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THE FAUNA OF AN ISLAND IN THE CHILKA LAKE.

The Ephemeroptera of Barkuda Island.

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THE FAUNA OF AN ISLAND IN THE CHILKA LAKE.¹

THE EPHEMEROPTERA OF BARKUDA ISLAND.

By B. CHOPRA, D.Sc., Assistant Superintendent, Zoological Survey of India.

The collection of Barkuda mayflies comprises only four species belonging to three genera. The family Ephemeridae is represented by a species of *Hexagenia*, the Caenidae by one of *Caenis*, while the Baetidae has two, both belonging to the genus *Cloëon*. Besides these a nymph was also collected in the pond on the island, which belongs to some undeterminable species of *Cloëon*, probably to one of the two of which the adults have been met with on the island. Of the four species two, one belonging to *Hexagenia*, and the other to *Cloëon*, are described as new, while the remaining two are Cingalese forms, also recorded from Eastern Bengal.

LIST OF THE SPECIES.

Ephemeridae.

Hexagenia indica, sp. nov.

Caenidae.

Caenis perpusilla (Walker) Needham.

Baetidae.

Cloëon marginalis Hagen.

Cloëon variegatum, sp. nov.

Cloëon sp., nymphs only.

Different species of mayflies are no doubt abundant on the island at different times of the year, but contrary to Dover's² statement, *Caenis* is the rarest genus, for only a single specimen of it is preserved in the collection. Species of *Cloëon*, especially *C. marginalis*, seem to predominate, particularly during winter.

In my notes Eaton's³ system of reference to the veination of the wing has been adopted, and Ulmer's⁴ classification of the order, which is the latest and the one generally accepted, is followed. In the description of species the names of various colour tints have been taken from Ridgway's⁵ "Color Standards."

I am greatly obliged to Dr. N. Annandale, Director, Zoological Survey of India, for the help he has given me in the course of this short work. Mr. T. Bainbrigge Fletcher, Imperial Entomologist, Agricultural Research Institute, Pusa, has kindly sent me a list of references to the Indian Ephemeroptera, which has proved of much use. For this I owe him my best thanks.

¹ For previous papers in this series see *Rec. Ind. Mus.* XXII, pp. 313—422 (1921); XXIV, pp. 289—311 (1922); XXV, pp. 221—263 (1923); XXVI, pp. 165—191 (1924).

² Dover, *Rec. Ind. Mus.* XXII, p. 397 (1921).

³ Eaton, *Trans. Linn. Soc. London* (2, Zool.) III, pp. 5—7 (1883).

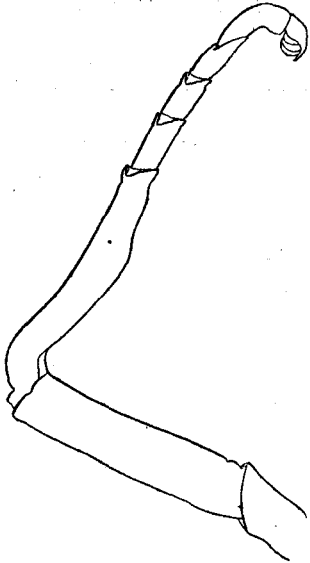
⁴ Ulmer, *Stettin Entomol. Zeitung* LXXXI, pp. 97—144 (1920).

⁵ Ridgway, *Color Standards and Color Nomenclature*: Washington (1912).

Family EPHEMERIDAE.

Hexagenia indica, sp. nov.

Imago ♀ (in spirit).—Head light bistre brown with the anterior end about the middle of the breadth almost white. Ocelli whitish, with a



TEXT-FIG. 1.—*Hexagenia indica*,
sp. nov. Foretarsus of
female: $\times 16$.

black circle round each. Eyes blackish, tinged with light sky blue. Pronotum pale ochraceous yellow, minutely spotted with bistre about the middle; a low narrow ridge, whitish in colour, running longitudinally in the middle. Mesonotum Sanford's brown in the middle, and darker verging to auburn all round; a white narrow ridge running mid-dorsally in the same line as that on the pronotum, and continued distally in a free blunt spine. Metanotum light orange rufous dabbled with white; a ridge like that on the mesonotum and ending distally in a spine, running longitudinally in the middle. First abdominal segment mostly covered over by the metanotum, much paler in colour than the rest of the body and almost white along the sides. Dorsum of abdomen dark chestnut-brown with an indistinct pale streak running mid-dorsally and the middle of each segment slightly lighter. Ninth segment largest,

