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FOR

MDCCCLXIII.

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“Have no desires, but accept what circumstances may bring before you.”

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LONDON:  
JOHN VAN VOORST, PATERNOSTER ROW.

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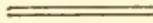
MDCCCLXIII.

# NEUROPTERA.



## SYNOPSIS OF THE BRITISH EPHEMERIDÆ.

BY DR. HAGEN.



### EPHEMERIDÆ.

BODY long and narrow; head rather small, but little broader than long; antennæ slender, short, pointed; with two short thicker basal joints and a fine bristle of greater length. Eyes generally large, of very different forms in the two sexes, but always further apart and smaller in the females, in the males sometimes very large, conical and placed near together. The males in two genera have double eyes, in which an upper segment branches off either as in many *Ascalaphi* (*Potamanthus*) through a lateral furrow, or in the form of a turban-like excrescence, which is generally brightly coloured (*Cloëon*). On the flat crown are the small ocelli remote from each other. The maxillary organs are undeveloped and unfit for eating. The prothorax is annular, sometimes very short. The mesothorax is very large, stout and barrel-shaped. The metathorax is small and sometimes ill-developed. Abdomen ten-jointed, long, cylindrical or flattened, generally attenuated towards the apex, beneath the dorsal plate of the last segment are inserted three long, thin, many-jointed, caudal filaments; the middle one is sometimes longer or shorter than the others, and in some genera or even as a sexual character is either entirely or almost entirely wanting. The caudal filaments in the male are always considerably longer than those of the female, often many times longer

than the body. Legs very thin and delicate, femora and tibiæ of nearly equal length; tarsi five-jointed, at the apex with two broad claws differing more or less in form; the first joint of the tarsi is generally very small. The anterior legs of the male are considerably longer than those of the female, sometimes as long as the body. In the males beneath the outer caudal filaments are two four-jointed, rather long anal forceps, between which protrudes the well-developed cleft penis, which differs in shape according to the species. Some of the females have a rounded egg-valve at the antepenultimate abdominal plate, but in others it is wanting, and the eggs appear to be pushed out by the disruption of the abdomen.

Wings four, in one genus only two are present, and the posterior wings are wanting in individual species of other genera. The anterior wings are large and triangular, the costa forming the longest side; the posterior wings are considerably smaller than the anterior wings, often almost quite undeveloped, resembling small scales. Near the costa and almost parallel to it are two simple longitudinal veins, the third is forked more or less, and supplies the entire wing with straight veins running to the margin. Transverse veins, in greater or less number, but never entirely wanting, connect the longitudinal veins and form cells, which are generally quadrangular. The apical half of the marginal field sometimes shows very irregular transverse veins and even rows of double cells.

The colouring of the *Ephemeridæ* is generally rather dull and monotonous. The head and thorax are often glossy. The colours of the abdomen are principally a more or less dark brown or black, yellow or yellowish-red in all shades, the belly sometimes white. The eyes are often very brightly coloured, blood-red, blue, green or yellow. The caudal filaments are generally paler than the body, the joints often

with dark rings. The legs are generally pale, but often the joints are darker; the anterior legs not unfrequently are darker than the others. The wings are generally transparent and hyaline, rarely dull; sometimes yellowish or brownish, or with dark spots; the costa, especially towards the apex, is often darker. The colouring in the sexes is often very different; the females being always the palest and having the abdomen unicolorous, when in the male it is of different colour.

The larvæ have almost the form of the imago, but yet are generally very unlike it; they are elongate-cylindrical or flattened, sometimes anteriorly much expanded. The strongly developed maxillary organs are adapted for carnivorous habits. The head is much larger than in the imago; on the sides of the abdomen are six or seven pairs of branchial tufts or plates; at the apex are three caudal setæ, often feathered. The pupa is only distinguishable by the appressed triangular wing-cases. Pictet's beautiful work gives detailed information on the larvæ, and is the best guide for the student.

The larvæ always live in the water, are very active, powerful and predacious; some genera lurk in holes in the mud at the sides of streams, others swim freely or await their prey under stones.

The pupæ of the *Ephemeridæ* are metamorphosed into the winged sub-imago, which in a short time again casts its skin and appears as the perfect imago. Hence, in this way, the *Ephemeridæ* have one metamorphosis more than other insects, yet some (especially the female of *Palingenia longicauda*) always remain in the sub-imago state, and never cast off the last skin. In the "Stettin Entomologische Zeitung," 1849, p. 365, I have given a detailed description of the mechanism of this last metamorphosis. The circumstance, that thus for each species there are four different winged forms (two for each sex), has much increased the

difficulties of the study of these insects, and impeded the identification of described species. Pictet first rendered the essential service of pointing out the characters by which the sub-imago can be distinguished from the imago; they consist in the dull membrane of the wings, the presence of delicate fringes of hair on the margins of the wings, and the distinct hairs on the caudal filaments. The form of the sub-imago is analogous to that of the imago, but the caudal filaments and legs are shorter. The colouring often differs essentially; that of the body is generally paler, with a greyish tinge, that of the opaque wings is always darker, yellow, grey or even blackish, but not bright.

The duration of the life of an *Ephemera* larva will in general not exceed a year; Swammerdam suspected for the larva of *P. longicauda* a duration of several years. When about to change it appears that the pupa climbs to the surface of the water, and the sub-imago swiftly escapes from the pupa skin; it then flies to some firm object and there changes in a short time (sometimes not till the following day) to the imago state. The name of these creatures indicates their known shortness of life, but this is only correct to a limited extent. Some genera, *Palingenia*, *Cænis*, *Oligoneuria*, appear towards evening, and are gone by morning; their life is but for a few hours. The males appear before the females; copulation takes place immediately whilst on the wing (the male beneath the female), and directly afterwards the eggs are ejected in two clusters into the water. The emission of the eggs takes place with such force that, partly through the disruption of the abdomen, the two ovaries appear to be ejected with their entire contents: at least in *P. virgo* the two oval bags of eggs make this credible. The circumstance that the eggs are not poured out through the oviduct in a continuous stream, but simultaneously in two lumps one on each

side, explains the use or rather the necessity of the double penis, since each side requires to be separately fertilized.

The other genera appear to live longer; especially those females which meet with no opportunity of copulation can live a long while, and Stephens notices a female of *C. dip-terum* which continued alive for three weeks. The imago takes no food, indeed its undeveloped maxillary organs are quite unserviceable; its sole object is the propagation of the species, hence speedy copulation. For the accomplishment of this the males perform in great numbers the well-known dancing flight; only very rarely is there a female in such a swarm, for directly she appears she receives proposals from one of the numerous males, and disappears with her consort immediately from the swarm. Generally the female is found sitting sideways in the grass, and probably requires a longer time to prepare her for her more important mission. The species of the genus *Palingenia*, which, by their appearance in such numbers, like falling snowflakes, have long attracted the attention of observers, are wanting in England. But even the English species of *Cænis* sometimes appear in Prussia in such quantities, that objects near the water, such as tables or windows of houses, are covered an inch thick, and on the Curische-Nehrung they are used to feed the pigs.

