

Part III. Read February 19th, 1885.

*Fourth Series of Group II. of the Genera of the Ephemeridæ.*

*Adult.*—The anal (8) and second axillar (9<sup>2</sup>) nervures, together with the inner margin of the mesothoracic wing, enclose a curved, trilateral, somewhat leg-of-mutton shaped space, which is abrupt at its anterior extremity; anal nervure distinctly separate from the pabrachial (7) at the base of the wing; first axillar (9<sup>1</sup>) more or less curved, and rather long; second axillar approximated to or united with the first at the base, where this is distinctly independent of the anal nervure; præbrachial nervure (6) essentially simple. Hind wings small or absent; costal border spurred or protuberant at about the first  $\frac{1}{3}$  of the wing's length; neuration incomplete, the subcosta somewhat curved. Thoracic spiracles straight-lipped, usually closed in the dried insect; mesothoracic spiracle without a guard, its valves unequal; when open, the apertures of both spiracles are oval. Pronotum of ♀ closely appressed to the mesonotum. Hinder tarsi absolutely 4-jointed, with the proximal joint long. Forceps-limbs sessile upon the segment, with a short fleshy protuberance from it between their proximal joints, which is not represented in the ♀. Penis normally retracted and invisible, very rarely protruded by captured living specimens. Median caudal seta aborted. Oculi of ♂ divided into two unequal parts; the upper segment, cylindrical or somewhat turbinate, is faceted solely on the terminal surface; the lower and much smaller segment, oval in form, is annexed to the under (or rarely to the anterior) orbit of the former, and is faceted all over with facets of less diameter than those of the turbinate part. Hinder ocelli large; the foremost much smaller. The virgin *imago* can live many days if kept in a moderately damp cool place. *Subimago* usually quiescent for at least twenty-four hours, standing upon all its feet with wings erect and setæ divergent.

*Section 9 of the Genera.*—Type of *Baëtis*. *Adult.*—Pronotum of ♀ transverse and short, prominent above and somewhat smooth, closely appressed to the mesonotum and receding in the middle behind. Hind tibia at least  $\frac{3}{4}$  as long, and sometimes nearly of the same length as the femur; the tarsus from about  $\frac{1}{2}$  to about  $\frac{3}{4}$  as long as the tibia. Ungues in every tarsus dissimilar each to the other. Mesothoracic wings large, ovate-oblong, gradually rounded off from the terminal to the inner margin; the first and second axillary nervures (9<sup>1</sup> and 9<sup>2</sup>) enclose a narrow space, which usually maintains an almost even width for some distance from the inner margin and (leaving cross veinlets out of account) commonly extends to the wing-roots. [In fig. 31 *d*, through individual aberration, the functions of 9<sup>1</sup> have evidently been usurped by an intercalary nervure, to which the numeral has therefore been assigned, whilst the true first axillary nervure is abbreviated and isolated.] Præbrachial nervure of the fore wing separate from the second of the following intercalary nervures, and therefore simple. *Nymph.*—Terminal margins of the mesothoracic wings free. Palpus of maxilla i. 3-jointed [probably 2-jointed in *Callibaëtis*], not shorter than the lacinia; the latter terminated at the tip with either spines or strong teeth, and near the tip nude externally, but armed with rigid setulæ, diversely in different genera, along the adjoining portion of the inner

edge. Tracheal branchiæ borne by segments 1–7 of the abdomen, all exposed, foliaceous, fringedless, and without fasciculated fibrils; those of segment 1 smaller than the intermediate pairs, sometimes minute and erect. Hinder angles of the abdominal pleuræ hardly produced at all. Setæ natatorial; the outer setæ ciliate along their inner side, and the median seta plumose, either throughout or in the greater part of their length. Natation agile, effected solely by undulations of the body and setæ, the legs trailing through the water extended at full length close to the sides.

