

NEW SPECIES OF INDIAN EPHEMEROPTERA

BY D. E. KIMMINS

THE material upon which this paper is based was collected during the period October, 1945, to early January, 1946, whilst the author was serving with the Royal Air Force in India. The main area in which collecting was done lay to the north of Calcutta, near Dakhineswar (adjacent to the new Willingdon Bridge over the Hooghly River). The country is flat and low, and abounds in large ponds, known locally as "tanks" or "gheels." The water is static and warm, and, as might be expected, the ephemeropterous fauna appears to consist solely of members of the families BAETIDAE (*Cloëon*, etc.) and CAENIDAE. Five species of the former and two of the latter were collected, six of the seven species being here described as new to science. Collections were also made at another locality about two miles nearer Calcutta, and at the Calcutta Botanic Gardens. Indian species of *Cloëon*, like our British species *C. dipterum*, are quite at home in urban surroundings, and the author has seen large swarms of males dancing in the sunlight in the centre of Calcutta.

The author wishes to express his sincere thanks to Dr. S. L. Hora, Director of Fisheries, Bengal, and to Dr. B. N. Chopra, Director, Zoological Survey of India, for their ready assistance in providing him with collecting equipment, which he was unable to bring with him by air from England.

Before proceeding to the description of the various species, it should be pointed out that, in the absence of such direct evidence afforded by specimens taken *in coitu*, the association of males and females of the various species of *Procloëon* and *Cloëon* must be regarded as provisional. This fact, together with the good characters offered by the female wings, has influenced me in selecting females as holotypes of the various species. In the case of the two species of *Caenis*, only one species was on the wing at the time of capture. Unless otherwise stated, the descriptions have been made from specimens collected into alcohol and subsequently preserved in 2% formalin.

The types of all species have been presented to the British Museum (Natural History), but whenever possible paratype material is being sent to the Zoological Survey of India.

Family BAETIDAE.

Procloëon bimaculatum (Eaton) (figs. 1, 5, 9).

Cloëon bimaculatum Eaton, 1884, *Trans linn. Soc. Zool.* (2) 3 : pl. 17, fig. 31d ; 1885, *op. cit.* : 182 (Ceylon).

The type series of this species is now in the British Museum (N.H.). It consists of one male and seven females, all somewhat imperfect. The male is mounted on a card, together with two of the females, and as regards the wings it is difficult to reconcile it with Eaton's description.

Indeed it would appear that the description of the wings of this species has been made from a female example, as in the male specimen there is no trace of the pterostigmatic pattern he describes. I have therefore selected as holotype of this species one of the females.

Examination of the proportionate lengths of the 1st and 2nd segments of the hind tarsus (3 : 1) suggests that this species should be transferred to the genus *Procloëon* Bengtsson. The venational character given by him (first cross-vein between R1 and R2 in line with the one below it) has been shown to be variable and unreliable.¹ Among the material collected near Calcutta in November, 1945, are a number of specimens which I believe to belong to this species, in spite of the distance from the type locality, Ceylon. In life the body of the female is light green in colour, with sparse reddish markings. At rest it sits with the wings slightly separated, and the abdomen sinuously upcurved between them.

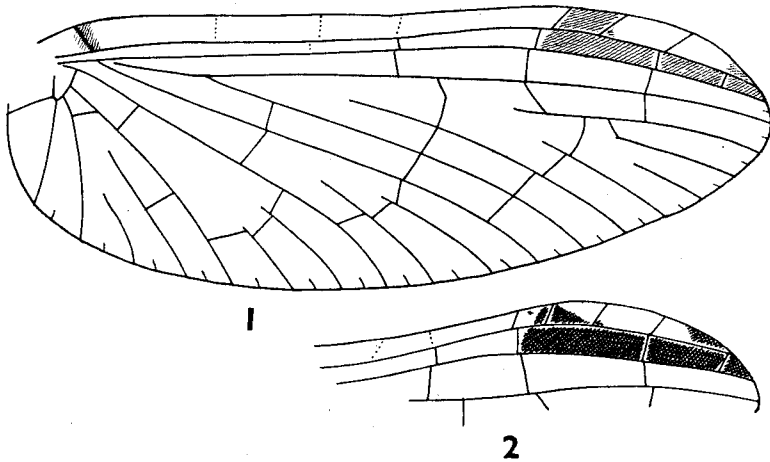


FIG. 1. *Procloëon bimaculatum* (Eaton). ♀ Right wing.