The best time for capturing *Ephemeridæ* is evening and night, especially on sultry, thundery days, but yet some species of *Potamanthus* and *Ephemera* are also to be found swarming in the air in great numbers in the morning and at mid-day, but then they are almost all males. The free-swimming larvæ and pupæ are easily netted in the water, and these are not difficult to rear in ordinary aquariums in which water plants are growing. The burrowing larvæ (at least *Eph. vulgata*) are easily found when one presses the net along the side of the steep clay banks of ditches. I

have never tried to rear these; probably it would be rather difficult, since their food in sufficient quantities ought to swim past them, whilst the free-moving larvæ seek their own food.

In collections *Ephemeridæ* can only be imperfectly preserved; when pinned they lose almost entirely their colour and markings, and their delicate abdominal skins change their form very essentially. Neither do they keep well in spirits of wine, their colours then going entirely. I have, however, observed, that on taking great numbers, which in their swarms is often possible, individual specimens will always partially preserve their forms, so that, in this way, one may obtain by degrees approximately good specimens. The alteration in the *Ephemeridæ* after death is naturally one of the main causes of the low state of our knowledge of species. I am of opinion that this evil can only be remedied in one way, namely, by the careful description of living specimens, and by noticing at the same time how the same specimens change after death. But since the males and females are generally very different, and also the imago and sub-imago differ essentially, this renders necessary for each species four, and if we add thereto the dead insects, eight separate descriptions; a work the completion of which will yet require considerable time, since at present we hardly know all the four-winged states of a dozen species, and only possess descriptions of the living insects of single species. Hence here there is rich unexplored field open to investigation!

One will seldom be in doubt as to the genus to which any species should be referred, but to distinguish the species is, on the other hand, a work of considerable difficulty, and the differences which I have mentioned are those which are apparent on the examination of dried cabinet specimens. In the first place, the wings must be examined, the form and

colour of which only varies very little; unfortunately these seldom afford characters easily intelligible, yet the transverse veins in the apical part of the marginal field are not unfrequently very serviceable. The legs and caudal filaments differ in length and colouring, but are rarely so striking as to furnish decided characters for dead specimens. The eyes lose their form and colour almost entirely, the prothorax and head likewise, the thorax loses at least its colour, the abdomen generally loses entirely both form and colour; so that only very few characters are retained by which the species can be recognised. The external sexual organs, that is, the anal forceps and penis of the male, the egg-valve and the last abdominal segment, appear to me in a number of species to furnish differences rather easily recognisable, although these organs likewise lose some of their form in drying. Besides this uncertainty of the characters, there is still an aggravating circumstance to be mentioned. The sub-imago sometimes undergoes a partial metamorphosis after being pinned, and hence specimens actually occur in which the head and thorax, or else only the abdomen and the caudal filaments, are freed from the skin of the sub-imago. In the larger species such a condition is easily perceived, but in the smaller species, which shrink more in drying, attention must be paid to this, in order to avoid mistakes.

At any rate the species of *Ephemeridæ* are considerably more numerous than is generally supposed. I possess about 150 species, and in the collections which I have examined there are many species which I do not possess, so that probably at the present time there are about 250 species in collections. We know comparatively few of the exotic species, but wherever insects have been eagerly collected, a large number of species has turned up, so that we may with certainty calculate that at the present time we only know a

fragment of the existing species. Pictet's beautiful monograph is doubtless the best work we possess on the *Ephemeriidæ*, and is certainly a rich source for the investigator. Considering the scanty materials of 54 species which he possessed, we must not complain that the descriptive portion is frequently insufficient, especially since of 28 species he only had before him one condition.

With respect to the English authors, I do not precisely know what occurs in the older authors, such as Berkenhout, Samouelle, Donovan; but, as far as I remember, it is unimportant. Leach, in the Edinburgh Encyclopædia, 1815, t. ix. p. 1, p. 127, divides these insects into two families, *Baëtidæ* and *Ephemeriidæ*, with two and three caudal filaments. The former contains two genera, *Baëtis* (*bioculatus*) with four, and *Cloëon* (*pallida*) with two wings; the latter one genus, *Ephemerella* (*vulgata*).

Curtis, Philos. Magazine, 1834, vol. 4, p. 120, describes very briefly nineteen species; 1 *Ephemerella*, 11 *Baëtis*, 4 *Cloëon*, 3 *Brachycerus*. The last-named genus is synonymous with *Cenis* of Stephens. In the second edition of the Guide (1837) he enumerates fifty-six species, viz. 17 *Ephemerella*, 7 *Brachycerus*, 22 *Baëtis*, 10 *Cloëon*. In his British Entomology he figures *Ephemerella cognata* and *Baëtis dispar* in his usual masterly style. The types I have not examined.

Stephens describes (1835), Illustrations, Mandibulata, vol. 6, p. 55, the fifty species already enumerated in his Catalogue, and figures three of them. His descriptions are very short and unsatisfactory, and, as he observes at p. 62, some of the insects were much injured by damp. The Curtisian types were not compared by him, and six species were only taken from the Curtisian descriptions. Of the sixteen species placed in the genus *Ephemerella*, only the two first belong thereto, the remainder to *Potamanthus*, some

even to *Baëtis* and *Cloëon*, although the presence of three caudal filaments is expressly given as the generic character. The genus *Cænis* with seven species is divided by Stephens into two sections, with long or short (*Brachycerus*) caudal filaments. That this character was only sexual seems to have escaped him. *Baëtis* includes eighteen species, of which, however, the eight last with faint venation belong to *Cloëon*. Finally, in *Cloëon* he has eight species.

My comparison of the types has admitted of a considerable reduction of species, but I fear I may thereby have committed mistakes. The investigation of the species is the more difficult, as the types are not labelled according to the Illustrations but according to the Catalogue, and some of them do not agree with the descriptions.

Westwood in his Introduction gives a masterly sketch of the families and their habits. In the Synopsis he enumerates fifty-six species, namely, 6 *Ephemera*, 10 *Leptophlebia* (*Potamanthus*), 23 *Baëtis*, 5 *Brachycerus*, 2 *Cænis*, 10 *Cloëon*. Walker in the British Museum Catalogue describes no new English species.

In working out this synopsis I have carefully compared the species in my collection with the existing descriptions, and have arrived at the conviction that our knowledge (or at any rate mine) of the *Ephemeridæ* is still very defective. Instead of the fifty-six species hitherto recorded as British, I can only make out the trifling number of twenty-five. I am sure that England possesses a considerably greater number of species, and probably on a more careful investigation of the types some of my reductions would be found to be incorrect. My work only represents the state of my knowledge of this remarkable family. I have, however, endeavoured to avoid errors as far as possible, and have therefore, when practicable, always made the descriptions

from English specimens. A number of species, kindly communicated by Mr. Francis Walker, has been of essential aid to me. It is to be hoped that English investigators will soon be incited to fill up the existing gaps.

