shaped figure, which is thin, transversing hemelytra just in front of the membrane.

Structural characteristics: Front margin of head roundly curved. Eyes not prominent. Vertex: synthlipsis:: 2: 1. Mesotrochanter with angle produced into a long sharp spine. Male genital capsule near that of *N. unifasciata* Guér.

Described from 10 males and 15 females taken by G. F. Knowlton at Lehi, Utah April 4, 1930. One female taken by R. H. Beamer at Carson City, Nevada, 8-9-1929 and two specimens from Logan Meadows, Utah. One of them collected by G. F. Knowlton April 8, 1930 and the other by G. F. and B. J. Knowlton, April 5, 1930. Other collections as follows: Brigham, Utah, April 26, 1930, G. F. Knowlton, 2 specimens, American Fork, Utah, May 3, 1930, G. F. Knowlton, 6 specimens; Lehi, Utah, May 3, 1930, G. F. Knowlton, 49 specimens. Holotype, allotype and some paratypes in Kansas University Entomological collection, other paratypes in National Museum at Washington, D.C., Canadian National Collection, Ottawa, Canada, Museum of the California Academy of Science and Mr. Knowlton's collection.

Comparative notes: Size of *N. undulata* Say from which it is distinguished by the flavous margin of the scutellum and shape of mesotrochanter which in *N. undulata* Say is rounded. It is larger than *N. unifasciata* Guér. (=*N. indica* various American authors) which also has flavous margin of the scutellum. The synthlipsis is narrower and head longer than in Guérin's species. Mesotrochanter of *N. unifasciata* Guér. is angulate but not produced into a long spinous process.

CONTRIBUTION TO THE BIOLOGY OF ONTARIO MAYFLIES WITH DESCRIPTION OF NEW SPECIES.

BY F. P. IDE,

(Continued from page 213)

Eurycaenis. Three male adults of this genus were taken swarming at the edge of a small lake at Daventry, Ont. early in the morning of September 5, 1929. These specimens have the characters set forth by Ulmer in his key to the genera of mayflies (Stettiner Entomologische Zeitung. 81. 1920). namely "Prosternum very broad, twice as broad as long, so that the coxae of the forelegs are widely separated: second antennal segment three times as long as the first segment." In *Caenis* the second antennal segment is less than three times the length of the first segment and the prosternum is longer than wide. Needham gave the name *Caenis lacustris* to a nymph which from its close resemblance to the nymph of the European *Eurycaenis harrisella* Curt. may well prove to be the nymph of the species described below. It seems advisable however, to describe these adults under a new name until the species are reared through and nymphs and adults thus definitely associated.

Eurycaenis pallida n. sp.

Imago Male (dried). Length of body 3.5 mm., caudal setae 16 mm. wings 4.5 mm.

Head:—Eyes dark; lateral ocelli very large and transparent and situated at the bases of the compound eyes. (Figure 5, Plate XVIII.). Vertex pale medially, dark cinnamon brown toward the eyes. Antennae setaceous, 2nd segment three times as long as basal segment.

Thorax:—Pronotum and mesonotum pale brown, pleura paler; prosternum about twice as broad as long, separating the coxae widely; a narrow transverse dark line between the coxae. Anterior portion of mesosternum dark piceous, metasternum paler with dark piceous transverse band. Front legs longer than body with femora dark blackish brown; mesothoracic and metathoracic legs entirely pale and femora about equal in length to the tibia and tarsus together. Wings whitish especially towards the posterior border; subcosta and radius dark piceous in proximal two thirds.

Abdomen:—First five segments very short, segments 7-10 longer. Terga of segments 4-10 pale with blackish transverse bands at the joints. Venter pale with dark spots laterally in some segments. Pleura of segments 4-7 with long whitish setaceous prolongations. Three caudal setae long and whitish.

Holotype.—Male. Daventry, Ont., 5, IX, 1929, (F. P. Ide), in Royal Ontario Museum.

Paratypes.—Two males, Daventry, Ont., 5 IX, 1929 (F. P. Ide), one in Canadian National Collection.

Eurycaenis harrisella, Curt. is a much larger species and could be readily separated on this character and its blackish colour.

Caenis. At least three species of this genus were taken in the localities studied. One species from the ponds at Horning's Mills 12, VII, 1928. Apparently two species from Lake Nipissing and one very small species from Wolf lake, Algonquin Park in 1929.

Baetis parvus Dodds. Horning's Mills, 30, VI.-26, VII, 1928.

The nymphs of this species were not uncommon in the more rapid stretches of the small streams where they were found crawling about in the moss on the submerged stones. The imagos, which were readily identified as this species by the forking of the vein in the secondaries, were found in abundance. All individuals in a series of fifty, of which ten were reared from the nymphs, were females.

