings of the oviducts, by dipping to the surface of the water. On July 12th a female was caught just after copulation, and she deposited a large number of eggs by being held by the wings and touching her abdomen frequently to some water in a jar. These eggs hatched in thirty-six days.

Nymph: (Pl. VI, fig. 1.)

Measurements—Body 30-35 mm.; setæ 13-15 mm.; antennæ 5-6 mm. Head rather yellowish, with dorsal surface between

ocelli and between eyes entirely brown or in some cases lighter along median line and posterior margin. Antennæ very hairy at joints of basal halves, while apical halves are entirely bare and become very slender. Margin and base of frontal piece hairy. Clumps of hairs between eyes and at bases of antennæ, in front of lateral ocelli and posterior to eyes. Mandibular tusks $\frac{3}{4}$ length of antennæ, upcurved, brown at tips, and with three longitudinal rows of hairs. Prothorax has a broad longitudinal band of brown on each side of middle line on dorsal surface, and is very hairy along lateral margins. Mesothorax brown for the most part, dorsally. Each abdominal segment has a large, almost triangular brown area with two light areas within it; these light areas often reduced to mere stripes. Ventrally on segments 6 to 8 there is a faint median longitudinal dark streak, while on ninth segment are two lateral streaks. Setæ of about equal length, and very hairy at joinings for entire length. Gills and legs of usual *Hexagenia* type.

Ephemera simulans Walker.

The imagos of this species appeared from June 5th to July 27th, but were most abundant during the first two weeks in July. The nymphs were not taken at Go-Home Bay, although diligent search was made. The male imagos would appear shortly before 8 o'clock in the evening, and were often noticed in the morning, also, as late as 10 o'clock. They would dance in swarms of a couple of hundred individuals, usually at a height of from 10 to 35 feet. When a female appeared, several males would take after her. The successful male, flying up beneath the female, would seize her around the prothorax with his long fore legs, and bending up his abdomen would grasp her abdomen with his forceps, and his penis could then be inserted in the oviducts. His setæ usually aided him in securing and maintaining his hold by being bent up over the female's body. The couple would then go off on a gradual downward slant toward the water, before reaching which the male would disengage himself and fly back to the swarm, while the female would fly out over the water and soon begin depositing her eggs by skimming the surface of the water with her abdomen. A peculiar thing was noticed, namely, that the male *Ephemera*

frequently attempted copulation with the male *Hexagenia*, apparently being deceived by the colour.

Subfamily—*Baetinae*.

Baetisca obesa Walsh.

The very interesting nymphs of this species were quite abundant along the north-east shore of Giant's Tomb Island, on May 26th. The shore is rather sandy, with numerous small stones, and deepens very gradually. The nymphs were clinging to the stones in water 3 to 15 inches deep. Imagos did not emerge from this collection until July 13th.

Leptophlebia sp. ?

A single almost mature nymph was taken on July 21st in quiet water at the side of an old lumber chute, but it died before time of emergence.

Blasturus cupidus Say.

This is an early species, mature nymphs being found May 25th, and subimagos appearing May 31st. A small nymph, collected May 31st, was observed to be filled with small, oval, brownish bodies. Upon dissection by Mr. A. R. Cooper, these were found to be the eggs of a trematode, and in the midst of them was the trematode itself, which belonged to the genus *Halicometra*. Another nymph, taken some time afterwards, was also discovered to be parasitized.

Blasturus nebulosus Walker.

The nymphs and imagos of this species were first taken June 9th, on a small, bare, granite island a short distance out in the open bay. On top of this island were numerous pot-holes of all sizes, and in these, under loose pieces of rock and some rubbish the nymphs were very abundant, having tadpoles, chironomid larvae and water beetles for associates. Many nymphs were covered with *Vorticella*. Several nymphs were observed to crawl out of the water and transform on the rock just above the surface of the water. Subimagos were clinging to the sides of the rock in sheltered places, and a few imagos were flying above the pools. This species was again observed on June 27th, on an island five miles from the

mainland. The island had an area of about three acres, and was almost smooth, bare granite. On top was a pretty lagoon, margined with water plants, shrubs and a few small trees. Imagos of *Blasturus nebulosus* were dancing over this pond in the sunlight, about 3 p.m., matings frequently occurring.