### CÆNIS, Stephens.

(BRACHYCERUS, *Curtis*; OXYCYPHA, *Burmeister*.)

Head short, broad; eyes simple, small, far apart; thorax long and thick; wings large, almost without transverse veins, fringed at the hind margin and at the base; posterior wings wanting. Abdomen short, conical; in the male with small lateral anal forceps; in the female a large oval egg-valve; in the male with three very long caudal filaments, the middle one always the longest; in the female short, feathered near the base, at the tip with a stout tuft of hair (this peculiarity is observable in the sub-imago in both sexes); penis of the male large, double, invertedly triangular; the claws of the tarsi replaced by two large quadrate lobes.

Larva and pupa unknown. I once bred the perfect insect, but unfortunately without having observed the larva. They live in stagnant water which has clayey banks, and probably belong to the tribe of burrowing larvæ. The sub-imago only differs from the imago by the duller colour, shorter legs and caudal filaments, and hairy wings. It appears in multitudes in the middle of summer towards evening, especially on thundery evenings, immediately moults, then copulates and dies in the course of the night. The small yellowish eggs are deposited in two large lumps.

1. *C. MACRURA*, Stephens, *Illust.* p. 60, 1, pl. 29, fig. 1, ♂.

Imago. Head, thorax and base of the antennæ shining dark black-brown; abdomen and the entire underside

dark pitchy-brown; antennal bristle and caudal filaments grey; legs pale-brown; anterior legs grey; wings transparent milky-white; the two costal nervures black-brown, the basal half darkest. The colouring of the female is only a little paler; caudal filaments white, feathered for some distance, the base rather darker.

Length of the body  $1\frac{1}{2}$  lines; expansion of the wings  $4\frac{3}{4}$  lines; setæ ♂ 7 lines, ♀  $1\frac{1}{2}$  lines.

Habitat near London, in June.

The description is made from a pair communicated to me by Mr. Walker. Stephens says, "filaments faintly dotted with fuscous," which probably only arises from the darker parts of the joints. Probably this is identical with *C. luctuosa*, Burmeister, Pictet; but my specimens from Nice are rather smaller, and show distinctly the black spot at the tarsal joints mentioned by Pictet; this scarcely appears to be represented in the English specimens.

2. *C. HALTERATA*, F.; *C. grisea*, Pict.; *C. chironiformis*, Steph. 62, 6, ♀ imago; Curtis, Phil. Mag. 122, 2.

Imago. Head and thorax shining pale-brown; antennæ grey, the base darker; the antennæ of the female quite dark-grey; mesothorax anteriorly gently sloping; abdomen beneath yellowish, above brown-grey, with indistinct black transverse streaks from the stigma; legs white, the anterior legs greyish; anterior femora of the male dark grey, blackish at the joint, tibiæ and tarsi snow-white, with the tips rather darker; caudal filaments white. Wings hyaline; the two costal nervures black-brown nearly to the apex.

Length of the body ♂  $1\frac{3}{4}$ , ♀  $2\frac{3}{4}$  lines; expansion of the wings ♂  $4\frac{1}{4}$ , ♀  $5\frac{3}{4}$  lines; setæ ♂  $7\frac{1}{2}$ , ♀  $2\frac{1}{2}$  lines.

Sub-imago unknown. The description is made from living specimens from Prussia: the type of Stephens' *C. chironiformis*, has been compared with them and is identical; the specimens of Curtis I have not seen, but the description is not discordant. *C. interrupta*, Stephens, 62, 7, is wanting in Stephens' collection; it is a female, and should probably be referred here.

Habitat London, Bath (Stephens).

A male sub-imago from England probably belongs to this or the preceding species; according to the colouring it agrees with *C. halterata*, yet I received it with the described specimens of *C. macrura*.

3. *C. DIMIDIATA*, Stephens, 61, 2, ♂ imago; *C. pennata*, Stephens, 61, 5, ♀ imago; *C. brevicauda*, Stephens, 61, 3, ♀ sub-imago; ? *C. minima*, Curt. Phil. Mag. 122, 3.

Imago. Head and thorax brown (when alive violet-grey); antennæ white; mesothorax anteriorly steeply sloping; abdomen grey-brown, the terminal half white; caudal filaments white; legs white; the anterior legs grey; wings narrow, hyaline, the costal veins black-brown to near the apex, the basal half darkest.

Length of the body ♂  $1\frac{1}{2}$ , ♀  $1\frac{3}{4}$  lines; expansion of the wings ♂  $3\frac{1}{2}$ , ♀ 5 lines; setæ, ♂ 6, ♀  $1\frac{3}{4}$  lines.

Sub-imago similar throughout to the imago; the colours duller; the wings dim greyish-white, darker towards the base.

This species is readily distinguished by the white colour of the tip of the abdomen, which occupies 3 or 4 segments, and is strongly contrasted with the dark colour of the base. The description is made from living specimens from Prussia,

which have been compared with the types of the three species mentioned by Stephens. In *C. dimidiata*, Stephens says (head and thorax) "pitchy-black." I have observed differences in the colouring and met with some darker specimens, but never "pitchy-black." Stephens does not mention the dark base of the abdomen. Since his description was made from dead specimens, these two circumstances are not sufficient to prevent our uniting the species. The same remark may be made with regard to *C. pennata*, and although he here mentions a sub-imago, the description of *C. brevicauda* appears to suit very well for the female sub-imago. Curtis's description of *C. minima* is too short to decide on the species; it is very possible it belongs here.

Habitat London, Hertford, in June; Cambridge, Whittlesea Mere, in July.

The circumstance that *C. brevicauda* and *interrupta* are found in the same localities and at the same time does not prove anything for an identity of the species; since *C. halterata* and *dimidiata* fly simultaneously in Prussia in the same localities.

*C. Harrisella*, Curt. Phil. Mag. 122, 1; Steph. 61, 4; is only made out from Harris's figure, Exposition, pl. 6, f. 3. Harris figures a female sub-imago, which, according to the size given, belongs to *C. halterata*.

The genus *Palingenia*, Burmeister, has simple eyes, four dull wings with numerous transverse veins, three caudal filaments, the middle one very short. The two European species, *P. longicauda* and *virgo*, live in large sluggish streams, whence they seem to be excluded from the English Fauna; moreover both species, by their size, their colouring and their generally abundant occurrence, are so remarkable

that they could hardly have escaped the observation of English naturalists.

### EPHEMERA, Linné.

Head moderately broad ; eyes simple, semi-conical, rather large, far apart ; wings four, with numerous transverse veins ; the anal forceps of the male is long and four-jointed ; the penis is double, like a fork ; egg-valve hardly present ; three long caudal filaments of equal length ; the first tarsal joint very short.