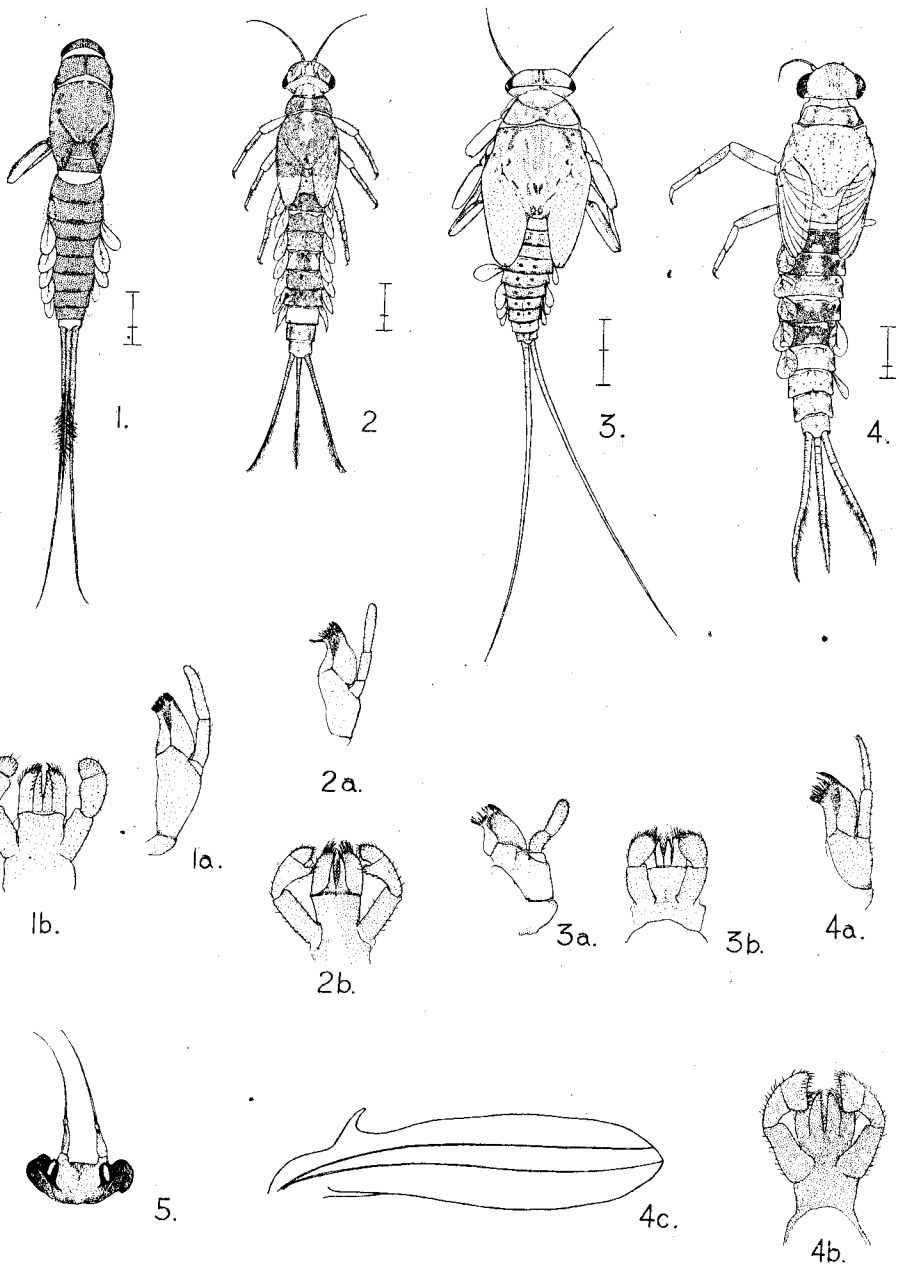
Nymph. Length of body 4.5 mm.; caudal setae 2.5 mm.

Head:—Somewhat triangular from above with vertex anteriorly directed: antennae white; maxilla and labium from below as in figures 1a and 1b, Plate XVIII.

Thorax:—Prothorax wider than head, uniformly brown. Mesonotum broader than the prothorax and of the same colour; wing pads longer than shown in figure 1, which was drawn from a young nymph, in the full grown nymph reaching beyond the posterior border of the second abdominal segment. Legs pale; dorsal edge of femora with scattered small spines.

Abdomen:—Dorsum of segments 1-9 even light brown, darker where one tergum slips under the one in front giving a double layer of chitin; two pale oblique streaks on the anterior portion of tergites 2-7, reduced to mere dots on 8 and 9, with traces of a fine pale medio-dorsal line between them. Segment 10, only, pale. Venter of abdomen paler with the tracheae marked in black. Gill lamellae on segments 2-7, all simple and with rounded apices; no traces of gills on segment one. Caudal setae pale, the median seta hairy and slightly shorter than the others. The white band shown in the figure following segment 1, is nothing more than the intersegmental membrane.

CAN. ENT. VOL. LXII. PLATE 18.



BIOLOGY OF ONTARIO MAY FLIES

Baetis pygmaeus Hag. Lake Nipissing, 16, VII, 1929.

Nymphs of this species were collected from masses of *Ranunculus aquatalis* in the slow-flowing parts of Sand Creek and subimagos were taken emerging at the same time. The adults individuals were very small and the females had a diagonal purple band in the antero-lateral angle of the otherwise pale ventral surface of the segments which seems to be lacking in the more typical specimens of *B. pygmaeus*.

Nymph. Length of body 4 mm.; caudal setae 2 mm.

This description is of a full-grown male nymph.

Head:—Evenly rounded in front; turbinate eyes dark brown in middle, paler around outside; antennae whitish; maxillae and labium as in figures 2a and 2b, Plate XVIII.