Nymph:

Measurements—Body 9.5-10 mm.; setae 7-10 mm. General colour blackish brown. Head brown, with a dark area behind middle ocellus and between the lateral ones; black, scroll-like markings between the eyes. Pronotum has a small light spot on each side, close to median line and near anterior margin; posterior to this and farther from median line is another larger oval light spot, and lateral to this again is an elongated light area; the rounded lateral margin is colourless. Abdomen is blackish brown, with light brown markings; segments 5 or 6 to 10 have a light median longitudinal stripe; on each segment is a slightly elongated, incurved small light spot on each side of median line toward the anterior margin of the segment; posterior and more lateral is a larger round light area, which usually disappears on segments 8, 9 and 10. Ventral surface is light brown, with three faint dark longitudinal lines, one median and two lateral; on each side of the median line in each segment is a very small white oblique line near anterior margin, and posterior to this is a small light dot. Median seta shorter, slenderer and lighter in colour than lateral ones. All fringed with hairs at joints. Legs light brown; posterior margins of tibiae and tarsi fringed with hairs, and anterior margins covered with serrated teeth; inner margins of claws with rows of teeth for their entire lengths.

Up to the present time I have not been able to find any apparent differences between the nymphs of these two species of *Blasturus*.

Choroterpes (?) *basalis* Banks.

Large numbers of the nymphs of this species were found in a small stream July 30th, clinging to the lower sides of stones in the quiet water. The next day several subimagos emerged from this

collection. As late as September 5th mature nymphs could be found here.

Ephemerella lululenta sp. nov.

Male imago:

Measurements—Body 8-9 mm.; wing 10 mm.; setæ 12-14 mm.; fore leg 8 mm. Face dark brown; a spotted reddish-gray streak down carina, and two similar lateral streaks from it to the bases of antennæ. Thorax dark reddish brown. Abdomen blackish brown; segments 9 and 10 slightly lighter in colour; venter pale; posterior lateral margins of 9th segment produced into spines. Forceps pale, with tips brown. Setæ reddish brown toward bases, but becoming pale toward tips; articulations brown. Legs greenish yellow, claws brown. Segments of fore tarsi in order of increasing lengths, 1, 5, 4, 3, 2; 1 very small; fore femur about five-sixths length of fore tibia. Wings entirely clear.

Female imago:

Measurements—Body 9-10 mm.; wing 10 mm.; setæ 10-12 mm.; fore leg 5 mm. Quite similar to male. Posterior lateral projection of 9th abdominal segment not as long as in male.

Nymph:

Measurements—Body 10-11 mm.; setæ 6-7 mm. A large species, with colour varying from a dirty brown to a deep blackish brown, often of a granular appearance. Body and legs hairy. Head with a pair of occipital tubercles of varying size; in the male these are often obscured by the developing eyes of the imago. Pronotum rectangular. Abdominal segments 2-9 produced laterally into flat spines; none on segment 1, minute on 2, increasing in size to the 9th, none on the 10th. A double row of spines on dorsal surface, very minute on segments 8-10, large on 1-7. On venter, six small black dots on each segment, sometimes very faint. Rudimentary gills on segment 1; gills on segments 4-7, covered by a large jointed clytroid gill cover 1.5 mm. in length. Femora stout, brown in colour, with numerous round white dots and several irregular light areas. Tibiæ with median brown band, distal ends light, proximal ends dark. Tarsi about same length as tibiæ, and with proximal half dark and distal half light. Claw with numerous

pectinations. Setæ well fringed with hairs along middle, almost bare at base and tip; each two alternate segments brown.