Larva long, round ; head two-pointed ; mandibles ensiform, curved upwards. Legs flat, the anterior legs fitted for burrowing, on each side are six tufts of branchiæ.

The larvæ live in the banks of sluggish streams.

#### 1. *E. VULGATA*, Linné ; Stephens, 55, 1.

Imago. Head and thorax shining dark black-brown ; mouth beneath yellow ; antennæ black-brown, the apex of the bristle whitish ; abdomen yellowish-brown, with two black longitudinal streaks on the back, these expand externally at the base of each segment, so as to form a row of triangular spots ; between these streaks are two black longitudinal streaks on each segment ; anal forceps yellowish-brown ; caudal filaments of the same colour, the joints annulated a little darker ; legs yellowish-brown ; femora and tibiæ of the anterior legs black. Wings smoky-brown, with a hyaline spot at the base, transverse veins generally margined with brown ; marginal field of the anterior wings and a broader margin on the posterior wings darker ; in the middle of the anterior wings near the costa are three or four quadrate brown spots, and a single one near the base ; in

the middle of the posterior wings is generally a minute dark spot.

Female similar, but of paler colours; the middle of the head and the middle and sides of the prothorax rusty yellow; abdomen paler; the black streaks remain straight, and do not expand into triangular spots; the colouring of the wings is essentially paler than in the male, and the spots more indistinct.

Length of the body ♂ 7, ♀  $9\frac{1}{2}$  lines; expansion of the wings ♂ 15, ♀ 20 lines; setæ ♂  $15\frac{1}{2}$ , ♀ 12 lines.

Sub-imago similar to the imago throughout, only the general colouring has a dull grey tinge, the caudal filaments are black. Stephens rightly observes that the colouring of *E. vulgata* is very variable, the costa and wings especially are more or less dark. Pictet's *E. Danica* should be referred to *E. vulgata*.

This description is made from Prussian specimens which have been compared with the Stephensian types.

Habitat near London, common ("the May Fly").

In comparison with the abundance of the males, one rarely meets with the female; she does not share the mazy dance of the males, but sits solitarily on the grass.

I know also one female English sub-imago of the pale variety which Pictet figures, pl. 7, f. 2, but I am not yet certain whether it should not form a distinct species.

2. *E. DANICA*, Müller; *E. cognata*, Stephens, 56, 2; Curtis, Brit. Entom. fol. 708, ♀ imago; Collinson, Philosoph. Transactions, 1746, pl. 44, p. 363—366, fig.

Imago. Head and antennæ black; mouth beneath yellow; prothorax ferruginous, on each side with a

broad black stripe; mesothorax shining black; abdomen whitish-yellow, dark brown at the base and at the tip; each of the pale segments has on each side a black line on the back and on the belly; anal forceps brown; caudal filaments dark brown, the joints annulated with black; legs yellowish, the joints and tarsi blackish; the anterior legs black-brown; wings as in *E. vulgata*, but generally paler, with the transverse veins margined with darker brown, whence they have a very different appearance.

Female similar; the abdomen yellow above, with a wavy, black, longitudinal streak on each side; the tip of the abdomen yellow, with two thick black central stripes on each segment; the anterior legs and wings are paler than in the male.

Length of the body ♂ 7, ♀  $8\frac{1}{4}$  lines; expansion of the wings ♂ 15, ♀  $20\frac{1}{2}$  lines; setæ ♂ 17, ♀ 12 lines.

Sub-imago similar to the imago, but with the same differences as in *E. vulgata*.

Habitat near London, common.

This description is made from English specimens.

3. *E. GLAUCOPS*, Pictet, Ephem. 132, 3, tab. 8, f. 1—3.

Imago. Pale fawn-colour; prothorax with two lateral brown spots; mesothorax with red streaks; abdomen with black streaks; eyes blue; wings hyaline, with brownish margins, the hind wings rather darker; venation pale brown, the second longitudinal vein darker; spots as in *E. Danica*, but paler; legs yellow; caudal filaments yellow, with black annulations.

The female is paler.

Length of the body ♂ 8, ♀  $7\frac{1}{2}$  lines; expansion of the wings ♂ 14, ♀ 15 lines; setæ ♂ 8, ♀  $6\frac{1}{2}$  lines.

Sub-imago straw-yellow; mesothorax and metathorax with a black stripe on each side, which have between them a rhomboidal spot; wings dull yellowish-grey, with a few dark spots in the middle.

Habitat London.

Stephens probably united this species with *E. vulgata*; I have before me only two English specimens of the sub-imago.

### POTAMANTHUS, Stephens.

(EPHEMERA, *Stephens*(partim); BAËTIS, *Stephens*(partim).

Head rather small; eyes of the male double, large, far apart; wings four, unspotted, with numerous fine, transverse veins; males with four-jointed anal forceps; penis double; egg-valve long; three long caudal filaments of equal length; first tarsal joint very short.

Larva short, roundish; maxillary organs and legs slight; on each side are six branchial plates, sometimes with branchial setæ; three long caudal filaments.

The larva swims freely; at least some of them do so, and occurs in stagnant water or sluggish streams.

1. *P. MARGINATUS*, L., Zetterstedt; *Eph. stigma*, Stephens, 56, 3, ♀ imago; *Eph. talcosa*, Stephens, 57, 4, ♀ imago.

Imago. Head and thorax shining black; abdomen dark brown, the posterior segments with pale annulations; caudal filaments brown; legs yellowish-brown; the joints darker; anterior legs black-brown, the tarsi brown. Wings hyaline, the apical half and the costa rather smoky, the apical third of the marginal field brown, with rows of irregular double cells; venation yellowish-brown; anal forceps pale brown.

Female similar to the male, but the anterior wings with very little colouring, the smoky tint being almost entirely wanting; the apex of the marginal field is slightly tinged with brown, the large oval whitish egg-valve extends beyond the anus, and is cleft nearly to its base.

Length of the body ♂  $4\frac{3}{4}$ , ♀ 5 lines; expansion of the wings ♂  $10\frac{1}{2}$ , ♀  $11\frac{1}{2}$ ; setæ ♂ 11; ♀  $6\frac{1}{2}$  lines.

Sub-imago. The colouring is black, with a dull grey tint, only the four posterior legs and the anal forceps are pale brown; wings unicolorous, grey, the veins margined, and hence appearing darker; the marginal field of the anterior wings, especially towards the apex, is darker; the posterior wings only a little paler.

Habitat England.

Stephens' descriptions are made from female specimens of unknown locality, my description from Prussian specimens which I have compared with the types, and from an English sub-imago.

Of this species, which is so very common in the north of Europe, one very rarely finds a female amongst the swarms of males. I have bred this species. *P. marginatus*, Pictet, is a distinct species.

2. *P. GEERII*, Pictet; *Eph. dispar*, Stephens, 58, 8, ♂ imago and sub-imago; *Eph. submarginata*, Stephens, 58, 7, ♀ imago.