FIG. 2. *Procloëon harveyi* sp. n. ♀ Pterostigmatic region of right wing.

Female. General colour whitish, with sparse reddish markings. Head immaculate, antennae with small red spots apically on the inner and outer sides of two basal segments, style blackish apically. Pronotum with a faint reddish sagittate spot on disc. Abdomen with a pair of reddish triangles, one in each apical angle of the 3rd tergite. Tergites 1 to 7 faintly reddish apically (fig. 9). Setae white, irregularly banded with black. Anterior femur with two pale orange bands on inner surface, median and posterior femora each with a faint sub-apical reddish ring. Wings hyaline, veins pale brownish, cross-veins white. Pterostigma brownish with a sub-apical pale spot in costal area; humeral cross-vein marked with reddish, area between it and pterostigma very faintly yellow-brown (fig. 1).

Male. Head fulvous, turbinate eyes fulvous-orange, scarcely wider at apex than at base, lower eyes blackish. Antennae fulvous, shaded with brownish at apices of 1st and 2nd segments. Thorax fuscous, sutures paler. Abdominal segments 1 to 7 very pale fuscous, 8 to 10 rather darker fuscous. Tergites 1 to 6 each with a narrow reddish apical line, interrupted at its centre, and tergites 2, 3 and 6 in addition each with a dark reddish-brown

¹ Kimmins, D. E., 1942, *Sci. Publ. Freshwater Biol. Assoc.* 7 : 40.

triangular spot on each side, tergites 8 to 10 with indefinite fuscous markings (fig. 5). Sternites very pale fuscous, 2 to 7 each with a pair of indistinct short divergent dashes at base, 7 and 8 each with a pair of reddish longitudinal lines, 9 faintly marked with reddish. Forceps light fuscous, becoming paler apically. Between their bases is a triangular process, whose rounded apex is upcurved in the form of a hook. Setae whitish, with alternate joints ringed with light fuscous. Legs whitish, anterior femur with a reddish ring in apical half, a small spot externally at base. Wings hyaline, venation pale fuscous, cross-veins whitish, a distinct red spot on posterior end of humeral cross-vein and base of radius. Three or four cross-veins in pterostigma.

Length of wing: ♂ 4.5 mm., ♀ 5 mm.; of body: ♂ 5 mm., ♀ 6 mm.

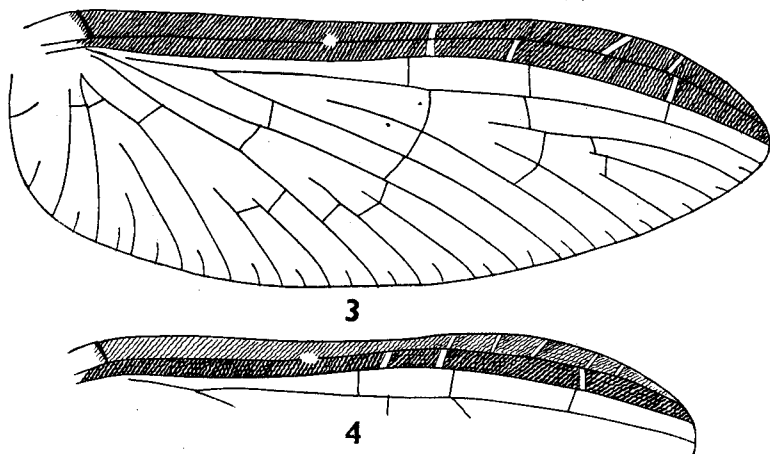


FIG. 3. *Cloëon bengalense* sp. n. ♀ Right wing.