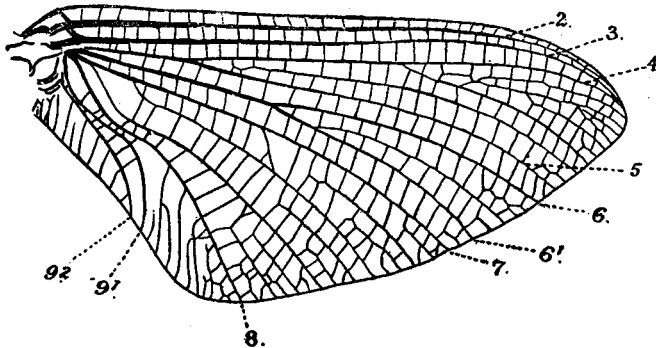
its posterior border much darker than the rest of the abdomen.

Ventral surface of head whitish, infuscated with light bistre brown. Thorax, especially the mesosternum, dark orange-red, with the places for the articulation of legs white. Abdomen with its first eight segments pale whitish infuscated with chestnut; last two segments chestnut, with a pale area about the middle of the length.

Legs well developed and functional; fore legs about as long as hind legs. Fore legs cream coloured, somewhat lighter on the under surface, with longitudinal stripes of light bistre or light chestnut on all the segments except the tarsus, and a dark stripe on the upper surface of the femur. Tibia and a portion of the femur in some of the specimens more or less uniformly coloured in light bistre. Fore femur about as long as the tibia or the tarsus; the latter formed of four distinct and one indistinct segment, each having near its distal end a ring of light bistre completely surrounding it. Unguis also with a spot of bistre on it. Hinder legs lighter in colour, pale whitish, with the femur, tibia and tarsus almost entirely devoid of colour-stripes.

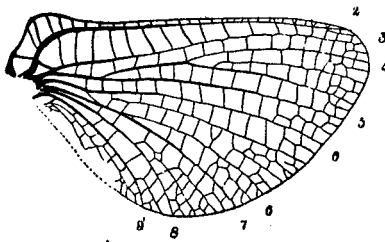
Setae smoke-gray, with pale whitish rings corresponding with annulation in the anterior part; posterior portion altogether whitish. Minute hairy pubescence present throughout. Median seta present as a small rudimentary process between the two long lateral setae.

Wings transparent, smoke-gray to light grayish olive; both fore and hindwings almost uniformly tinted. Longitudinal veins, except



TEXT-FIG. 2.—*Hexagenia indica*, sp. nov. Forewing: $\times 4$.

the radius, pale whitish. Radius (3) light ochraceous buff, especially towards the wing-root, becoming almost pale whitish distally. Subcosta (2), at the wing-root, and the great cross-vein with a patch of Sanford's brown. Cross-veinlets whitish. Sector (4) and cubitus (5) rather less strongly developed than usual. Anal (8) unequally sinuous, enclosing with the second axillar ($9''$) and the inner margin a semi-sagitate space. First axillar ($9'$) strongly arched towards the extremity, second simple and only gently curved.



TEXT-FIG. 3.—*Hexagenia indica*, sp. nov. Hind wing: $\times 8$.

Hind wing pale whitish; veins whitish; the bases of some of the anterior veins patched with reddish brown. Arrangement of veins (illustrated in the accompanying drawing) as in other species.

♂.—Unknown.

Length of body 12–15 mm.; wing 17–19 mm.; setae 16–18 mm.

Type-specimen.—7528/H₂, Zoological Survey of India (*Ind. Mus.*).

A number of specimens belonging to this species were collected by Dr. N. Annandale on the surface of the Chilka Lake off Barkuda in August, 1919. There is no evidence, however, that the species breeds on the island for the only specimens in the collection were captured on the surface of the lake, into which they had fallen, off the shore. Of the eleven specimens procured two are pinned; of the rest all but four or five are more or less fragmentary, some being devoid of the entire abdomen. All the specimens are females.

The genus *Hexagenia* superficially resembles *Palingenia* (*s.l.*) but may be easily distinguished from it by the well-developed fore legs, and by the presence of a rudimentary median seta. The facies in the two genera is also quite different.