Imago. Head and thorax shining black; abdomen black-brown at the base and tip; the 3rd to 6th joints pale brown; caudal filaments yellowish, the joints annulated with brownish; anal forceps pale; legs pale brown, femora and tibiæ of the anterior legs

dark brown; wings and venation hyaline, the longitudinal veins of the anterior wings yellowish; apex of the marginal field with some furcate veins.

Female similar to the male, but the abdomen unicolorous brown; the large egg-valve projects beyond the anus, and is divided by a fissure in half its length into two triangular sharp points.

Length of the body ♂  $4\frac{3}{4}$ , ♀ 5 lines; expansion of the wings ♂ 10, ♀  $10\frac{1}{2}$  lines; setæ ♂  $7\frac{1}{2}$ , ♀  $4\frac{3}{4}$  lines.

Sub-imago blackish-grey; wings grey, the dark margined veins give them a banded and chequered appearance. In the middle of the anterior wings are a few larger white spots, which arise from the absence in those places of transverse veins.

Habitat near London in July, not scarce.

This description is made from Prussian specimens which I have compared with the types; I have English specimens only of the sub-imago.

Pictet's dimensions are not accurate, especially those given for the caudal filaments.

? 3. *P. DILUTUS*, Stephens; *Eph. diluta*, Stephens, 58, 10.

The type is wanting; according to the description I imagine the species must be a female *Potamanthus*, coming near to the preceding in colouring and size; one can hardly hope to indentify the species with certainty.

4. *P. FUSCUS*, Stephens; *Eph. fusca*, Stephens, 58, 9, ♂ imago; Curtis, Phil. Mag. 120, 7; *Eph. rufescens*, Stephens, 59, 12, ♂, ♀ imago; *Eph. rosea*, Stephens, 59, 13, ♂, ♀ imago.

*Baëtis obscura*, Stephens (= *Eph. rosea*), 65, 9, ♀ imago.

On a comparison of the types I have noted their identity as above; the description is made from English specimens which have not been compared with the types. *P. brunneus*, Pictet, Ephem. 217, 6, tab. 27.

Imago. Head and thorax shining pitchy-black; abdomen brown, the middle segments rather paler in the middle at the base; anal forceps brown; caudal filaments pale, the joints with darker annulations; legs pale-yellow, the anterior legs brown, the femora black. Wings hyaline; the posterior very small; venation very fine, the veins near the costa yellowish, in the apex of the marginal field are six straight, rather darker transverse veins.

Female similar to the male; egg-valve quadrate, a rectangular incision goes more than half the length and makes it two-pointed.

Length of the body ♂  $2\frac{3}{4}$ , ♀ 3 lines; expansion of the wings ♂  $6\frac{1}{2}$ , ♀  $6\frac{1}{2}$  lines; setæ ♂  $5\frac{1}{2}$ , ♀  $4\frac{1}{4}$  lines.

Habitat Hertford in June.

The description of *Ephemera fusca* suits very well. *Eph. rosea* is probably discoloured; *B. obscura* certainly appears to belong here. With reference to *Ephemera rufescens*, comparison should be made with *P. erythrophthalmus*.

5. *P. CINCTUS*, De Geer; Pictet, Ephem. 219, 7, tab. 28; *Eph. dubia*, Stephens, 59, 15 ♂.

Imago. Head and thorax shining black-brown; the upper segment of the eyes red; abdomen snow-white, the first and the three last segments black; anal forceps and caudal filaments white; legs white; femora of the anterior legs and the tips of the tibiæ black-brown; wings hyaline, the posterior very small; vena-

tion very delicate, some straight transverse veins at the apex of the marginal field.

Length of the body ♂  $3\frac{1}{2}$  lines; expansion of the wings ♂  $4\frac{1}{4}$  lines; setæ ♂  $3\frac{1}{2}$  lines.

Habitat near London.

The description is made from English specimens.

6. P. ERYTHROPTHALMUS, Schrank; Pictet, *Ephem.* p. 222, 8, tab. 29 and 30; *Eph. rufescens*, Stephens, 59, 12, ♂, ♀ imago.

Imago. Head and thorax reddish-brown; on the side of the mesothorax is a sort of yellowish stripe; abdomen reddish, the tips of the segments with a darker transverse streak; caudal filaments pale yellow, the joints annulated with brownish-red; penis pale brown, of the form of a narrow oblong plate, the apex with a triangular excision; legs yellowish, the anterior pair darker. Wings hyaline, the marginal veins yellowish; apical field with oblique veins and a row of double cells; the row of cells next the margin much smaller than the others.

Female very similar to the male, but the abdomen unicolorous and darker; egg-valve projecting beyond the anus, large, oval, the apex slightly emarginate.

Length of the body ♂  $3\frac{1}{4}$ , ♀  $3\frac{1}{4}$  lines; expansion of the wings ♂  $8\frac{1}{2}$ , ♀ 8 lines; setæ ♂  $5\frac{1}{2}$ , ♀  $3\frac{1}{4}$  lines.

Sub-imago entirely yellowish-grey; the caudal filaments distinctly annulated with darker; wings unicolorous ashy-grey.

Habitat near London.

Pictet refers Stephens' *Ephemera rufescens* to this species, and probably he is right; when I was examining the Stephenian types, I was not sufficiently acquainted with the dis-

tinguishing characters of *P. erythrophthalmus*, and have probably been in error in referring *E. rufescens* to *P. fuscus*.

The description is made from English specimens, which however I have not compared with the types.

Possibly *B. autumnalis*, Stephens, 67, 17, of which the description is only copied from Curtis, also belongs here; only as a *Baëtis* it should have only two caudal filaments.

### BAËTIS, Leach, Stephens.

Head rather long; eyes simple, in the male large, conical, almost confluent; in the female far apart; wings four, the posterior wings hardly one-fourth the size of the anterior wings; venation considerable and distinct; the males with long four-jointed anal forceps; penis furcate, securiform; egg-valve short, broad; two long caudal filaments.

Larva short, flat and broad; mandibles slight; branchial tufts on the side of each segment but the last; caudal filaments fringed. They swim freely or hide under stones in rapid streams.

1. *B. VENOSA*, F.; Pictet, Ephem. 167, 2, tab. 20, 1; *B. dispar*, Stephens, 63, 1, ♂ imago; Curtis, Brit. Ent. fol. 484; *B. venosa*, Stephens, 63, 2, ♀ imago.

Imago. Head and thorax shining chestnut-brown; abdomen yellowish-brown; the tips of the segments with broad dark-brown margins; anal forceps black-brown; caudal filaments very long, brown, at the base black-brown; wings hyaline, yellowish towards the base; costa yellowish, apical half of the wings brown, with irregular double cells in the marginal field; legs pale brown, tarsi darker; anterior legs black-brown. Female of similar colouring, but the

wings paler; egg-valve short, broad, with rounded corners.