FIG. 4. *Cloëon bicolor* sp. n. ♀ Costal region of right wing.

BENGAL: Calcutta, Nov.-Dec., 1945 (*D. E. Kimmins*). Males and females in the collections of the British Museum (N.H.) and the Zoological Survey of India. Females were found at rest during the day on the walls of buildings and the males were seen flying in swarms at 0800-0830 hours in November and 1430-1600 hours in December (Bengal Standard Time). During the latter month, no males were seen on the wing in the early morning.

***Procloëon harveyi* sp. n. (figs. 2, 6, 10).**

Allied to *P. bimaculatum* (Eaton), but distinguishable therefrom in the female sex by its luteous ground colour (in life), differences in body markings, and by its darker pterostigma.

Female. Head pale luteous, base of oculi and four small dorsal spots reddish. Eyes black, antennae with basal segments generally pale, second segment tipped with reddish. Prothorax luteous, with a median reddish stripe, narrow anteriorly and extending basally as a narrow border, and with a dark spot in each posterior angle. Mesonotum pale, darker posteriorly, metaseutum brownish. Abdomen luteous dorsally, with conspicuous red-brown markings on tergites 2, 3 and 6, and with smaller spots on other tergites as in fig. 10. Ventrally pale luteous, with two reddish lines which tend to fuse on the apical segments. Setae whitish, with alternating long and short blackish marks. Anterior femur orange-brown, dorsally with two pale spots, tibia and tarsus whitish. Median and posterior legs whitish, femora with indistinct blackish markings. Pterostigma dark brown as in fig. 2, remainder of

costal and subcostal areas with indefinite pale brownish markings, a strong reddish-brown spot over humeral cross-vein.

Male. Eyes light fulvous, slightly more dilated than in *P. bimaculatum*, lower eyes green. Antennae pale fulvous, apex of 2nd segment dark brown. Thorax medium brown, with considerable paler areas on each side dorsally. Abdomen translucent whitish, with considerable reddish-brown markings (fig. 6). First tergite with vague reddish suffusion, 2 and 3 each with a distinct triangular patch in apical angles, 4 and 5 with a narrow apical line interrupted centrally, 6 with a triangular patch in each apical angle, 7 with a pair of less defined reddish patches, 8 and 9 mostly reddish-brown, 10 with a trifold fuscous mark. Ventrally whitish, with a median red-brown band on sternites 8 and 9, and apex of 7. Forceps whitish, shaped much as in *P. bimaculatum*, chitinous process between them more pointed. Setae white, with sparse reddish annulations. Legs whitish, anterior femur banded with reddish apically, median and posterior femora with fine reddish-black lines on ventral carinae. Wings hyaline, venation pale fuscous, with a red-brown dot at junction of radius and humeral cross-vein.

Length of wing: ♂ 4 mm., ♀ 4 mm.; of body: ♂ 5 mm., ♀ 6-7 mm.

BENGAL: Calcutta, Oct.-Dec., 1945 (*D. E. Kimmins*).

Holotype female in collections of the British Museum (N.H.), paratypes male and female in collections of the British Museum (N.H.) and the Zoological Survey of India.

Many of the specimens, especially the males, were damaged by the journey through the post to England. This species is named after Mr. J. W. Harvey, a good naturalist and brother officer with whom I spent much of my off-duty time in the R.A.F., both in England and in India.

***Cloëon bengalense* sp. n. (figs. 3, 7, 11).**

? *Cloëon marginale* (Hagen), Eaton, 1885, *Trans. linn. Soc. Zool.* (2) 3: 181 (♀).