Thorax:—Pronotum dark greyish brown with a fairly broad irregularly-defined median pale band. Mesonotum and basal half of the wing pads greyish brown; in the anterior half of the thorax a pale area as shown in figure 2, Plate XVIII; scutellum and distal half of wing pads pale. Metanotum dark with a median pale band. Legs pale with slightly darkened bands on tibia and tarsus.

Abdomen:—Maculation very variable, but the figure shows a typical, well-marked, male individual. Segment 1 usually pale with two sub-median dark areas; segments 8 and 10 usually pale; segments 5 generally with a lateral flask-shaped pale area. Segment 7 shows a colour pattern which is typical of most of the segments as follows, — dark greyish brown with pale areas in the antero-lateral angles and at the base of the gills, three pale areas along the posterior border of the segment and immediately in front of each of these a vaguer pale dash. Gills present on segments 1-7, simple lamellae; gill of segment 7 lanceolate, gill on segment 6 pointed but broader, other lamellae with rounded apices. Caudal setae relatively short and pale, with dark band in distal third; outer ones fringed on inner side only.

Baetis vagans McD. Horning's Mills, 6. VI.-1, VIII. 1928. Lake Nipissing 23. VI.-25. VII. 1929.

Nymphs of this species were very abundant in the shallow rapids of the stream investigated at Horning's Mills and a long series of both sexes was reared. At Lake Nipissing the nymphs were taken along the shore and were in general of paler colour than the Horning's Mills ones, the maculation not being so obscured with brown.

Baetis plūto McD. Horning's Mills. 10-24. VII. 1928.

Adults were plentiful in the vicinity of streams but nymphs were not secured.

Baetis brunneicolor McD. Horning's Mills, 14. VI. 1928.

One adult male was taken near the source of one of the streams.

Pseudocloeon carolina Bks. Horning's Mills, 14. VI.-8. VII. 1928.

This stocky little nymph was found in abundance in the moss covering stones in the shallow rapids of one of the small streams studied at Horning's Mills, and a series of adults were reared. The nymph lacks the median caudal seta, a character shared by *Acentrella* Bgtss. of Europe. The presence of secondary wings in *Acentrella* Bgtss. and their complete absence in *Pseudocloeon* Klap. distinguishes these genera.

Nymph. Length of body 3.5-4 mm.; caudal setae 4.5 mm.

Head:—Much wider than long; two submedian brown lines on the vertex between the developing male eyes. Maxillae and labium as in figures 3a and 3b, Plate XVIII.

Thorax:—Pronotum much wider than long with brown markings on a pale background. Nymph widest across the mesothorax at the base of the wings. Mesonotum pale with light brown markings as shown in figure 3, Plate XVIII; a dark brown submedian elongate spot two thirds of the way back in the mesothorax; two narrow dark marks lateral to these; wing pads reach nearly to posterior border of segment 4. Legs with broad stout femora (seen on edge in the figure); pale, with darker areas in middle of femur, at the joint of tibia and tarsus and at the distal end of the tarsus.

Abdomen:—Relatively small, tapering; light brown above. Segments 9 and 10 and sometimes 4 and 5 paler; a row of round dark spots on either side of the middle line, these spots usually more distinct on the middle segments; sometimes a narrow median dark line on some of the segments. Gills all simple lamellae with rounded apices. Caudal setae, two in number, as long or longer than the body, with very few short hairs, and pale in colour.

Centroptilum convexum n. sp.

Nymphs of this mayfly were abundant in the Mad river at Horning's Mills where they were found among pond weeds and lily pads. Early in the afternoon of July 6 subimagos were taken rising from the water and nymphal skins floating at the surface. The subimagos were reared to the imago stage.

Imago Male. Length of body 4 mm., caudal setae 8 mm., forewing 5 mm.

Head:—Brown with darker brown marking down the median carina and around the bases of the antennae; ocelli blackish brown and a dark brown V-shaped mark subtended by the lateral ocelli projecting posteriorly between the eyes. Turbinate eyes (dried) pale chestnut brown, rest of eyes dark blackish brown.

Thorax:—Prothorax and mesathorax brown marked with ochreous white on the pleura and scutellum; metanotum brown in posterior half, pinkish across anterior border. Legs entirely pale yellowish. Metathoracic wings broad, with two longitudinal veins and a prominent costal projection as shown in figure 4c, Plate XVIII.

Abdomen:—Segments 1-6 hyaline, with a median pinkish shading sometimes; segments 7-10 opaque whitish with a pink flush which is most noticeable on segment 9 where it is concentrated in a pink area on the lateral border. Caudal setae whitish.

Imago Female. Length of body 4 mm., caudal setae 6 mm., forewing 5 mm.

Head:—Olive brown becoming reddish brown around the eyes and ocelli.

Thorax:—Very similar to male but usually has a dark reddish brown mark extending from the base of the wing, over the pronotum, to the base of the antennae. Legs and wings as in male.

Abdomen:—Dorsum dark reddish brown on segments 1-6, whitish brown on 7-10. A dark reddish line in each of segments 1-6 along the pleura and above this line a pale area. Venter pale with brown submedian strokes on the posterior borders of some segments. Caudal setae whitish.

Holotype.—Male. Mad river. Horning's Mills, Ont. 6. VII. 1928. (F. P. Ide), in Royal Ontario Museum.

Allotype.—Female. Same locality and date.

Paratypes.—1 male, 4 females. Same locality and date, 1 ♂ 2 ♀ in Canadian National Collection.