Length of the body ♂  $6\frac{1}{2}$ , ♀ 7 lines; expansion of the wings ♂  $17\frac{1}{2}$ , ♀  $16\frac{1}{2}$ ; setæ ♂  $22\frac{1}{2}$ , ♀ 14 lines.

Sub-imago dull brown-grey; thorax yellowish in the middle; caudal filaments and legs brown-grey; wings grey, the transverse veins generally margined with darker; the marginal field not darker.

The description is made from Prussian specimens, which have been compared with the types of the sub-imago. I have English specimens before me.

Habitat near London; Ambleside, June; scarce.

2. B. LUTEA, Stephens; *Eph. lutea*, Stephens, 57, 5, ♀ imago; *Eph. marginata*, Stephens, 57, 6, ♂ imago.

Imago. Dark luteous; on the hinder part of the head near the eyes is a triangular black spot; the abdominal segments with a dark-brown band at the tips; caudal filaments yellow, the joints annulated with black; anal forceps and legs yellow, the anterior legs hardly darker; wings hyaline; costa pale yellow, with partially darker black-brown transverse veins; apex of the marginal field with straight transverse veins; penis double, straight, cylindric, the apex cup-shaped.

Female similarly coloured throughout, but paler; egg-valve oval; ventral plate of the last segment incised in the middle.

Length of the body ♂  $3\frac{1}{2}$ , ♀ 4 lines; expansion of the wings ♂  $11\frac{1}{4}$ , ♀ 14 lines; setæ ♂ 14, ♀  $8\frac{1}{2}$  lines.

Sub-imago coloured quite similarly to the imago, but duller, with a greyish tinge; easily recognised by the black-brown transverse veins of the costa.

Habitat near London, in June.

The description is made from an English male, and from Prussian specimens which I have compared with the types.

Stephens' description of *E. lutea* suits the female well, but the length of the caudal filaments is somewhat too little.

I have referred Stephens' *E. marginata* as the male; but he describes the head and thorax as too dark, viz. "black," and the caudal filaments as short as those of the female. A further comparison of these types would solve these doubts. From a comparison of the types it would also appear that the male of *B. costalis*, Stephens, should be referred to *B. lutea*.

3. *B. LONGICAUDA*, Stephens, 63, 3, ♂; ♀ imago.

*B. subfusca*, Stephens, 64, 5, ♀ imago; *B. costalis*, Curtis, Phil. Mag. 120, 7; Stephens, 64, 4, only ♀ (the ♂ belongs to *B. lutea*); *B. cerea*, Pictet, Ephem. 183, 10, tab. 23, f. 2; ♀ imago.

Imago. Ochreous-yellow, on the hind part of the head is a black streak on each side near the eyes; thorax shining; the joints of the abdominal segments darker; caudal filaments pale, the joints annulated with black; legs yellow, the anterior a little darker; tips of the femora brown. Wings hyaline, costa yellow with strongly marked black transverse veins; apex of the marginal field with straight transverse veins; egg-valve rounded, ventral plate of the last segment circular, not incised.

Length of the body ♀  $5\frac{1}{2}$  lines; expansion of the wings ♀ 18 lines; setæ ♀  $12\frac{1}{4}$  lines.

Habitat Hertford, in June.

The description is made from a solitary English female, which, however, has not been compared with the types. *B. cerea* of Pictet doubtless belongs here; the black streak on the hind part of the head, which is not mentioned in the

description, is represented in the figure. The description of *B. longicauda*, Stephens, suits very well, the length of the caudal filaments indicates the male; *B. subfusca* of Stephens indicates a smaller and darker female. Of *B. costalis*, according to my observations, the female only belongs to *B. longicauda*.

This species comes very close to the preceding in form and colouring.

Probably *B. mellea*, Curtis, Phil. Mag. 121, 5, should be referred here as the sub-imago. But where the allied sub-imago *B. straminea*, Curtis, 121, 5 a, should be referred, I cannot say.

4. *B. ELEGANS*, Stephens, 64, 6, ♂ sub-imago, ♀ imago; Curtis, Phil. Mag. 120, 6.

The female in my collection, which, after a comparison of the types I had labelled *B. elegans*, I am not now able to separate from *B. lutea*. But as, according to my notes, *B. elegans* is a distinct species, I can only here quote the description of Stephens.

“Bright ochreous-yellow; abdomen palish-chesnut; filaments pale, the tips of the joints fuscous; legs very pale ochreous; the tarsi with the apex of each joint blackish; wings iridescent, pale ochreous-yellow; costa darker, especially towards the apex, forming a stigmoid spot.”

Length of the body  $4\frac{1}{2}$  lines; expansion of the wings  $13\frac{1}{2}$  lines; setæ 8 lines.

Habitat near London.

Probably *B. flavescens*, Curtis, Phil. Mag. 121, 8, should be referred here as the sub-imago.

5. *B. SEMICOLORATA*, Curtis, Phil. Mag. 121, 9; Stephens, 64, 7; Pictet, Ephem. 178, 7, tab. 22, f. 4—9.

Imago. Shining yellowish-brown; the tips of the abdominal segments with a brown stripe; caudal filaments pale, the joints rather darker; anal forceps pale; penis divided, cylindrical, the apex cup-shaped; legs brownish-yellow; the tip of the femora and the tarsi darker, the femora of the anterior legs internally darker; wings hyaline, the basal half yellowish, the apex of the marginal field with straight transverse veins.

The female similar to the male, but the wings destitute of yellow; egg-valve rounded; the last ventral segment oval, with the apex excised.

Length of the body ♂  $3\frac{1}{2}$ —4, ♀  $3\frac{1}{2}$  lines; expansion of the wings ♂  $9\frac{1}{2}$ — $10\frac{1}{2}$ , ♀ 10 lines; setæ ♂  $10\frac{1}{2}$ , ♀  $5\frac{1}{2}$  lines.

Sub-imago pale yellowish-grey; wings very pale yellowish.

Habitat near London.

The description is made from English specimens, but they have not been compared with the types. The larger males have the base of the wings less yellow, but otherwise appear identical.

6. *B. MONTANA*, Pictet? Ephem. 172, 4, tab. 20, f. 3.

Imago. Head and thorax shining pale-brown; abdomen yellow; tips of the segments with brown stripes, which laterally expand into triangles; the last joint unicolorous yellow; caudal filaments pale brown, the joints scarcely darker, the base dark brown; anal forceps brown; the cleft penis, of which, however, the

halves keep close together, is much expanded at the tip, and almost T-shaped; legs yellow; tarsi brown; anterior legs dark brown; wings hyaline, with brown transverse veins; costa pale yellow, with the apical half brownish; the apex of the marginal field with oblique, irregular, partially double cells.

Female similar to the male; the unicolorous abdomen darker; the costa of the wings paler; ventral plate of the last segment oval.

Length of the body ♂  $4\frac{1}{4}$ , ♀  $4\frac{1}{4}$  lines; expansion of the wings ♂  $10\frac{1}{2}$ , ♀  $11\frac{1}{2}$  lines; setæ ♂ 12, ♀ 7 lines.