The nymphs were taken almost everywhere about Go-Home Bay from May 29th to June 19th, in quiet water. Mr. R. P. Wodehouse gave me specimens from various places around Georgian Bay, including Shawanaga Bay, Penticost Island, French River and Sturgeon Bay.

Ephemerella lineata sp. nov.

Female imago:

Measurements—Body 9 mm.; setæ 14 mm.; wing 10.5 mm. Very similar to female of *E. lutulenta*, but has a rusty brown median longitudinal stripe on dorsal surface of abdomen. In a fresh specimen the stripe would probably extend over the thorax, and thus correspond to the stripe of the nymph. No male specimens were reared.

Nymph (Pl. V, fig. II):

Measurements—Body 10 mm.; setæ 6 mm. Slightly smaller than *E. lutulenta*, but very similar in colour, except that there is a dorsal median longitudinal white stripe from the anterior margin of the pronotum to the posterior margin of the 10th abdominal segment. This stripe lies between the double row of spines on the abdomen. Occipital tubercles slightly longer than those of preceding species.

The nymphs were not very abundant, but were found in about the same localities as *E. lutulenta*, from June 3rd to July 9th. My bred specimens are dated June 14th and June 15th.

Ephemerella bicolor sp. nov.

Male imago:

Measurements—Body 5-6 mm.; wing 6 mm.; setæ 8-9 mm.; fore leg 6 mm. A small brown species, very similar to *E. lutulenta* in form and structure, but very much smaller. The size, apparently, is the only character by which to distinguish it.

Female imago:

Slightly larger than male.

Nymph: (Pl. VI, fig. 3.)

Measurements—Body 6-6.5 mm.; setæ 3 mm. These nymphs show a great variation in colour pattern. The light-coloured

specimens are of a dirty white colour, with brown markings. Head for the most part brown, slightly paler towards posterior margin. Pronotum brown laterally; anterior margin of mesonotum brown, and a brown area at posterior margin between the wing pads. Anterior halves of abdominal segments 2 and 3 brown, and slight marks on the 4th segment; brown areas on 6 and 7 about the median line, and on segment 9 there are two small brown dots at anterior margin, and a rather semicircular brown band posteriorly. Some specimens are almost entirely brown, and between these two extremes the amount of brown and white varies. Many specimens, especially females, show slight indications of tubercles on the head, but they are never large, as in the preceding species. A double row of spines on abdominal segments 1-7; postero-lateral margins of segments 3-9 produced into broad, flat spines. Gills on segments 4-7 covered by a large jointed elytra. Setæ light brown basally, becoming paler distally; well fringed with hairs; joints brown. Legs rather small; femora stout; colour for the most part brown, divided into two areas, the proximal one large and contains a rectangular white spot, the distal one smaller and contains a perfectly round white dot. Tibiæ brown at proximal end and a brown band near distal end. Tarsi with a brown band toward proximal end. Claws dark and pectinated.

The nymphs were everywhere abundant, in exposed as well as sheltered places. Imagos were captured and reared from July 1st to July 12th.

Genus *Drunella* Needham.

Several nymphs of this genus were taken, but no imagos were reared.

Cænis diminuta Walker.

This little nocturnal species came to the lamp in the reading-room for the first time on July 2nd, and was taken as late as August 12th. The nymphs were common in ponds and lagoons from June 5th to July 30th.

Tricorythus allectus Needham.

Imagos were captured on July 3rd and 9th, but none were reared. Nymphs which apparently belong to this species were

dredged up from a slightly sandy bottom in water 5 to 15 feet deep, on September 3rd.

Chirotenetes albomanicatus Needham.

On July 16th I found a nymph slough at Sandy Gray Falls, on the Go-Home River, but was unable to find either nymphs or imagos. I did not get up to the falls again until August 23rd, and then found the numerous small nymphs of the next generation.