The wing marking of the female of this species very closely resembles that described by Eaton in the female of *Cloëon marginale* (Hagen). This latter species was, however, described from one or more female subimagines, and the female imago later attributed to it by Hagen has been shown by Eaton to be a *Teloganodes*, not *Cloëon*. Amongst the examples in the McLachlan collection determined by Eaton as *Cloëon marginale* (Hagen) are females of two different species. One of these females, from Ceylon, agrees very well with his description of *C. marginale* and the other (from N.W. India) is more the pattern of my second species of *Cloëon*. This confusion has raised doubts whether his example from Ceylon is truly a female of *C. marginale* (Hagen). Collecting in the type locality (Rainbodde, Ceylon) is needed to establish the identity of Hagen's species, and under the circumstances I have thought it wiser to treat as new the species represented by my series from Calcutta.

The living female is light blue-green, with a dark brown median dorsal stripe. Eyes blue-green, legs greenish, setae white, faintly annulated with brownish. In fluid the blue-green colour fades to a creamy white.

Female. Head whitish, with two broad, dark brown stripes covering the greater part of the head, antennae with the two basal segments heavily marked with dark brown apically. Pronotum with two broad, almost contiguous, median, red-brown stripes, and a small spot towards each posterior angle. Meso- and metanota with a broad, dark brown, median band, median suture finely whitish. A red-brown spot above posterior coxa. Abdomen dorsally

with a reddish-brown stripe occupying about one-half of total width (fig. 11). On tergites 3 and 6 the band is expanded laterally almost to the margins, and on tergites 2 to 9 there is a narrow, median, pale area and a pair of elongate, divergent, pale spots basally within the dark band, and on tergites 2 to 7 there is also a small dark spot laterally on sternites 2 to 8. Setae whitish, faintly annulated with brownish. Legs whitish, anterior femora shaded with red-brown on anterior surface. Wings hyaline, with dark brown venation, costal and subcostal areas dark brown (except basad of the humeral cross-vein), cross-veins and bulla white.

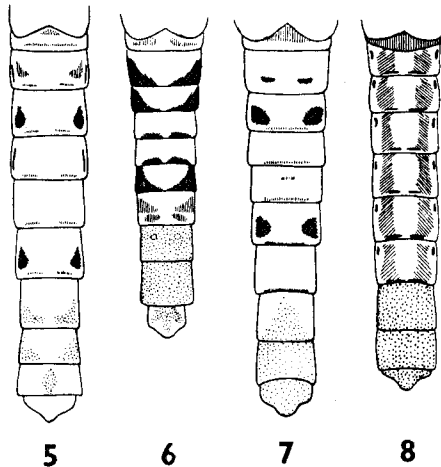


FIG. 5. *Procloëon bimaculatum* (Eaton). ♂ Abdominal pattern, dorsal.
 FIG. 6. *Procloëon harveyi* sp. n. ♂ Abdominal pattern, dorsal.
 FIG. 7. *Cloëon bengalense* sp. n. Abdominal pattern, dorsal.
 FIG. 8. *Cloëon bicolor* sp. n. ♂ Abdominal pattern, dorsal.

Male. Head dark luteous, with orange brown eyes; antennae luteous with dark brown markings on apices of two basal segments. Thorax dark brown, with paler markings on sides and beneath. Abdomen either translucent or opaque whitish, with red-brown markings varying in intensity in individuals (fig. 7). Tergites 2 to 7 with slight reddish or fuscous shading at apices, 2 with a pair of indefinite reddish spots, 3 and 6 with strong reddish spots, 8 to 10 either fuscous or reddish. Ventrally whitish, except 8 and 9, which are pale fuscous. Forceps of the pattern of *C. dipterum*, basal segment pale fuscous, remainder white. Setae white, with sparse reddish or fuscous annulations. Legs whitish. Wings hyaline, venation pale fuscous, stronger at base of costa and radius.

Length of wing: ♂ 5 mm., ♀ 5 mm.; of body: ♂ 5 mm., ♀ 6 mm.

BENGAL: Calcutta, Oct.-Dec., 1945 (*D. E. Kimmins*).