Habitat England.

The description is made from English specimens. I have not seen Pictet's type, but the identity appears probable. Stephens' description of *B. elegans* suits for this species: perhaps it should be referred here.

7. *B. OBSCURA*, Pictet? Ephem. 182, 9, tab. 23, fig. 1.

Imago. Head and thorax shining-black; abdomen brown, the tips of the segments darker; caudal filaments dark fawn-colour, the joints annulated with darker near the base; anal forceps brown; penis divided (but not very perceptibly); legs brownish; wings hyaline; venation pale brown; the apical part of the marginal field with straight veins; costa very pale yellowish. Female with the abdomen unicolorous pale brown.

Length of the body ♂  $3\frac{1}{2}$ , ♀  $3\frac{1}{2}$  lines; expansion of the wings ♂ 9, ♀  $10\frac{1}{2}$  lines; setæ ♂ 7, ♀ 6 lines.

Habitat England, Ambleside.

The description is made from English specimens; Pictet's type I do not know. The *B. obscura* of Stephens, which

Pictet refers here, is a *Potamanthus*. Probably a sub-imago should be referred here which has the head and thorax yellowish, the abdomen brown and the wings ashy grey.

*B. carnea*, Curtis, Phil. Mag. 121, 9 a, the description of which is quoted by Stephens (65, 10) may probably belong here.

8. *B. LATERALIS*, Curtis, Phil. Mag. 121, 8 a, the description of which is repeated by Stephens, 65, 8, I cannot make out. According to my notes the male and female of a distinct species are in the Stephensian collection. But since Stephens quotes his *B. phæopa* as a synonym, and a specimen in my collection which on comparison with the types I had labelled *B. phæopa* is a sub-imago of *Cloëon*, I am unable to give any satisfactory explanation with regard to *B. lateralis*.

CLOËON, Leach, Stephens, Curtis.

(CLOË, *Burmeister*.)

Head small; eyes of the male double, the upper half turban-like; wings four, the posterior very small (in *C. dipterum* entirely wanting); venation very delicate; transverse veins few in number, generally only two rows in the middle of the anterior wings; male with powerful, three-jointed anal forceps; penis broad, deeply cleft; egg-valve divided; two long caudal filaments and a scarcely perceptible rudiment of the middle one.

Larva narrow, rounded; mandibles slight; seven pairs of small lateral branchial plates; caudal filaments fringed. The larvæ live as free swimmers.

1. *C. DIPTERUM*, Linné ; Pictet, *Ephem.* 266, 11, tab. 42 ;  
*C. dipterum*, Stephens, 68, 1, ♀ imago and sub-  
 imago ; *Eph. helvipes*, Stephens, 59, 14, ♀ imago ;  
*Eph. apicalis*, Stephens, 59, 11, ♂ imago ; *Baëtis*  
*culiciformis*, Stephens, 66, 14, ♂ imago.

Imago. Head and thorax black-brown ; eyes black, the turban-like part red ; abdomen pale fawn-colour ; the four last segments brown ; anal forceps white ; caudal filaments white, the joints and a slender ring in the middle of the joints blackish ; legs yellowish ; wings hyaline ; venation fine, whitish ; in the apical portion of the marginal field are some straight transverse veins ; posterior wings wanting. Female very different from the male, reddish-yellow ; eyes blue ; on the crown and prothorax are two small reddish streaks ; abdomen with a brown raised spot on the side of each segment and a dot in the middle ; egg-valve with oval tip, entirely cleft ; legs yellowish ; before the tip of the anterior femora is a red spot ; wings hyaline, the costa to a little beyond the second marginal vein yellowish-brown, marbled with white spots.

Length of the body ♂ 3, ♀  $2\frac{3}{4}$ — $3\frac{1}{4}$  lines ; expansion of the wings ♂  $8\frac{1}{2}$ , ♀  $7\frac{1}{2}$ — $10\frac{1}{2}$  lines ; setæ ♂ 9, ♀  $6\frac{1}{2}$  lines.

Sub-imago ♂. Eyes black ; turban orange ; head and thorax dull brown-grey ; metathorax pale brown ; abdomen grey, the points and sides, together with the last segment and the underside, paler ; anal forceps grey ; caudal filaments grey, the joints darker ; legs dull yellow, the tip of the femora and tarsi darker ; anterior legs greyish-yellow, the femora above and the tarsi darker ; wings ashy-grey.

Sub-imago ♀. Similar to the imago, the spots obsolete; wings unicolorous grey, the costa brown, spotted with white, but duller than in the imago. The pupa is distinguished by its black wing-cases, and swims very nimbly. The 2nd—6th abdominal segments have on each side above a pale spot behind a dark dot, and in the middle of the base is a small yellowish triangle; on each side are seven pair of branchial plates, but none on the three last segments; the seventh branchial plate is single, the others are double; caudal filaments pale, with the base of the joints annulated with dark to the middle; exactly in the middle is a long joint quite dark, with three slender pale rings; then follow some joints which are quite pale, the remainder is dark; up to the end of the white part they are fringed with double rows of long hairs, which are white on the white joints, and almost blackish on the darker joints.

Length of the body  $3\frac{1}{2}$ ; setæ  $2\frac{3}{4}$  lines.

This description is made from English and from Prussian specimens, which have been compared with the type; I reared the insect from the larva (which is still undescribed) and from the pupa.

Habitat common near London, end of May.

Stephens' *C. dipterum* decidedly belongs here; *Eph. apicalis* is the male according to a specimen which I had labelled after comparing it with the type; but the description says of the caudal filaments they are unicolorous; according to my notes *Eph. helvipes* (which from the description was probably a bleached specimen) should be the female. *B. culiciformis* also, according to my notes, is only the male of *C. dipterum*. Although this species varies considerably in

size and colouring, a further accurate investigation should be made in order to confirm my conclusions.

Synonyms for the imago are *C. dipterum* and *C. mar-moratum*, Curtis, Phil. Mag. 121, 1; and for the sub-imago, according to the conjecture of Curtis, *C. obscurum*, 121, 2.

2. *C. RHODANI*, Pictet, Ephem. 248, 2, tab. 37—39; *B. horaria*, Stephens, 66, 15, ♂ imago; *B. verna*, Stephens, 66, 16, ♀ imago; *B. cingulata*, Stephens, 67, 18, ♂ imago; *C. ochraceum*, Stephens, 68, 2, ♀ imago; *B. vernus*, Curtis, Phil. Mag. 121, 11 a.

Imago. Head and thorax shining black; the turban of the eyes red; abdomen pale brown, the tip darker; caudal filaments pale brown, with darker annulations; legs yellowish-brown, anterior legs dark brown; anal forceps pale, the thick basal joint brownish; penis short, not visible externally; wings hyaline; costa pale yellow, darker towards the apex; apex of the marginal field with numerous, irregular oblique transverse veins, which are only here and there united to form double cells.