Nymph. Length of body 5 mm., caudal setae 1.5 mm.

Head:—Much deeper than broad, mouth parts directed ventrally and slightly backwards; between the developing turbinate eyes in the male, rows of dots and a pair of submedian brown bands. Antenna not longer than head and thorax together. Maxilla and labium as in figures 4a and 4b, Plate XVIII.

Thorax:—Pronotum light with brown areas; sometimes two dark brown spots in the middle of the segment, one on either side of the mid-line, and another brown spot half way to the lateral border of segment. Mesonotum very convex rising to a rounded angular point about 1/3 of the way back in the segment and best seen in profile; anterior angles not so prominent in many specimens as shown in figure 4, Plate XVIII; pale in colour with darker areas, sometimes a dark brown spot in the middle of the thorax and one at the base of each wing-pad; wing-pads with veins well marked in brown. Metathoracic wing-pads very small and narrow. Legs pale with dark marks near proximal and distal ends of femora and smoky shading at proximal ends of tibiae and tarsi.

Abdomen:—Segment 1 pale with a small dark area in the middle; segment 2 mostly dark brown, a pale area on the posterior border in the mid-line, a pale area in the anterior lateral angle fused with a curved pale area which extends posteriorly to the base of the gill, two small pale dots towards the front of the segment sometimes connected by a pale line to the anterior border of the segment; in segment 3 pale areas have fused to form a wide median pale band; segment 4 paler, the dark marks indistinct; segment 5 similar to segment 3, sometimes however with the median pale area restricted posteriorly; segment 6 very similar to segment 2; segments 7-10 paler. Posterior border of all segments provided with very small closely set spines. Gills on segments 1-7, all simple lamellae, and all with well rounded apices. Caudal setae stout with weak fringes of hairs on the median seta and the inner edges if the lateral ones; a dark band across the setae just beyond the middle.

The type specimens are somewhat teneral so that some of the colours may become darker. The abdomen of the female is somewhat discoloured by the presence of the eggs. This species is very close to *Centroptilum album* McD. but can be readily distinguished from the latter by the much broader metathoracic wings. In the type of *C. album* these are very narrow. The nymphs also show some differences, especially in the shape of the mesothorax and in the abdominal maculation. See McDunnough's figure for *C. album.* (McDunnough, 1930).

Centropilum bellum McD. Primrose, 10, VII. 1928.

The nymphs of this species were very numerous in the moderately rapid water of the stream at Primrose where they were clinging to the upper surfaces of stones. These nymphs are very active and when disturbed would swim rapidly from one resting place to another.

Two female imagos of what appear to be *Centroptilum bellum* McD.

(1924) were taken along the stream and these were the only *Centroptilum* taken in this locality so that the nymph is described under this name.

Nymph. Length of body 6.5 mm., caudal setae 2.5 mm. additional.

Head:—From above as in figure 1, Plate XIX; dark marks on the vertex between the developing turbinate eyes; head almost twice as deep as broad and the mouth parts directed ventrad and backwards. Maxilla and labium as in figures 1b and 1c.

Thorax:—Pronotum subquadrate; its length contained about three times in its width. Mesothorax wider than prothorax and about equal in width to the widest part of the abdomen; wing-pads reach about middle of segment 3. Legs pale, with dark shading, sometimes near the distal end of the femur and in the proximal half of the tibia; femur nearly twice the length of the tibia; tibia and tarus subequal.

Abdomen:—Segments 4, 5, 7, 8 and 10 generally paler than the remainder giving a banded appearance to the abdomen. Maculation of segments very variable but there is a tendency for the segments to be crossed by a broad dark band along the posterior border, this band extending forward in the middle region (see segment 6 of the figure); a large pale area on either side of this dark area ending at its antero-medial angle in a narrow diagonal pale dash; segment 9, dark, with a median pale area and two lateral pale areas whose axes follow lines drawn from the middle point in the posterior margin of the segment to the antero-lateral angles and two narrow pale dashes diverging from points in the anterior border of the segment near the mid-line Segments produced laterally into flaring margins ending in a sharp spine in the postero-lateral angle and the lateral edge in segments 8-10, bearing sharp spines; flaring margin transparent laterally, opaque medially, usually dark brown along the posterior border. All the segments with closely-set, sharp, spines along the posterior border. Gills flat and strong, with the tracheae branching on the inner side only; a small dorsal lobe at the base as shown in figure 1a Plate XIX. Caudal setae very short and strong; median one broadly fringed on both sides, the lateral ones broadly fringed on the inner side only, the outer side armed with strong spines; in the basal half are strong sclerit-ized annuli occurring above every four segments; pale at base, darker distally with a pale band about 2/3 of the distance from the base.

Cloeon mendax Walsh. Inglewood, 28-30. VIII. 1928.

At about 1.30 p.m. standard time on August 28 adults of this species were found swarming during a heavy rainstorm. The following day subimagos were taken emerging from weedy areas at the edge of the pond and collections of the exuviae and nymphs made. The nymphs were not plentiful in the pond at this date.