Holotype female in British Museum (N.H.), paratypes male and female in British Museum (N.H.) and Zoological Survey of India.

The males assigned to this species were on the wing during the middle of the day in November and December. The females of this species and also those of the two following species sit with the wings closely pressed together over the back, the body straight and not upcurved between them.

Cloëon bicolor sp. n. (figs. 4, 8, 12).

Female (in fluid). Head warm luteous, with two castaneous longitudinal stripes, one on each side of the median line; eyes light grey (in life light blue-green); antennae pale luteous, basal segment internally with a piceous spot, 2nd with a piceous apical ring, style piceous except at base. Pronotum luteous with a pair of castaneous median stripes, and a spot or narrow line towards basal angles. Mesonotum pale luteous, with narrow line towards basal angles. Mesonotum pale luteous, with narrow brownish median and humeral stripes. Abdomen luteous, with a median dorsal castaneous band, not widened on segments 3 and 6 (fig. 12). Tergites 2 to 8 basally with a lanceolate median, and two triangular pale spots, and a small castaneous line on lateral margins. Setae pale, with sparse blackish rings. Legs luteous, anterior femora light castaneous above. Wings hyaline, with a luteous costal and dark brown subcostal streak. Costa, subcosta, radius and cross-veins in costal and subcostal areas pale, remainder of venation fuscous.

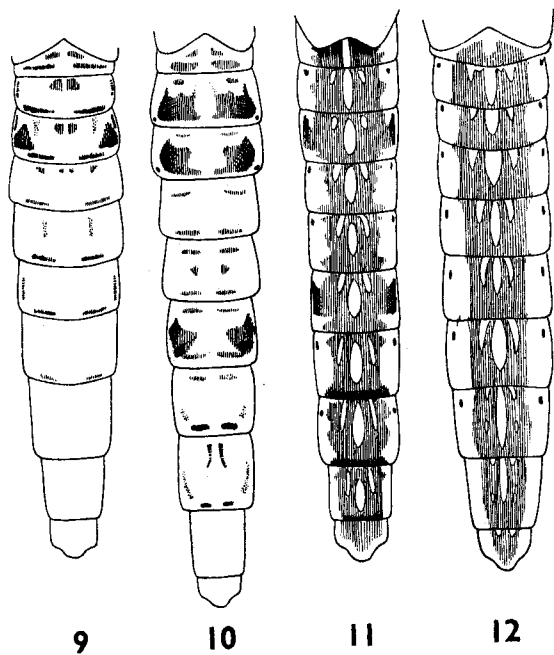


FIG. 9. *Procloëon bimaculatum* (Eaton). ♀ Abdominal pattern, dorsal.

FIG. 10. *Procloëon harveyi* sp. n. ♀ Abdominal pattern, dorsal.

FIG. 11. *Cloëon bengalense* sp. n. ♀ Abdominal pattern, dorsal.

FIG. 12. *Cloëon bicolor* sp. n. ♀ Abdominal pattern, dorsal.

Female subimago (in fluid). Wings light greyish with faint indications of costal streak. Imaginal body markings showing through the skin, ground colour in life pale green.

Male (in fluid). Eyes orange to orange-yellow. Thorax pale brown, often with a darker median stripe. Abdomen translucent white or whitish, segments 8 to 10 reddish or orange-brown above, white, sometimes tinged with reddish, beneath (fig. 8). Segments 2 to 7 vary considerably in the extent of their markings, from a suggestion of a reddish-brown transverse apical line to a definite pattern of two reddish triangles and a short reddish lateral line on the tergites, and a suffusion of reddish and a reddish lateral line on the sternites.

Setae and forceps white, the latter similar in pattern to *C. dipterum*. Legs whitish, anterior femur finely lined with piceous. Wings hyaline, venation pale piceous, except costa, subcosta and pterostigmatic cross-veins, which are white.