The genera of this type have near relations with the *Leptophlebia* section of the second group of the Ephemeridæ. A common, though not universal, feature in the neuration of the fore wing in this group is noticeable in the order of shortening of the sectorial intercalary nervures, which are usually five in number. Their ordinary rank in diminishing length, when numbered successively from the foremost, is 5, 1, 4, 2, 3; or occasionally 5, 1 subequal to 4, 2, 3. In the third group of the genera, and also in some genera of the first group, their most frequent gradation is 5, 4, 1, 2, 3. Differences in the tarsi, and in the oculi of the males, disguise their affinities with the section of *Siphylurus* when adult; but their essential approximation to that type is manifest in the nymphs. The number of joints in the antennæ of nymphs of the *Baëtis* type largely exceeds the maximum hitherto observed in those of that section.

*Compsoneturia*, a genus of the *Ecdyurus* section of the third group of the Ephemeridæ, has the cross veinlets of the fore wings arranged very much in the same manner as in those of most of the genera of the *Baëtis* type. But, without looking at its hind wings and tarsi, and apart from other important differences, the forked præbrachial nervure (6) in the fore wing is sufficient to distinguish it from every genus of this type.

#### *Summary of Generical Characteristics.*—Type of *Baëtis*.

Among miscellaneous representatives of the genera, adult and in good condition, *Cloëon* is easily distinguished by the absence of hind wings; *Callibætis* by the large rounded costal projection and numerous cross veinlets of its broad, oblong, obtuse hind wings; *Baëtis* by hind wings as broad and obtuse as those of the preceding genus, but with the costal projection (if any) small and acute, and with scarcely a cross veinlet at all; *Centroptilum* by the extreme narrowness of its very small hind wings, and usually by the slenderness of their costal projection.

But to discriminate from *Cloëon* defective specimens of the other genera deprived accidentally of their hind wings is a task attended often with insurmountable difficulty. Satisfactory determinations of the genera of such examples may, however, be arrived at sometimes by means of the following indications afforded by the fore wings; or, when absolute determinations are impossible, a near approach may be made to their identification sufficient to facilitate the comparison of the defective specimens with better examples of the same insects. In the first place, it may be noted that in genera of the present type the rudimentary intercalary veinlets of the terminal margin of the mesothoracic wing are disposed either singly or in pairs. In a large majority of the species of *Cloëon* and *Centroptilum*, as well as in many of *Callibætis*, these veinlets are single. As a rule, the species of this last genus have more numerous cross veinlets than the others

in their fore wings, and this is especially noticeable in advance of the cubitus (4) in the proximal half of the wing. *Cloëon* and *Centroptilum* cannot be distinguished from one another absolutely by their mesothoracic wings; but several species of the former genus can always be recognized by peculiarities of minor detail not essential characteristics of that genus. The aforesaid intercalary veinlets are paired in *Baëtis*, in a few exotic species of *Centroptilum* and *Cloëon*, and often in *Callibætis*; their relative length is usually greatest in *Baëtis* and *Centroptilum*, which, like *Cloëon*, have fewer cross veinlets than *Callibætis* in advance of the cubitus in the proximal half of the wing. In *Baëtis* a short veinlet from the inner margin of the fore wing almost invariably meets the second axillary nervure (9<sup>2</sup>) so as to form a small fork; but the corresponding nervure is simple in *Centroptilum*.

In the Appendix will be found a statement of the classification of these genera, adopted by me in 1868, which was accidentally omitted from page 20.

The nymphs may be tabulated as follows:—

TABULATION OF NYMPHS OF SECTION 9 OF THE GENERA.—TYPE OF BAËTIS.