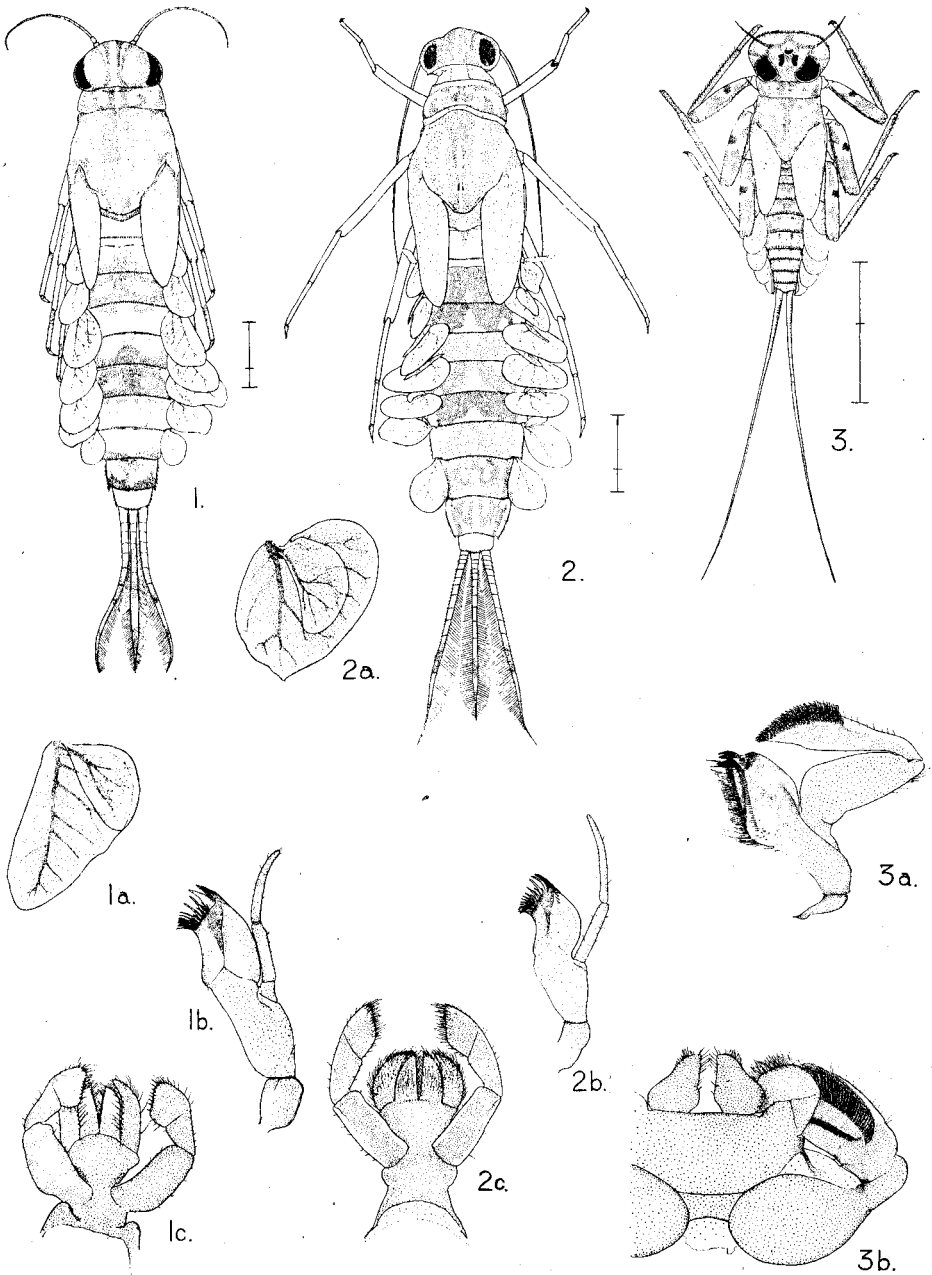
Nymph. Length of body 7.5 mm. caudal setae about 3 mm.

Figure 2, Plate XIX shows a full grown female nymph.

Head:—Short and deeper than broad; antennae very long, reaching back to about the anterior border of the second segment; maxilla and labium as in figures 2b and 2c, Plate XIX.

Thorax:—Pronotum with a transverse depression or fold near the anterior margin; brown with pale areas as in figure 2, Plate XIX. Mesonotum with a

CAN. ENT. VOL. LXII. PLATE 19.



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narrow median pale stripe and lateral to this is a dark area attenuated posteriorly and ending in a dense brown dash about ¾ of the way back; wing-pads present on mesothorax only and extending to posterior border of segment 2. Legs long and rather weak, pale with very indistinct dark band on femur; tarsal claws very long and weak and pectinated in the proximal half.

Abdomen:—Segments 2, 3, 5 and 6 usually more heavily pigmented than the others; segment 6 has maculation which is fairly typical of most segments as follows:—dark background with a submedian pale round dot in the middle of the segment, a pale diagonal dash immediately in front of it, a pale transverse band on the posterior margin produced anteriorly in the mid-line, lateral to this area two pale round spots on the posterior border of the segment and lateral border of segment pale with dark shading at base of gills. In the posterior segments the pale areas become fused and their borders are not well defined. The first segment is light except for a dark area in the mid-line on the anterior border. Lateral borders of most segments with spines, posterior borders also with closely set sharp spines. Gills broad and leaflike, double on the 1st six segments, single on segment 7. Figure 2a, Plate XIX shows the fourth gill of the left side. Caudal setae broadly fringed with hairs except the outer edge of the lateral setae which is spined; distally the setae are darker, crossed by a pale band near the distal end. Some of the nymphs, particularly the females, are pale in colour, showing practically no maculation.