Length of wing: ♂ 4 mm., ♀ 4.5-5 mm.; of body: ♂ 5 mm., ♀ 5 mm.

BENGAL: Calcutta, Nov. 1945-Jan. 1946 (*D. E. Kimmins*).

Holotype female in British Museum (N.H.), paratypes male and female in the British Museum (N.H.) and the Zoological Survey of India.

This species resembles *C. bengalense* Kimmins, but may be distinguished in the female sex by the paler, bicoloured costal streak and the difference in the abdominal pattern, which lacks the lateral extensions on segments 3 and 6. The male may be distinguished by the absence of the reddish spots on segments 3 and 6. The males were taken flying in small swarms, generally about 8-10 feet from the ground, between 1700 and 1730 hours, Bengal Standard Time. The females were fairly abundant on the walls of buildings, window-screens, etc., and the subimagines taken at light and also on the wing, 1730 hours, in January.

Cloëon viridis sp. n.

Female in life with apple green body, marked with reddish-brown, costal stripe yellow-green.

Female. Head pale yellowish-green, with two narrow reddish-brown stripes; antennae with two basal segments tipped with blackish. Eyes greyish (in life blue-green), with two parallel reddish lines on anterior half. Thorax yellowish-green, with a median and a narrower lateral band of reddish-brown. Abdomen yellow-green, with a broad dorsal band of reddish-brown. Tergites 2 to 7 with three pale basal marks much as in *C. bicolor*, and lateral marks on the tergites and sternites as in that species. Setae pale, with alternate narrow and broad dark annulations. Legs yellowish, anterior femur faintly reddish. Wings hyaline, with dark brown venation, except costa, subcosta and radius, which are pale. Costal and subcostal areas pale yellow-green.

Length of wing: 5 mm.; of body: 6 mm.

BENGAL: Calcutta, Oct. 1945 (*D. E. Kimmins*).

Holotype female and paratypes in the British Museum (N.H.).

This species was much less frequently met with than either of the two foregoing species, and I have been unable to associate any male with it with any degree of certainty. It resembles the female sex of *C. bicolor* Kimmins in markings of body, but is distinguished by the rather broader pale area dividing the head stripes, and particularly by the yellow-green costal stripe.

In addition to the foregoing, the following three Indian species of the genus *Cloëon* have been described:—

Cloëon marginale (Hagen), 1858, *Verh. zool.-bot. Ges. Wien* 8: 477 (Ceylon).

Cloëon pulchella Banks, 1913, *Proc. ent. Soc. Wash.* 15: 137 (Bengal).

Cloëon taeniolatum Navas, 1932, *Rev. Ac. Ci. Zaragoza* 15: 21 (Bombay).

Family CAENIDAE.

Caenis piscina sp. n. (fig. 13).

Male (dried). Head and thorax pale yellowish-brown, slightly greyish above, eyes purple-black. Abdomen translucent whitish, lateral margins of sternites, and also apical margins of some basal tergites, lightly marked with blackish, terminal segments cream. Setae and forceps white. Legs whitish, except anterior, which are shaded with purplish-grey. Wings hyaline, veins whitish, except subcosta and radius, which are purplish-black.

Female (in fluid). Rather more greyish than the male, and with a definite pattern of purplish-grey on tergites 1 to 7 (fig. 13). A small purplish spot on apex of median and posterior femora.

Length of wing: ♂ 2 mm., ♀ 2 mm.; of body: ♂ 2 mm. ♀ 3 mm.; of setae: ♂ 7 mm., ♀ 3 mm.

BENGAL: Calcutta, Oct. 1945, at light and in spiders' webs (*D. E. Kimmins*).

Holotype male (dry) and paratypes male and female (dry and in fluid) in the British Museum (N.H.).