Abdominal tracheal branchiæ all simple; the laminæ broadly obovate, obtuse. Terminal joint of the palpus of maxilla II. rotund, forming with the penultimate a clavate mass indented on the inner side at the joining. Terminal joint of the palpus of maxilla I. long.....	Pl. XLIV. <i>Baëtis</i> .
partly oblong and partly ovate-lanceolate, oblique and acute. Terminal joint of the palpus of maxilla II. short and ellipsoidly rounded at the tip, forming with the penultimate joint a simply clavate mass. Terminal joint of the palpus of maxilla I. very short.....	Pl. XLV. <i>Nameless Gen.</i>
partly linear-obovate-lanceolate, and partly broadly so, acute. Terminal joint of the palpus of maxilla II. quadrangular, forming with the penultimate joint a compressed clavate mass broadly and abruptly truncate at the end. Terminal joint of the palpus of maxilla I. long and slender.....	Pl. XLVI. <i>Centroptilum</i> .
Abdominal tracheal branchiæ mostly, or all, conduplicate with unequal segments; the larger segments of the laminæ irregularly subrotund; the laminæ of the hindermost branchiæ single. Terminal joint of the palpus of maxilla II. large and compressed, forming with the penultimate joint a compressed clavate mass obliquely truncate and acute at the extremity. Palpus of maxilla I. triarticulate, with the terminal joint long and slender.....	Pl. XLVII. <i>Cloëon</i> .
of the first and second of the series somewhat contorted; those of the 3rd to 6th obliquely subovate; that of the seventh elongate-oval; all of the laminæ are duplicate, but the lesser lobes are much smaller in most of the series than those of <i>Cloëon</i> . Terminal joint of the palpus of maxilla II. small, forming with the penultimate joint a narrow slightly compressed mass, acute at the point. Palpus of maxilla I. (in alcoholic specimens) 2-jointed, with the last joint long; but if ever triarticulate, the terminal joint would be minute [the joining might have been obliterated in the samples examined].....	Pl. XLVIII. <i>Callibætis</i> .

## BAËTIS, Leach, 1815.

*Illustrations.*—*Adult* (details), Pls. XVI. & XVII. 29 *a-f*, also LXIV. 9–20; (whole figures) see citations, under *Baëtis*, of *Cloë* Pictet *passim*. *Nymph*, Pl. XLIV.; see also Pictet, *op. cit.* pls. 34 & 36 (1843–5).

*Adult.*—Hind wing oblique, widened rapidly in front from the roots to the costal projection, usually rather broad and obtusely ovate, but sometimes oblong or ovate-lanceolate with the tip ellipsoidally rounded; costal projection in general small and acute, but in *B. atrebatinus* suppressed; neuration very sparse, comprising only 2 or 3 distinct longitudinal nervures (of which the intermediate is forked in some instances), the great cross vein, and in certain species very scanty feeble traces of rudimentary cross veinlets or intercalar veinlets that are liable to much individual variation. Fore wing [except *B. Salvini*, Pl. XVI. 29 *a*] devoid of colour ornamentation; marginal and submarginal areas [with the same exception] free from cross veinlets from the great cross vein to the bullæ; terminal margin beset with paired rudimentary intercalar veinlets; cross veinlets in the disk disposed mainly in two dislocated series between the subcosta and the cubitus (5), and two, also dislocated, behind the latter nervure, with occasional sparse indications, near the base and tip of the wing, of others irregular and defective, all at some distance from the terminal margin. Of the series in advance of the cubitus, the innermost commences at the subcosta or radius shortly beyond the bullæ and extends quite to the cubitus, if not farther, often blending with the outermost of the posterior series; the second series in advance of the cubitus starts abreast of the former just before the pterostigmatic dilatation of the marginal area, and terminates at the hindermost of the sectorial intercalars; the defective third anterior series nearer the apex of the wing is usually represented by only a single cross veinlet uniting the shortest of the sectorial intercalars with the one immediately in front of it. Of the two main series of cross veinlets posterior to the cubitus the outermost is the longest, extending most commonly from this nervure to the first axillar, but sometimes to the second axillar; between the cubitus and the pabrachial (7) nervure the cross veinlets composing it are liable to displacement outwards so as to be nearly in even line with the innermost of the anterior series, above described, rather than with the remainder of their own series: the second of the series posterior to the cubitus is liable to a similar dislocation outwards between the same two nervures, and to displacement inwards posterior to the anal (8) nervure; its first portion reaches from the pabrachial to the cubitus [in *B. Salvini* it is prolonged to at least the sector (4)] somewhere near the proximal extremity of the fifth sectorial intercalar; its intermediate portion is a single cross veinlet between the pabrachial and anal nervures, in a line with the junction of the sector and cubitus; its third portion lies nearer the wing-roots between the anal and second axillar nervures; sometimes a third posterior series is indicated by a few cross veinlets quite close to the axilla, which commences at the anal nervure. Forceps-limbs of ♂ 4-jointed; basal joint short and compact, considerably the stoutest, and suddenly contracted towards the distal joining; second joint rather stout and usually tapering gradually from the base; third joint comparatively slender, subcylindrical,