From India, so far as I know, *H. indica* is the first species of the genus to be described. Eaton¹ has, however, mentioned a form from N. W. India and has given figures of its wings, but as they are unaccompanied by any description, or even the exact record of the locality, it is impossible to say whether the present species may be the same or not. The arrangement of the veins of the wing of *H. indica*, however, is almost exactly like that shown in Eaton's figure. The comparatively feeble development of sector and cubitus seems to be a characteristic feature of both and the adventitious nervures are also similarly disposed.

The genus is known to occur commonly in Central and North America. The only species described from outside this limit is *H. fulva*² from Africa. An undescribed species is also recorded from Siberia³ and another, as mentioned above, from India.

Family CAENIDAE.

Caenis perpusilla (Walker) Needham.

1853. *Caenis perpusilla*, Walker, *Brit. Mus. Catal. Neuropt. Ins.* part iii, p. 585.

1884. *Caenis perpusilla*, Eaton, *Trans. Linn. Soc. London* (2) III, pp. 147, 148.

1909 *Caenis perpusilla*, Needham, *Rec. Ind. Mus.* III, pp. 191, 192, pl. xx, fig. 7.

A single specimen in spirit identical with those described by Needham and referred by him to Walker's species was collected by Dr. N. Annandale at light, at Barkuda on 26th October, 1923. It is a female imago 3.5 mm. long with the setae slightly over 3 mm. The fully extended wing is about 3 mm. The colouration of the body and the neururation of the wing agree with those of pinned specimens from Rajshahi in the collection of the Indian Museum, identified by Needham, and also with Needham's description and figure of the species. The wings have, however, a grayish (and not purplish) costal band, and the anal nervure is less strongly developed. As in other Ephemerid wings there are two adventitious nervures between the pabranchial (7) and the anal (8), although in Needham's figure only one is shown. This, however, is an error in drawing for the wing in the Rajshahi specimen is exactly like that in the Barkuda specimens.

Walker's original description is inadequate for the proper determination of his species, and it is indeed somewhat doubtful if the form re-described by Needham as *C. perpusilla* is actually identical with it. The anal setae appear to be proportionately much longer in Walker's *perpusilla* and the sooty black lines on the dorsum so characteristic of the Indian form are apparently absent in that from Ceylon.

¹ Eaton, *Trans. Linn. Soc. London* (2, Zool.) III, p. 49, pl. vii, fig. 11a (1883).

² Petersen, *Ann. South Afric. Mus.* X, p. 179 (1911-1914).

³ Eaton, *Trans. Linn. Soc. London* (2, Zool.) III, p. 307 (1887).

Dover's¹ record of an Ephemeroptera as being "abundant in the rains, breeding in the lake and in the pond" of the island, which he thinks is a *Caenis*, may possibly refer to this species.

C. perpusilla was so far known only from Ceylon and from Rajshahi in Eastern Bengal.

Family BAETIDAE.

***Cloëon marginalis* Hagen.**

1858. *Cloëon marginalis*, Hagen, *Verh. Zool.-bot. Ges. Wien* VIII, p. 477.

1871. *Cloëon marginalis*, Eaton, *Trans. Entomol. Soc. London*, p. 132.

1885. *Cloëon marginale*, Eaton, *Trans. Linn. Soc. London* (2) III, pp. 181, 182.

1909. *Cloëon marginata*, Needham, *Rec. Ind. Mus.* III, p. 191.

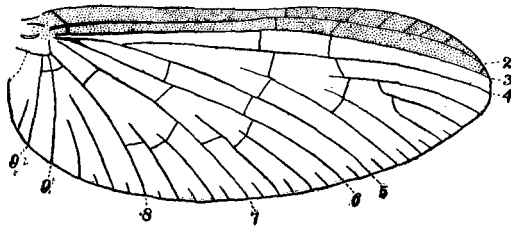
A number of specimens, both males and females, were collected by Dr. N. Annandale, some at light, at Barkuda in November, 1923. The species is represented in the collection both by dry and by spirit specimens.

There are also one dried female imago and a number of other specimens in spirit, including both imagos and subimagos, in the collection of the Indian Museum, all from Rajshahi and determined by Needham.

The species is readily recognized by the coloured marginal and sub-marginal areas of the wings, especially in the female, and by the reddish brown colour of the dorsum of the posterior abdominal somites of the male. Nothing much need be added to Eaton's fairly detailed description of the species, especially so far as characters pertaining to the male are concerned. The coloured area of the wing is, however, sometimes of a very light grayish shade rather than amber.