Siphylurus flexus sp. nov.

Two beautiful *Siphylurus* nymphs were taken early in the season, but both died before time of emergence. The first was found May 25th in the bottom of a canoe, when some water was being emptied from it; the other was found June 3rd beneath a stone in about 1½ feet of water along the open, exposed shore of Station Island. Quite a number of imagos, apparently *Siphylurus*, were captured about this time, and it seemed quite probable that they were the same species as the nymphs. I think I have proved this quite conclusively by the wing venation. The wing of the imago has a very characteristic bend in cubitus 2 at the base, and the wing pad of the nymph shows this bend very distinctly. Again, the imago has claws like *Ameletus*, the two on each leg being unlike. These two unlike claws can be made out in one of the nymphs, due to the nymph dying just when about to transform. Imagos were captured on May 23rd, May 26th, and June 12th. On the latter date a swarm of 12 or 15 were observed flying off the west point of Station Island, about 5.30 p.m., at a distance of from 12 to 20 feet from the surface of the water. They faced the west, and had the characteristic fluttering rise and leisurely fall.

Male imago: (Pl. VI, figs. 10, 11.)

Measurements—Body 13-14 mm.; wing 12-13 mm.; setæ 23-24; fore leg 12-13. Head blackish brown, except lower part of face, which is tinged with brown; eyes large, meeting dorsally. Notum blackish brown. Sides of thorax marked irregularly with white. Abdominal segments 1, 8, 9 and 10 dark, segments 2-6 lighter in colour; these latter are light toward anterior margin and brown toward posterior; in the median line the brown is dark and forms a triangular area, the apex extending almost to the anterior margin; from the anterior margin in the median line two bands arise, com-

posed of black dots, passing backwards, curving outward, end near the base of the triangular brown area; between this line and the triangular area is a light brown oval area; segments 7-10 almost entirely blackish brown dorsally, but 7 and 8 have triangular white areas on sides, and 9 a slight indication only; segment 10 has the sides of dorsum white. Ventrally segment 1 is dark brown, and remainder white with brown markings; segment 2 has two brown spots; 3 with two smaller brown spots and a slightly reddish area at anterior margin in median line; on 4 and 5 the brown spots become smaller and the reddish areas larger; on segment 6 the reddish area is elongated to the posterior margin; on 7 and 8 there is a median longitudinal brown line, thickened about the middle, and two dots of unequal sizes on each side of it; segment 10 brown, except for a lateral white streak on each side. Forceps white and 4-jointed. Setæ white, with brown joints, and minutely pubescent. Fore legs brown; femur with a light area near distal end, next to which is a dark brown band; tarsal joints 1, 2 and 3 about equal in length, 4 slightly shorter, and 5 about half the length of 4th. Hind legs lighter in colour than fore; a brown band on femur in distal half; tibia with a brown band about middle; tarsus light in colour, but brown at joints; joint between tibia and tarsus 1 not distinct. Claws unlike. Wings with brown neuration; costal cross veins and others toward base of wing margined more or less with brown; a slight brown cloud in apical costal area; a heavy brown cloud at bulla; often a small cloud at bifurcation of median vein; cubitus 2 strongly bent at base; hind wing with a large brown cloud at base.

Female imago:

Quite similar to male.

Nymph: (Pl. VI. figs. 8, 9.)

Measurements—Body 15 mm.; setæ 5 mm. The two nymphs collected proved to be a male and female, both mature, but, unfortunately, both died when just about to transform. On this account it is difficult to describe the colour pattern, as the body of the subimago shows through the nymph skin.