often somewhat curved, and usually much the longest; fourth joint commonly subglobular or oval and much the shortest, seldom elongate-oval and as long as the third. The interspace between the basal joints of the forceps-limbs varies in relative width with the species. Lobes of the penis without apparent stimuli. The intermediate segments of the ♀ abdomen are mutually subequal in length. Caudal setæ in ♂ im.  $2-2\frac{1}{2}$ , in ♀ im.  $1\frac{1}{4}-2\frac{1}{2}$ , in ♂ subim.  $1\frac{1}{6}-1\frac{3}{7}$ , in ♀ subim.  $\frac{7}{8}-1\frac{3}{7}$  as long as the body. Fore tarsus of ♂ very nearly of equal length with the tibia, which is about  $1\frac{1}{3}$  as long as the femur; its joints in diminishing succession rank 2, 3, 4, 5, 1: fore tarsus of ♀ about  $\frac{2}{3}$  as long as the tibia, which is just as long as the femur; its joints rank 2, 5, 3, 1, 4. Hind tarsi of ♂ about  $\frac{2}{3}$  as long as the tibia; the joints, shorter than in the ♀, rank 1, 4, 2, 3.

*Nymph.*—Abdominal tracheal branchiæ all somewhat alike in form, each obtusely ovate or obovate and traversed lengthwise by a pinnately branched, irregularly subdivided trachea. Antennæ about as long as the head and thorax together. Outer caudal setæ about  $\frac{3}{4}$  as long as the body; median seta commonly  $\frac{2}{3}$  as long as it, but in some species (e. g. *B. melanonyx*) of shorter proportions; the fringes narrowed acuminate to the extremities of the setæ. Each mandible terminates in a slightly prolonged, compressed, and obliquely abrupt lobe, eroso-denticulate at its termination; endopodite absent. Palpus of maxilla I. as long as the lacinia, 3-jointed; the terminal joint slender and about as long as the other two together: the lacinia armed with compressed teeth at the point, that are preceded by a series of setulæ on the inner edge, arranged evenly and gradually increasing in length away from the teeth, so as to constitute an acute oblique-pointed flattened beard. Lacinia of maxillæ II. narrow and cultriform, broader than the subulate lobes of the labium; proximal joint of the palpus about as long as the remainder, which are compressed and combined into a clavate piece rounded at the tip and slightly indented on the inner side just before the tip, the terminal joint being subrotund and somewhat imperfectly delimited by suture from the penultimate joint. Tongue, as a whole, cuneate, with the narrower extremity truncate; the median lobe narrower than the paraglossæ and bluntly mucronate. Hind tarsus, claw excluded, about  $\frac{2}{3}$  as long as the tibia; the leg altogether about as long as the fore leg. Resident in running water and lakes; two brooded in temperate regions.

*Type.* *B. binoculatus* (in *Ephemera*), Linn.

*Distribution.* Europe, including Egypt and Greenland; Northern and Central America, the Argentine Republic, and perhaps Chili; Asia; Indo-Malay region and Australia.

*Etymology* doubtful; probably a misreading of *Bætis*, the classical name of the Guadalquivir.

*Synonymous* with *Brachyphlebia*, Westwood (1840). At p. 20 *ante* reference is made to the identity with *Baëtis* of the nymphs partly figured in detail by M. Vayssière (1882) under the name † *Centroptilum*; and also to the probability of those quoted by him as † *Cloëon* being only junior grades of the same. The difference in form of the laminæ of their tracheal branchiæ, judging from the description, is such as might readily be produced by the alcoholic solution in which the specimens were preserved. Distention of these laminæ by endosmosis, to a large or small extent, is an accident of common

occurrence; and M. Vayssière is not the first nor the second entomologist who has been misled by it.

The nymph of *Baëtis* has probably been reared by others besides myself. I have identified and examined those of *B. vernus*, *B. rhodani*, *B. gemellus*, *B. melanonyx*, and *B. pumilus*, in addition to many undetermined species.