The body colouration of the female imago has not been described by Eaton or any other author and as it differs from that of the male I give below a brief account of it.

Dorsum more or less uniformly coloured, light bistre to bistre brown, with a somewhat darker band at the posterior margin of each abdominal somite. Head slightly lighter, with two broad streaks of darker shade middorsally. Notum also bistre, with three faint ridge-like lines radiat-



TEXT-FIG. 4.—*Cloëon marginalis* Hagen. Forewing; $\times 12$.

ing from a point about the middle of the posterior margin, one running medially, the other two obliquely to the sides of the anterior margin. Venter of a light colour, narrowly edged with a slightly darker shade at

¹ Dover *Rec. Ind. Mus.* XXII, p. 397 (1921).

the joints and infiltrated more or less with chlorophyll, especially around the origin of the legs and wings. Legs as described by Eaton for the male.

Wings vitreous, coloured with bistre-brown in the marginal and sub-marginal area. About five straight cross-veinlets in the pterostigmatic area appearing white in opaque light. Great cross vein bistre brown, with clear hayline space between it and the wing root.

Setae whitish, with black or blackish brown annulations and joints, the former often coinciding with every alternate joint in the proximal part of the seta.

In the collection there are a number of subimagos also, and these agree with Eaton's description in all essential particulars. In some specimens, however, the venter and sides of the thorax are pale greenish owing to the presence of chlorophyll, which seems to be better developed in the subimago than in the adult.

A female specimen in spirit, probably a subimago, is with some doubt referred to this species. It is straw-yellowish in colour, with the dorsal surface slightly darker. The dorsum of the abdomen has a light brownish tinge near the margins of the segments. The ventral surface is markedly infiltrated with chlorophyll. The wing is transparent and has the usual coloured marginal and sub-marginal areas but the colour in this case is pale greenish and not any shade of bistre.

Most of the specimens in the collection are from 4.0-5.5 mm. in length, with about as much wing length. The setae in the female are about $1\frac{2}{3}$ to $1\frac{3}{4}$ times the length of the body.

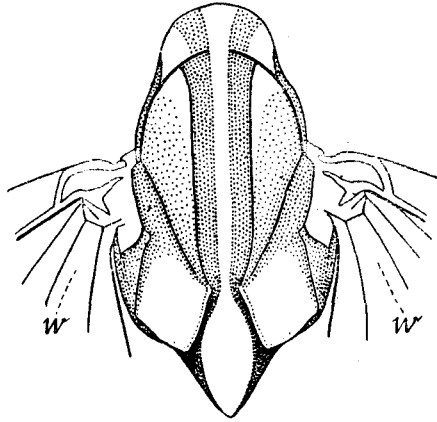
The species was formerly known from Rainbodde (Ceylon), Rajshahi, Sylhet and Calcutta. It seems to be the common winter species on Barkuda and also, indeed, in all other places from which it is recorded. I have often seen it during December and January in Calcutta,¹ sitting on window panes and lying in water-sinks.

Cloëon variegatum, sp. nov.

Imago ♂ (in spirit).—Eyes turbinate, clove-brown above, somewhat lighter at the sides; lower eyes blackish brown, with a faint line traversing each about the middle, upper and anterior part darker than the lower, and with a dark spot. Body luteous or lutescent on the dorsal surface, paler on the ventral. Notum lutescent, light buff tinged with light brown, variegated with bistre-brown; variegation always forming a definite pattern as illustrated in accompanying drawing (fig. 5), consisting of two light parallel longitudinal bands in the median line, with darker lines, circularly disposed, outside. Dorsum of abdomen luteous, segments 3-6 translucent, whitish in the middle, luteous at the sides; segments 7-10 or sometimes 5-10 with their proximal edges and part of the lateral margin ochraceous tawny to light bistre. Venter pale whitish.

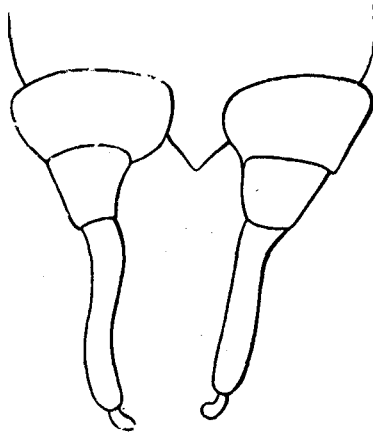
¹ In a female imago in spirit from Calcutta the bistre brown colour on the dorsum of the abdomen is not uniformly spread but leaves two unpigmented spots on each of the 2nd to 9th segment, so that the pale greenish ground-colour is visible. The ventral surface is pale, but on segments 2-9 there is a pair of dark brownish spots one on each side.