This species runs very close to *Cloeon ingens* McD. in both adult and nymphal characters but is smaller and the imago males have the pale ferrugineous colour to the abdominal segments which is mentioned in the original description of *C. mendax*. McDunnough (1930) has given figures of the exuvia of *C. ingens* and this species has a very small dorsal lobe to gill 7 which is lacking in the specimens of *C. mendax* examined. *C. mendax* has relatively shorter caudal setae also.

Cloeon rubropicta McD. Lake Nipissing, 11-25. VII. 1929. Wolf Lake, Algonquin Park, 20 and 22. VIII. 1929.

This species was very abundant around some of the islands in Lake Nipissing where the adults were taken swarming in the late evening. Nymphs were very common along the shore and these fit the description of the nymph described by Clemens (1915) under the name *Cloeon dubium* Walsh. *Cloeon dubium* is a *Pseudocloeon* having double intercalary veinlets and this is a typical *Cloeon* nymph so that the description probably refers to *Cloeon rubropicta* McD.

Cloeon simplex McD. Lake Nipissing, 4-20. VII. 1929.

This species was not so common as the preceding. Nymphs were not located. The adults were taken at rest on the foliage of trees on a low sandy island at the western end of the lake.

Callibaetis americanus Bks. Horning's Mills, 25. VII. 1928; Glen Major, 7-15. VIII. 1928; Lake Nipissing. 7. VI-19, VII. 1929.

The nymphs of this species were very plentiful in all the trout ponds in the vicinity of Horning's Mills and Glen Major, Ont. In the latter place some observations were made on the mating flight of these insects. About 2 p.m. standard time on August 10, 1928, a swarming of male imagos was noticed near

the edge of the pond, just above the surface of the water, where *Chara* reached the surface. No females imagos were seen in the swarm but some were found floating in the water. At frequent intervals a female subimago would emerge from its nymphal skin in the *Chara,* and, after standing a few seconds on the surface film, take flight. Immediately several males of the swarm would pursue her and one always succeeded in fixing himself securely to her. The pair would then soar up into the air and the other males return to the swarm. This apparent mating of the male imago with the female subimago was demonstrated repeatedly during the afternoon until at about 4 o'clock the swarm of males was reduced to a few individuals. At this time a few male subimagos were taken as they arose from the *Chara* and the swarming imagos took no interest in these individuals. Several of the mating pairs were taken in the net but the insects separated immediately so that they could not be observed. One pair, however, was borne down into the grass at the edge of the pond and remained together long enough to observe that the pair were actually mating, the imago male being below the subimago female, suspended by its forelegs and claspers, with the posterior end of its abdomen turned forward and the ventral surface applied to the female. This phenomenon was observed again next year (1929) at Lake Nipissing, where several pairs of *Callibaetis americanus* were taken flying up from the lake, always a male imago and a female subimago, so it seems probable that this is the usual habit of this species. Eaton (1906) has made a similar observation in the case of *Ephemera danica* Mull. in Ireland.

As mentioned above the imago females were found in the water with their wings spread out and stuck to the surface film. In the early forenoon they were still alive, in the afternoon dead and beginning to decay. Two female *Callibaetis* imagos bred from the subimagos at Lake Nipissing and kept in a glass jar with some water and a stick of wood showed no hesitation in creeping below the surface of the water and remaining under for some time, the wings then being covered with a thin film of air giving them a silvery appearance. Morgan (1911), has mentioned that a *Baetis* species creeps below the surface of the water to oviposit and it seems probable that *Callibaetis americanus* Bks. does this regularly too, oviposition probably taking place during the night or very early morning.

Callibaetis skokiana Needh. Horning's Mills, 3. VIII. 1928; Glen Major, 14-16. VIII. 1928; Inglewood, 28. VIII. 1928.

This species were not at all common and the individuals taken were mostly females found floating in the water of the ponds.

Callibaetis sp. Inglewood 25-30. VIII. 1928.

A few adult specimens of a species which may be *C. ferrugineus* Walsh were taken swarming in the vicinity of the pond.

Subfamily HEPTAGENIINAE

Isonychia siccus Walsh. Horning's Mills, 2-21. VII. 1928; Inglewood, 30. VIII. 1928; Nipissing R. Algonquin Park, 3. IX. 1929.

Adults were taken along the lower reaches of the Pine river and nymphs were taken in the rapids. The species was not plentiful.

Siphloplecton basalis Wlk. Lake Nipissing and French river, 10-23, VI. 1929.

Both nymphs and adults of this species were taken along the shores of the river and lake; the adults were taken swarming in groups of three or four individuals about sundown. The species was not plentiful.

Siphlonurus alternatus Say. Horning's Mills 5. VII. 1928; Lake Nipissing, 10-23, VI, 1929.

Two individuals were taken swarming at Horning's Mills along the Pine river. At Lake Nipissing a few nymphs from a small quiet pool of Sand creek and a few taken along the shore of Franks bay were reared. The species was not plentiful.

Siphlonurus quebecensis Prov. Lake Nipissing 10-24, VI, 1929.

This species was very common in the lower reaches of Sand Creek and also along the shores of Franks bay. The adults were taken swarming over the rapids of the creek at dusk on several occasions. Nymphs taken in a quiet pool in a side channel of the stream were reared.