The species of this genus being numerous are arranged geographically in the following order:—European, North American, Central American, South American, and Cingalese. The figures of wings and forceps of European species published in 1871 were engraved after a photograph on reduced scale of my original drawings; but the engraving was not faithfully executed in *fac-simile*, and consequently the value of the figures was impaired. I therefore deem it advisable to reissue some of them, on the scale of the original drawings.

#### EUROPEAN SPECIES.

BAËTIS BINOCULATUS, Linn. Plate XVI. 29 *b* (wings and forceps).

[*Ephemera*] or *E. bioculata*, Linn., [Act. Upsal. (1736) 27, no. 2; *id.*, Fn. Suec. ed. i. no. 751 (1746)]; *id.*, Syst. Nat. ed. x. i. 547 (1758); *id.*, Fn. Suec. ed. ii. no. 1473 (1761); [Geof., Hist. Abr. d. Ins. . . . Paris, ii. 239, no. 5, pl. xiii. 4 (1764)]; Müll., Fn. Ins. Fried. no. 556 (1764); Linn., Syst. Nat. ed. xii. pars ii. 906 (1767); Fab., Syst. Ent. 304 (1775); *id.*, Sp. Ins. i. 384 (1782); Ström. N. Saml. Kongl. Dansk. Vidensk. Selsk. Skrift. ii. 91 (1783); Fab., Mant. Ins. i. 244 (1787); Vill., C. Linn. Ent. iii. 18 (1789); [Zsch., Mus. Lesk. i. 150, no. 16 (1789)]; Gmél., Linn. Syst. Nat. ed. xiii. i. pars v. 2629 (1790); Ol., Encyc. Méth. vi. 419 (1791); Fab., Ent. Syst. emend. iii. pars i. 70 (1793); Schr., Fn. Boica, ii. pars ii. 199 (1798); Cederh., Fn. Ingricæ Prodr. 134 (1798); Walck., Fn. Paris. ii. 9 (1802); Lat., Hist. Nat. Crust. & Ins. xiii. 97 (1805); Shaw, Gen. Zool. vii. part ii. pl. lxxxii. (1806); Lamarck, Hist. Nat. d. Anim. s. Vertèbr. ed. i. iv. 221 (1817); Stewart, Elem. Nat. Hist. of Anim. Kingd. ed. ii. ii. 225 (1817); Guér., Iconograph. Règn. Anim. ii. pars i. pl. lx. 9 (1829–43); Gray, Griffith's Anim. Kingd. ii. pl. xciv. 9 [after Guérin] (1832); Zet., Ins. Lapp. col. 1046 (1840); Westw., Introd. . . . Classif. of Ins. ii. 25 (1840); Blanch., Hist. Nat. d. Ins. iii. 54 (1840); Wallengren, Christ. Vidensk. Forhandl. no. ii. 21 (1880).—*E. fuscata*, Linn., Fn. Suec. ed. ii. no. 1474 (1761); Müll., Fn. Ins. Fried. 63 (1764); Linn., Syst. Nat. ed. xii. pars ii. 907 (1767); Vill., C. Linn. Ent. iii. 19 (1789); Gmél., Linn. Syst. Nat. ed. xiii. i. pars v. 2629 (1790); Ol., Encyc. Méth. vi. 419 (1791); Fab., Ent. Syst. emend. iii. pars i. 70 (1793); Walck., Fn. Paris. ii. 9 (1802); Lat., Hist. Nat. Crust. & Ins. xiii. 97 (1805).—*E. diaphana*, Müll., Zool. Dan. Prodr. 143 (1776).—*E. flava*, Schr., Beitr. z. Naturgesch. 82 (1776); *id.*, En. Ins. Austr. indig. no. 605 (1781); Vill., C. Linn. Ent. iii. 22 (1789); Ol., Encyc. Méth. vi. 421 (1791); Schr., Fn. Boica, ii. pars ii. 199 (1798).—*E. † lutea*, Fourc., Ent. Par. ii. 352 (1785).—*E. notata*, Gmél., Linn. Syst. Nat. ed. xiii. i. pars v. 2630 (1790); Ol., Encyc. Méth. vi. 422 (1791).—*E. † culiciformis*, *id.*, *op. cit.* vi. 420, note [excl. descript.] (1791); Lat., Hist. Nat. d. Crust. & Ins. xiii. 98? (1805).—*E. † striata*, Walck., Fn. Paris. ii. 10? (1802).