Head vertical; body curved. Posterior lateral margins of abdominal segments 1-9 produced into spines. Dorsal colour pattern

distinct on segments 9 and 10 only; 9th pale with a short median longitudinal brown stripe commencing at anterior margin; on each side of this is a short stripe of about same length, but placed more posteriorly; lateral to this, again, is a large brown area, roughly triangular, apex at posterior margin, base at anterior; at lateral margin, slightly below middle line, is a small brown spot; on the 10th segment is a median brown longitudinal stripe, with two dots on each side of it. Ventral surface of abdomen white, with three longitudinal brown stripes, one median and two lateral. Gills on segments 1-7, double on 1, 2 and 3. Three setæ of equal length; lateral ones fringed with hairs on inner margins only, except tips; all banded toward distal end with brown. Legs pale; femur with proximal end brown and a brown band beyond middle; tibia with a brown band about the middle; tarsus with brown band toward proximal end; fore tarsus much longer than fore tibia; hind tarsi only slightly longer than hind tibiæ; fore claw rather short, broad and bifid at tip; hind claws about twice length of fore, and very pointed.

Baetis propinquus Walsh.

The imago is described in Eaton's Monograph, but my specimens do not show the subopaque area between the two nervures of the hind wing. Nymphs were taken at Go-Home Bay from June 14th to July 22nd; on August 19th large numbers of them were discovered in a little bay of a small, bare island about three miles out in the open. This rock was the home of numerous gulls, and hence is commonly called "Rookery" Island. The nymphs were mature, and imagos emerged on August 21st and 22nd.

Nymph: (Pl. VI, fig. 6.)

Measurement—Body 6 mm.; setæ 2 mm. Face vertical, mostly brown in colour; on dorsal surface of head on each side of median line is a row of irregularly-shaped light spots. Notum brown with various light areas. Dorsum of abdomen for the most part brown; segments 2-4 brown, with a light area in each half of each segment, and margins colourless; on segment 4 there is also a light area in median line; segment 5 quite light in colour; segment 6 brown, with a light area along anterior margin and two faint ones posterior to it; segments 7 and 8 each with two rather large pale areas in posterior half; segment 9 almost entirely pale; segment 10

slightly brown, especially along posterior margin; on each of the brown segments there are two small faint pale oblique, slightly-curved streaks, and a pale dot posterior to each. Ventrally, the joining of segments brown. Setæ slightly tinged with brown, with tips darker brown and a brown band beyond the middle; lateral setæ fringed on inner sides only. Legs pale; femora banded with brown about middle; tibiæ and tarsi darker toward distal ends; each claw with a lateral row of setinations.

Cloeon dubium Walsh.

The imagos I have agree with the description in Eaton, except that the intercalar veins are single, not in pairs. Adults were numerous at Station Island about July 10th, flying in small swarms along the shore at a height of from 10 to 15 feet. They appeared about 7.45 in the evening. Not many nymphs were taken, collections dating July 30th to August 12th. Imagos were reared July 30th and August 2nd.

Nymph: (Pl. VI, fig. 7).

Measurements—Body 4-4.5 mm.; setæ 1.5 mm. Face vertical, with two large pale areas above antennæ; between eyes a large pale area, partly divided into two parts, and containing two brown stripes. Notum brown, with irregular light areas. Dorsum of abdomen brown, except lateral margins, which are colourless; on each segment there are two small, oblique, pale streaks and two round dots posterior to the streaks. Setæ pale, with brown band toward distal end; lateral setæ fringed on inner sides only. Gills double apparently on segments 1 and 2 only; broader than gills of *Bætis*; a main trachea in each slightly to outer side, and branchlets on inner side only. Legs pale; femora banded with brown in distal half; tibiæ and tarsi brown toward proximal ends; claws comparatively long, sharp-pointed, not pectinated.

Callibætis ferruginea Walsh.

Imagos, subimagos and nymph skins of this species were collected in Toronto by Dr. E. M. Walker, who kindly handed them over to me. The date would be about August 20th. None were taken at Go-Home Bay.

I am very grateful to Dr. Anna H. Morgan, Mount Holyoke College, So. Hadley, Mass., for the identification of a number of species for me.