Iron pleuralis Bks. Horning's Mills, 6. VI.-7. VII. 1928.

This nymph was found in abundance in the most rapid portions of one of the small streams. The subimagos were seen emerging about 2.30 p.m. standard time on June 5. They appeared suddenly on the stones and almost immediately took flight. On observing more closely it was seen that the nymphs crawled up the stones to within about an inch of the surface of the water, emerged there from the nymphal skin, and quickly crawled up the stone and through the surface film with wings fully expanded. When these nymphs were being reared in a cage in the stream later in the season, the exuviae were invariably found on the wire from ½ inch to 1 inch below the surface of the water.

This species apparently has a very long season of emergence, lasting from some time before June 3, when the first collections were made, until some time after August 2, when the last collections were made. This seems to be due to a temperature gradient in the stream causing a wave of emergence to run from the lower parts of the stream to the source. About half a mile from the source there is a large mill pond which raises the temperature of the water considerably. The first emergence was noticed on June 3, almost immediately below the dam and nymphs were not found there in collections on June 19, or later. Emergence a short distance above the pond began about June 14, and no nymphs were found in this location on July 26. On August 2, a sample collection taken about one hundred yards further up the stream contained one full-grown nymph and on August 3, within about one hundred feet of the source, a sample taken had nine full-grown nymphs. Above this point the bottom of the stream was not suitable for this species. Other mayflies collected at the same time gave further evidence of this wave of emergence proceeding up the streams.

Nymph. Length of body 8-9 mm., caudal setae 10-12 mm.

Head:—Broadest in front of eyes, frontal border slightly convex and densely fringed with hairs. Head capsule brown with pale areas in front of the ocelli, in front of the bases of the antennae on either side of the median line and lateral to the bases of the antennae. The antennae themselves brown in colour. Maxilla and labium from ventral side as in figures 3a and 3b, Plate XIX.

Thorax:—Pronotum brown, with pale median line, lateral areas and

antero-lateral margins. Mesonotum brown with light areas as shown in figure 3, Plate XIX; markings variable, some specimens showing considerably more pigmentation than others; wing-pads of full-grown nymph large and reaching posteriorly to about the posterior border of segment 4. Legs all very similar; broadened flat femora with hairy posterior margins, and with a dark blackish brown area on the dorsal surface of each at about the middle surrounded by a pale area of irregular outline and a pale band near the distal end; remainder of each leg brown.

Abdomen:—Segments suffused with brown which has a tendency in the middle segments to become concentrated into two dark spots one on either side of the mid-line; venter pale brown with paler median ganglionic spots and lateral borders. Gills on segments 1-7; on the first gill there is an acutely pointed anterior lobe which projects medially, but the gills of the two sides are not contiguous ventrally; gills of segment 7 folded and curving ventrally where they meet beneath segment 10. Caudal setae straight, diverging and practically devoid of hair.
Epeorus humeralis Morg. Horning's Mills, 21. VI.-2. VII. 1928.

The nymphs of this species were taken in the rapid parts of the small streams and adults were collected, but the species was not very common.
Arthroplea bipunctata, McD. (*Cinygma bipunctata,* McD).* Horning's Mills, 4. VI. 1928; Sand creek, Lake Nipissing 11-20. VI. 1929.

One specimen, a very young nymph, taken at the edge of a pond was the only record at Horning's Mills. At Lake Nipissing the nymphs were very plentiful in a still pool at the edge of a rapid part of Sand creek. A long series of adults was bred through and the nymph is described and figured elsewhere. (Ide 1930).
Heptagenia hebe McD. Horning's Mills, 2-21. VII. 1928; Lake Nipissing, 7-24. VII. 1929.

A few adults of this species were taken about four miles down the Pine river. At Lake Nipissing it was very common along the shores of the lake and around the islands. A series of nymphs was reared.
Heptagenia pullus Clem. Horning's Mills, 6. VI. - 19. VII. 1928; Lake Nipissing, 22. VII. 1929; Algonquin Park, 13. VIII. 1929.

The fine large active nymphs of this species were found fairly abundantly in the more rapid parts of the headwater streams at Horning's Mills and also in the stream connecting Ragged and Smoke lakes in Algonquin Park. These agreed well with the figure given by Clemens (1915). The adults were not found in any numbers, most of the series being obtained by rearing.
Ecdyonurus vicarius Wlk. Horning's Mills, 14. VI. - 5. VII. 1928.

This species was found in the same streams as the preceding but in the less rapid parts and particularly under stones at the edges of the quiet pools between the rapids. Neither adults nor nymphs were abundant.
Ecdyonurus ithaca Clem. and Leon. Horning's Mills, 27. VI.-12. VII. 1928.

A few nymphs were taken in a small stream connecting two ponds in the Pine river system. Adults were taken in a mating swarm in the vicinity and females taken ovipositing.

*—In a recent communication Dr. McDunnough informs me that the so-called *Cinygma bipunctata* McD. falls in the genus *Arthroplea* Bgtssn, and expects to comment on this shortly.

Ecdyonurus tripunctata Bks. Horning's Mills, 15-26. VI. 1928; Glen Major 22, VIII. 1928; Lake Nipissing 10, VI-25. VII. 1929.