*Baëtis bioculatus*, Leach, Brewst. Edinb. Encycl. ix. 137 (1815); Sam., Ent. Comp. 259 [*B. bioculata*] (1819); *id.*, Ent. Cab. ii. no. 53, pl. xxiv. 1 (1834); Steph., Ill. Brit. Ent. vi. 65 (1835); ! Etn., Ent. Mo. Mag. v. 88 (1868).—*B. binoculatus*, ! Etn., Trans. Ent. Soc. Lond. (1871) 111, pls. ii. 9 & v. 16, 16 *a* [details]; Hag. & Etn., *op. cit.* (1873) 401; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 309 (1874); Palmén, z. Morphol. d. Tracheensyst., Sect. i. pl. i. 1–7 (1877); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 86 (1878); ! Etn., Ent. Mo. Mag. xvii. 196 (1881); Palmén, Paar. Ausf. gange d. Geschl. org. b. Insect. S. 71 [anatom.] (1884).—*B. flavescens*, Curt., Lond. & Edinb. Phil. Mag. ser. 3 (1834) 121;

Pict., Hist. Nat. Névropt. ii. Ephém. 193 (1843-5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 561 (1853).—*B. autumnalis*, Curt., Lond. & Edinb. Phil. Mag. ser. 3 (1834) p. 121; Steph., Ill. Brit. Ent. vi. 67 (1835).—*B. fuscata*, Steph., *op. cit.* vi. 66 (1835).

*Brachyphlebia bioculata*, ! Westw., Introd. to Mod. Classif. of Ins. ii. 25 & Addend. to Gen. Synops. 158 (1840).

*Cloë bioculata*, Pict., Hist. Nat. Névropt. ii. Ephém. 244, pls. xxxiv.—xxxv. (1843-5); Hag., Smithson. Miscell. Coll. (1861) Synop. Neuropt. N. Am. 52 [excl. example in Brit. Mus.]; *id.*, Stet. Ent. Zeit. xxvi. 229 (1865); Oulianine, Neuropt. & Orthopt. of the Prov. of Moscow, p. 28 (1867).—*C. autumnalis*, Pict., Hist. Nat. Névropt. ii. Ephém. 270 (1843-5).—*C. † pumila*, Oulianine, Neuropt. & Orthopt. of the Prov. of Moscow, p. 28 (1867).

*Cloëon bioculata*, Walk., List of Neuropt. Ins. in Brit. Mus. 572, exempl. 1 *a-f* [excl. g.] (1853).—*C. autumnalis*, Walk., *op. cit.* 578 (1853).—*C. † pumilum*, ! Hag., Ent. Ann. (1863) 33; ! Etn., Ann. & Mag. of Nat. Hist. (3) xviii. 147 (1866).

*Subimago (living)*.—Wings pale grey or smoke-grey; the hind wings sometimes paler or whitish ochraceous. Femora greenish grey or very pale greenish yellow or greenish white, with pale grey tibiæ and black tarsi, the green tint more pronounced in the female sometimes, and then her fore femora are pale olive-green with a dark spot before their distal extremities, while her hinder tibiæ acquire a greenish yellow tint. Setæ pale grey.

*Imago (living)*.—♂. Turbinate eyes lemon- or bright yellow; lower eyes yellowish green, black-green, or piceous.

♂ *var.* 1. Thorax burnt sienna, or fuscous, or pitch-black above. Abdomen in segments 2-6 or 7 translucent white, with a more or less slight pale yellow tint, and with the spiracles and sometimes the tracheal trunks rubiginose or black; the remaining segments above either burnt sienna, or fuscous, or fusco-olivaceous, edged distally with bright yellow; the last segment sometimes lighter above than the others, and beneath either ochraceous or olivaceous. Setæ and forceps white. Femora yellowish white, the rest of the fore legs white or greyish white; the rest of the hinder legs white. Wings vitreous, with whitish neuration, but with the base of the subcosta and radius sometimes fuscous.