Legs dull whitish; forelegs with a faint brownish spot near the proximal end of the femur and a faint streak of the same colour on its



TEXT-FIG. 5.—*Cloëon variegatum*, sp. nov. Notum of male: $\times 40$. Slightly diagrammatic. *w.*—wing.

ventral surface; tibia also with an indistinct patch of brownish colour near its distal end; tarsus with dark brownish rings at the joints and the tip of the claw.



TEXT-FIG. 6.—*Cloëon variegatum*, sp. nov. Forcep limbs: $\times 150$.

Forceps as in *C. dipterum*¹ (Linn.), with a small projecting point above the interspaces between the basal segments of the forcep-limbs.

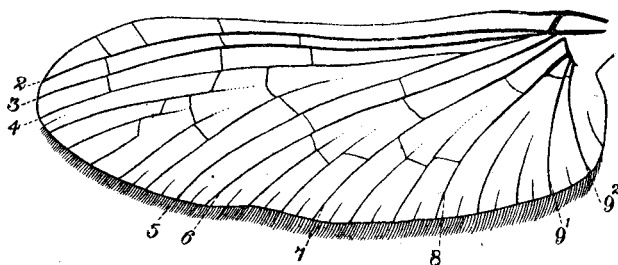
Setae whitish or light smoke-gray, with black joints and annulations.

Wing-membrane transparent, highly iridescent; neuration in opaque view whitish in the costal region and pale olive-buff posteriorly. Cross veins whitish; great cross vein white. Arrangement of veins as shown in the accompanying illustration.

Imago ♀ (in spirit).—Very similar to the male. Eyes soft blue-violet with a lighter area in the middle. Ocelli with a ring of dusky

¹ Vide Eaton, *Trans. Linn. Soc. London* (2, Zool.) III, p. 184, pl. xvii, fig. 31a (1883-1888).

violet near the margin and a whitish area in the centre. Variegations on the notum lighter than those in the male. Venter and sides of ab-



TEXT-FIG. 7.—*Cloëon variegatum*, sp. nov. Forewing : $\times 16$.

domen slightly infiltrated with chlorophyll in some specimens. Wing neuration in opaque view whitish throughout.

Length of body, ♂ 4.0–5.0, ♀ 5.0–5.5; wing, ♂ 4.2–5.0, ♀ 5.5–6.0; setae, ♂ 7.0–9.0, ♀ 5.0 mm.

Type-specimens.—7523/H₂, Zoological Survey of India (*Ind. Mus.*).

A number of specimens, both pinned and in spirit, representing this new species were collected by Dr. N. Annandale, mostly at light, at Barkuda in the months August to October, 1923. A couple of specimens were also collected by Messrs. S. Ribeiro and C. Dover in August, 1920. Both sexes are represented in the collection, but the number of males considerably exceeds that of females.

C. variegatum seems to be a rainy-season form, and to hatch out earlier than *C. marginalis*. With one or two exceptions all the specimens were collected during August and September, but the rains broke very late in 1923. The colour of the body of the female during life is, I am told by Dr. Annandale, bright green.

Cloëon sp.

A number of nymphs, unaccompanied by imagos or sub-imagos, collected by Dr. F. H. Gravely belong to an undeterminable species of *Cloëon*. As the nymphs of neither of the species of *Cloëon* mentioned above have been described, it is difficult to say with certainty whether the present nymphs belong to any of these. It is, however, probable that the nymphs are those of either *C. marginalis* or *C. variegatum*, more probably the former.

Rousseau, Lestage and Schouteden¹ give good keys for the determination of nymphs of Ephemeroptera. Those of the genus *Cloëon* are very easily recognized. Large visible branchiae, short mandibles and lateral eyes characterize nymphs of the family Baetidae, while the presence of hairs on the internal margin only of the lateral setae and the dissimilar branchiae with the seventh pair simple, others bilamellar, having the lower lamella rounded, are characters which mark off nymphs of the genus *Cloëon*.

The nymphs were collected in a pond on the island in August, 1919.

¹ Rousseau, Lestage and Schouteden, *Les Larves et Nymphes aquatiques des Insectes d'Europe* I, pp. 162-273 (1921).