Females similar to the male; abdomen entirely dark brown; the paler caudal filaments more distinctly annulated; ventral plate of the last segment two-pointed and deeply incised.

Length of the body ♂ 3, ♀ 3½ lines; expansion of the wings ♂ 9, ♀ 9 lines; setæ ♂ 9, ♀ 6 lines.

Sub-imago of both sexes unicolorous grey-brown; caudal filaments unicolorous brown; wings grey, costa rather darker, brownish.

Habitat near London, Hertford; May to July.

The description is made from English specimens; their identity with *C. Rhodani* appears to me very probable, but

I have not compared the types; however the dimensions given by Pictet in his description do not agree with the measurements in his figure. On examining the Stephensian types I noted that the four species above cited were identical, but I have no specimen before me which has been compared with the types. There is nothing in the descriptions which militates against their being referred here, but a further investigation is necessary in order to render my opinion certain. In order, therefore, to avoid mistakes, I have placed none of the Stephensian names foremost. A Prussian specimen which, after comparison with the Stephensian types, I had labelled *B. phæopa*, Stephens, is the sub-imago of *C. Rhodani*. Stephens himself refers this species to *B. lateralis* (Illust. 65, 8). The description, however, appears to refer to a sub-imago, but I cannot say with certainty of what species.

3. *C. DIMIDIATUM*, Curtis, Phil. Mag. 121, 6; Steph. 69, 7, ♂ imago; *C. cognatum*, Stephens, 69, 6, ♂ imago; *C. virgo*, Stephens, 70, 7 (partim) ♂ imago. Imago. Head and thorax shining chestnut-brown; abdomen clay-coloured, the tip brownish; the tips of the segments annulated with brown; caudal filaments pale yellow, the joints annulated with brown; anal forceps thin, cylindrical, pale brownish; penis small (apparently cylindrical and double); legs pale yellow, the anterior legs brownish; wings hyaline; venation yellowish; apical portion of the marginal field with some oblique veins; and closer to the marginal veins are some irregular transverse veins, which form smaller double cells. In the specimens which I take for the female of this, the abdomen is throughout of paler colouring; the wings and venation are as in

the male; but the caudal filaments are unicolorous pale, which makes their identity a little doubtful.

Length of the body ♂  $2\frac{1}{2}$  lines; expansion of the wings ♂  $6\frac{1}{2}$  lines; setæ ♂ 6 lines.

I consider as the sub-imago of this species some specimens which are of the same size and form of wing, but they are throughout of a dirty yellow, the caudal filaments with darker annulations; wings dull yellowish-grey, with the costa little darker.

Habitat near London, in June.

The description is made from English specimens, which have not been compared with the types. I noted that *C. cognatum*, *dimidiatum* and *virgo* (partim) were identical. The description of *C. cognatum* agrees, but the short caudal filaments indicate females, whereas the types are males. The yellow spot on the side of the prothorax in *C. dimidiatum* I could not perceive, but the specimens are much shrunk. According to the description of *C. virgo* it should have unicolorous caudal filaments, otherwise there is nothing against its identity.

Of this species I have only seen English specimens.

4. *C. PUMILUM*, Burmeister, Pictet, Ephem. 253, 4, tab. 40, fig. 2; *Baëtis bioculata*, Stephens, 65, 12, ♂ imago; *B. fuscata*, Stephens, 66, 13, ♂ imago.

Imago. Head and thorax shining dark brown; abdomen white, the tip brown; caudal filaments white; anal forceps white, with the base broad; legs white, tip of the femora darker; wings hyaline, venation delicate and pale; apex of the marginal field with a few straight transverse veins.

Female similar to the male throughout; only the abdomen is unicolorous black-brown above and pale beneath.

Length of the body  $1\frac{1}{2}$ —2 lines; expansion of the wings 6 lines; setæ ♂  $3\frac{1}{2}$ , ♀  $2\frac{1}{2}$  lines.

Sub-imago dirty yellowish-grey, with the tip of the abdomen darker in the male; caudal filaments grey; legs yellowish; wings dull grey.

Habitat near London; June.

The description is made from Prussian specimens, which I had labelled according to the types, and from English specimens. The description does not appear to refute the identity of the species of Stephens.

5. *C. BIUCULATUM*, Linné; Pictet, Ephem. 244, 1, tab. 34, 35; *C. albipenne*, Stephens, 69, 4, ♂ imago; *C. unicolore*, Stephens, 69, 5, ♀ imago; *C. hyalinatum*, Stephens, 68, 3, ♀ imago.

Imago. Head and thorax shining fawn-colour; turban of the eyes red; abdomen snowy-white, the three last segments yellowish-brown; caudal filaments white; anal forceps pale yellow, the basal joints very broad; legs white, the anterior yellowish; wings hyaline, the longitudinal veins pale yellow; the apical part of the marginal field with some wavy transverse veins, between which are the rudiments of other veins, still more irregular; posterior wings very small.

Female unicolorous, yellow; the tips of the abdominal segments brownish; caudal filaments white.

Length of the body ♂  $2\frac{3}{4}$ , ♀  $2\frac{3}{4}$  lines; expansion of the wings ♂ 7, ♀  $7\frac{1}{2}$  lines; setæ ♂  $4\frac{1}{2}$ , ♀  $2\frac{3}{4}$  lines.

Sub-imago unicolorous yellowish-grey; the dull wings yellowish-grey, paler in the female.

Habitat near London.

The description is made from English specimens and from Prussian specimens which have been compared with the types.

On investigating the Stephensian types I referred *C. albipenne* to the male, though the "nigrum" of the thorax does not agree; *C. unicolore*, Stephens, agrees for the female, as also does *C. hyalinatum*. According to my notes the female is also placed amongst *C. virgo*, Stephens (70, 8). The type of *B. striata*, Stephens, 65, 11, should also be the female of a *Cloëon*, but I cannot express any further opinion. The description, however, most decidedly indicates a male, and that of a species very near to *C. bioculatum*, if it be not identical; *B. autumnalis*, Curtis, Phil. Mag. 121, 11 b, of which the description is quoted by Stephens (67, 17) might perhaps be referred here.

I have before me some few sub-imagines of *Cloëon*, which I cannot refer to any of the above five species described. But it appears to me it would be unwise to construct from them new species before the imago is known.

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P.S.—Whilst correcting the proof sheets I learn with regret that the first investigator of British Ephemera, JOHN CURTIS, is no more. The insurpassable accuracy and like-life execution of his drawings will always secure for him a high rank in science. The examination of details, to which Entomology owes its greatest progress, was practised by him in a comprehensive degree, and to some extent thoroughly. As in the case of his great predecessor, Savigny, his eyes too truly used refused their further services, for Isis allows us not to glance behind her veil with impunity! It is to be hoped that his Collection, like that of Stephens, will be preserved for the purposes of science. To English Naturalists its loss would be irretrievable.

H. A. H.