♂ and ♀ *var.* 2. Body either light bistre-brown or greenish bistre-brown or olivaceous above, with the extreme tips of the abdominal segments either narrowly darker or bright yellow, and the subcutaneous tracheæ black or intense sepia-brown; venter olivaceous, marked with two dark dots near the base of every segment. Setæ either greenish white or else white or greyish, and tinged at the bases with greyish or dusky. Eyes of ♀ either olivaceous, piceous, or black. Legs in some lights olivaceous; in others the fore femur becomes fusco-olivaceous, with the knee pale, and the tibia and tarsus either uniformly warm sepia-brown, or the tibia brownish black and the tarsus charcoal-black; hinder femora and tibiæ much paler than the anterior, and marked before the knee with a curved greyish spot; hinder tarsi grey. Length of body 4-8; wing 6-8; setæ ♂ im. 12-14, subim. 7-10, ♀ im. 10-12, subim. 8-10 mm.

*Hab.* Europe, from Portugal, near Cintra (380 ft., 27 April, 1880), eastwards to Southern Persia and Armenia (Hagen Mus.), northwards to Moscow and Scandinavia. North America, in Hudson's Bay Ter. (Dale Mus.). The species is common in rivers northwards

of the Pyrenees and Alps. Amongst localities in France where it has been captured may be mentioned Orthéz, Blois, and the Vosges.

*BAËTIS VENUSTULUS*, sp. nov. Plate LXIV. 10 (forceps).

*Imago (living)*.—♂. Turbinate eyes citron-yellow; lower eyes olivaceous. Notum greenish bistre-brown (virescenti-fuscum) varied posteriorly with bistre-brown; the parts adjoining the meso- and meta-sterna are of the former colour, or olivaceo-fuscous. Segments 2–6 of the abdomen translucid white, with a cretaceous tint on the dorsum, and black spiracles; segments 7–9 above fusco-olivaceous with ochreous joinings and dark stigmata, beneath more or less ochraceous; segment 10 somewhat of a purplish tint above. Forceps and setæ smoky white. Femora translucid white, tinted very faintly at the tips with cretaceous; tibiæ and tarsi smoky white, with the ungues and in the hinder tarsi the terminal joints darker. Wings and neuration colourless; pterostigmatic cross veinlets variable.

♀. Very like *B. binoculatus* ♀. Oculi and orbits of ocelli olive-green; a rufescent spot on each side between the base of the antenna and the oculi. Hinder femora spotless; tibiæ and tarsi all dark smoky grey, with the tarsal joinings and the tips of the terminal joints darker. Neuration of wings pitch-black. Abdominal spiracles (not the tracheæ) black. Length of body 4–4.5; wing ♂ 4.5, ♀ 5; setæ ♂ im. about 9, ♀ im. 6.5 mm.

*Hab.* Switzerland; the Rhone, in the vicinage of Geneva, above the confluence with the Arvé; 25 August, 1879, on wing in the evening before dark.

*BAËTIS SCAMBUS*, Etn. Plate LXIV. 9 (forceps).

*Baëtis scambus*, ! Etn., Trans. Ent. Soc. London (1870) 3; ! *id.*, *op. cit.* (1871) 112, pl. v. 17, 17 a [details].

*Subimago (living)*.—Wings, setæ, tibiæ, and tarsi cinereous; forceps-limbs and femora cretaceous, or sometimes the latter are greenish white and are marked in the ♀ almost imperceptibly with a cinereous spot before the knee.

*Imago (living)*.—♂. Turbinate eyes clove- or warm sepia-brown; lower eyes black. Notum jet- or pitch-black. Abdominal segments 2–6 translucent white or greenish white, faintly suffused with light bistre-brown; the others bistre-brown. Setæ white, with a few of the basal joinings darker. Wings vitreous. Femora either cretaceous or olive-grey; fore tarsus smoky grey; hinder tibiæ and tarsi greenish white, with ungues and the tarsal joinings slightly darkened.

♀. Body olivaceous-brown. Eyes intense olivaceous. Femora olivaceous; tibiæ and tarsi dark smoky grey. Wings vitreous, with pitch-black neuration. Setæ smoky grey, with subopaque joinings. Length of body 6–6.5; wing 6–7; setæ, ♂ im. 12, subim. 7, ♀ im. 9–10, subim. 5 mm.