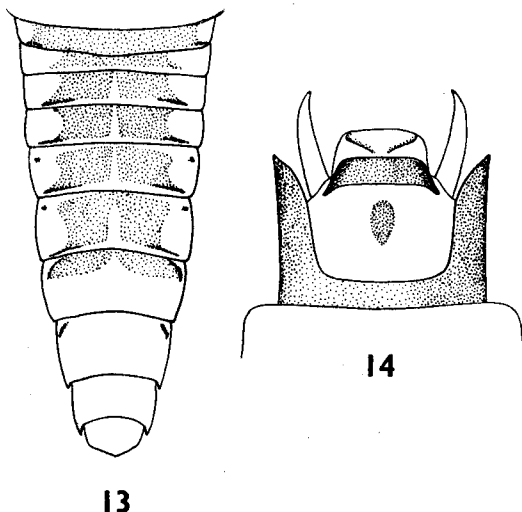


FIG. 13. *Caenis piscina* sp. n. Abdominal pattern, dorsal.
FIG. 14. *Caenis picea* sp. n. ♂ Apex of abdomen, ventral.

Caenis picea sp. n. (fig. 14).

Male. Head and compound eyes cool dark brown. Antennal segments and base of style grey, remainder of style white. Second segment of antenna tapering from base to apex. Thorax dark brown, whitish in parts on sides and ventrally. Abdominal tergites 1 to 8 whitish or very pale fuscous, 3 to 6 sometimes faintly margined apically with a pale reddish line, interrupted medianly. Tergites 9 and 10 cool pale brownish. Ventrally whitish, sternite 9 marked with cool brownish at sides, base and apex, and with an ovate median spot. Claspers whitish-grey. Setae white, with brownish basal segments. Legs white, anterior femur and apex of tibia with considerable grey markings dorsally. Wings hyaline, venation white apart from subcosta and radius, which are purplish-red.

Male subimago. Similar in general colour, but with purplish-grey markings on anterior tibia and tarsus.

Female imago. Paler than male. Thorax pale brown, with a paler sagittate mark posteriorly, its apex caudad. Abdomen creamy white, only slightly suffused with greyish apically and on tergites 1 and 2. Setae whitish.

BENGAL: Calcutta, reservoir of Baranagar-Kamarhati Waterworks, 29.xii.1945, 5.i.1946. 1615-1730 hours, Bengal Standard Time (*D. E. Kimmins*).

Holotype male in the British Museum (N.H.), paratypes male and female in the British Museum and Zoological Society of India.

On 29th December large numbers of this small Caenid appeared on the wing near and at the edge of the reservoir. Hatching was not observed, though duns were taken. It has a fairly active flight, resembling that of a swarm of Chironomids, but slower.

BOOK NOTICE.

Fleas of Western North America—their relation to the public health. By C. A. Hubbard. Pp. x+533, frontisp., pls., text illust. 8vo. Ames, Iowa (Iowa State College Press), 1947. Price U.S. \$6.00.

This book deals with the fleas of that area of North America west of the 100th meridian which includes the eastern approaches of the Rocky Mountains, the Kentucky Mountains, the Great Basin, the Great Cascade Sierra chain of mountains, the valleys between the Cascade-Sierras and the Coast Range, the Coast Range and the Pacific Slope. This area includes 66 genera and over 230 species and subspecies, some of which are important vectors of disease.

The work has been based on material collected by the author or his colleagues personally.

The text is divided into three sections. Part 1 deals with the contribution of earlier workers to the knowledge of the fleas of western America, the medical importance of fleas, field and laboratory technique and the anatomy of the flea in relation to its taxonomy.

Part 2 deals with the five subfamilies of Siphonaptera, HECTOPSYLLIDAE, PULICIDAE, DOLICHOPSYLLIDAE, HYSTRICHOPSYLLIDAE and ISCHNOPSYLLIDAE.

Part 3 covers the hosts of western rodent fleas and western lagomorpha fleas, their relation to plague, tularemia and murine typhus.

A bibliography of four pages and series of indices complete the work.

D. E. Kinnings Dr. T. T. Macan
Indian Ephemeroptera. With the authors compliments

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