Nymphs were taken at Horning's Mills in one of the ponds and also in one of the streams connecting two ponds. At Lake Nipissing a long series of adults was taken, the earlier dates being for specimens taken up Sand creek and the later dates for specimens taken around the islands in the middle of the lake. The series shows a continuous variation from light individuals taken in the lower part of Sand creek to very dark individuals taken round the islands in the lake. A very common species.

Ecdyonurus rubromaculata Clem. Horning's Mills, 27. VI. 1928; Lake Nipissing 10. VI.-4. VII. 1929; Algonquin Park, 6. VIII-30. VIII. 1929.

One adult only was taken at Horning's Mills. This species was very abundant in the rapids of Sand creek at Lake Nipissing and also in the rapids of the stream connecting Ragged and Smoke lakes in Algonquin Park at which place a number were reared.

Ecdyonurus canadensis Wlk. Horning's Mills, 27. VI-21. VII. 1928; Nipissing, 10. VI-24. VII. 1929; Algonquin Park 6 and 8. VIII. 1929.

These were not very plentiful around Horning's Mills but a few were taken in the larger streams. At Lake Nipissing this species was very common especially around the islands in the middle of the lake where mating swarms were formed in the evenings. A few individuals were taken along Sand creek.

Ecdyonurus frontalis Bks. Primrose, 10, VII. 1928; Lake Nipissing, 2-14. VII. 1929; Algonquin Park, 19. VIII. 1929.

One adult taken near the Boyne river at Primrose. This species was very abundant along the rocky shores of the French river at Lake Nipissing where a series was reared. The species also occurred along the shore at Ragged lake, Algonquin Park, but was not common.

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EXPLANATION OF PLATES.

PLATE XVII.

Fig. 1. Nymph of *Leptophlebia volitans* McD.; 1a, left gill of 4th segment; 1b, ventral view of left maxilla; 1c, male genitalia in profile.
Fig. 2. *Leptophlebia debilis* Wlk., left gill of 4th segment; 2a, ventral view of left maxilla.
Fig. 3. *Leptophlebia guttata* McD., left gill of 4th segment; 3a, ventral view of left maxilla.
Fig. 4. *Leptophlebia mollis* Hag., left gill of 4th segment; 4a, ventral view or left maxilla; 4b, ventral view of labium.
Fig. 5. *Leptophlebia adoptiva* McD., left gill of 3rd segment; 5a, ventral view of left maxilla.
Fig. 6. Nymph of *Ephemerella depressa* Ide; 6a, labium from below; 6b, left maxilla from below; 6c, right foreleg; 6d, portion of forewing of female imago.

PLATE XVIII.

Fig. 1. *Baetis parvus* Dodds, nymph; 1a, left maxilla from below; 1b, labium from below.
Fig. 2. *Baetis pygmaeus* Hag., nymph; 2a, left maxilla from below; 2b, labium from below.
Fig. 3. *Pseudocloeon carolina* Bks., nymph; 3a, left maxilla from below; 3b, labium from below.
Fig. 4. *Centroptilum convexum* Ide, nymph; 4a, left maxilla from below; 4b, labium from below; 4c, secondary of male imago.
Fig. 5. *Eurycaenis pallida* Ide, head of male (dried) from above.

PLATE XIX.

Fig. 1. *Centroptilum bellum* McD., nymph; 1a, left gill of 4th segment; 1b, left maxilla from below; 1c, labium from below.
Fig. 2. *Cloeon mendax* Walsh, nymph; 2a, left gill of 4th segment; 2b, left maxilla from below; 2c, labium from below.
Fig. 3. *Iron peuralis* Bks., nymph; 3a, left maxilla from below; 3b, labium from below.

COLEOPTERA OF THE NORTH SHORE OF THE GULF OF THE ST. LAWRENCE.*

BY W. J. BROWN,
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It was my privilege to spend the summer of 1929 collecting insects on the north shore of the Gulf of the St. Lawrence. This insect survey extended from Trinity Bay in the west to Bradore Bay in the Straits of Belle Isle. Particular attention was given to Coleoptera. Except where otherwise stated, the author is responsible for the determinations in the following list.

CICINDELIDAE

Cicindela duodecimguttata Dej. 1, Natashquan, Aug. 9.

Cicindela hirticollis Say. 19, Natashquan, June 22 and Aug. 10, abundant on the sand dunes.

Cicindela tanquebarica horiconensis Leng. 6, Natashquan, June 22 and Aug. 2-10, common on the sand dunes.

Cicindela longilabris novaterrae Leng. 1, Natashquan, Aug. 8, taken in an open white spruce forest growing in sand.

CARABIDAE

Carabus meander Fisch. 1, Fog Island Sanctuary, June 25; 1, Harrington Harbor, July 2; 2, Bonne Esperance, July 14.

Carabus sp. 1 ♀, Bonne Esperance, July 14.

Elaphrus riparius L. 1, Natashquan, Aug. 10.

Notiophilus aquaticus L. 1, Watshishu, June 18; 2, Natashquan, Aug. 9, 13; 2, Bonne Esperance, July 14.

Pelophila shermani Csy. 1, Kegashka River, June 23; 1, Harrington Harbor, July 3; 13, Tabatiere, July 11; 2, Bradore Bay, July 18; 4, Greenly Island, July 20; occurs beneath stones and beach drift, probably the most abundant Carabid on the coast.

*—Contribution from the Division of Systematic Entomology, Entomological Branch, Department of Agriculture, Ottawa.