*Hab.* England; Ashbourne and Norbury, Derbyshire, in the Dove and in the Henmoor Brook; <sup>p. 320</sup> June and September. Forceps rather similar to those of *B. binoculatus*; but the limbs are more slender, and are closer together at the base. Hind wings binerved.

BAËTIS VERNUS, Curtis. Plate XVI. 29 *d* (forceps).

? *Ephemera* † *bioculata*, Fourcroy, Ent. Paris. ii. 352 (1785).—? *E. testacea* [Zsch., Mus. Lesk. i. 50, no. 17 (1789)]; Gmél., Linn. Syst. Nat. ed. xiii. i. pars v. 2630 (1790); Ol., Encyc. Méth. vi. 422 (1791).—† *E. dubia*, ! Steph., Ill. Brit. Ent. vi. 59 (1835).

*Baëtis vernus*, Curt., Lond. & Edinb. Phil. Mag. ser. 3 (1834) 121; ! Steph., Ill. Brit. Ent. vi. 66 [*B. verna*] (1835).—*B.* † *culiciformis*, ! Steph., *op. cit.* vi. 66 (1835).—*B. phæopa*, ! *idem*, *inter synonym.* (1835).—*B.* † *striata*, ! *id.*, *op. cit.* vi. 65 (1835).—*B. phæops*, ! Etn., Trans. Ent. Soc. London (1870) 4; ! *id.*, *op. cit.* (1871) 115, pl. v. 21, 21 *a* [details]; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 310 (1874).

*Cloë verna*, Pict., Hist. Nat. Névropt. ii. Ephém. 270 (1843–5).

*Cloëon verna*, Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 578 (1853).

*Subimago (living)*.—Wings smoky or mousey grey; setæ and forceps smoky. Femora either testaceous grey, light greenish grey, or even greenish white, each with an ill-defined dark v-shaped mark before the extremity; tibiæ smoky, the anterior black at the tip; fore tarsus black; hinder tarsi cinereous, with black joinings.

*Imago (living)*.—♂. Turbinate eyes burnt-umber; lower eyes brown-black. Notum at first bistre-brown, changing with maturity to pitch- and jet-black. Dorsum of abdomen variously coloured; either bistre-brown or darker, with the extreme edges of the joinings greyish white; or in segments 2–7 bistre- or greenish grey and translucent, and in segments 8–10 bistre-brown with dark tracheæ; venter cinereous. Setæ white or smoky-grey. Forceps-limbs greyish white, or more of a greyish tint towards the base, with the last two joints white. Wings vitreous, with suffuscous longitudinal neuration. Fore femur subolivaceous, with a dark rounded spot before the tip; the tibia whitish grey, the tarsus dark grey: hinder femora either greenish grey, or cretaceous with a light greenish tint; tibiæ whitish; tarsi whitish or greyish white, with the joinings and the uncinatè claw scarcely darker.

♀. Very similar. Eyes sepia-black or black. Notum at first pitch-brown, becoming pitch-black or black. Femora olivaceous; tibiæ greyish- or greenish-white; tarsi charcoal-black with black joinings, the fore tarsus darker. Setæ white, tinged with brown-black basewards. Length of body 5.5–8; wing, ♂ 5–7, ♀ 7–9; setæ, ♂ im. 12–16, subim. 5, ♀ im. 10–12, subim. 7 mm.

*Hab.* Great Britain; Finmark, Hammerfest and Alten. It frequents English streams and rivulets in May, June, September, and October. The adult ♂ may be recognized by the forceps-limbs having each a callus at the interior extremity of the basal joint, no very marked denticulation at the inner base of the second joint, and an ovate-oblong terminal joint.

BAËTIS RHODANI, Pictet. Plates XVI. 29 *c* (hind-wing, ♂ head), and LXIV. 12 (forceps).

*Cloë rhodani*, ! Pict., Hist. Nat. Névropt. ii. Ephém. 248, pls. xxxvi.–xxxix. (1843–5); Brauer, Neuropt. Austr. 26 (1857); ! Hag., Ann. Soc. Ent. Fr. (4) iv. 39 (1864); Meyer-Dür, Mitth. Schw. Ent. Ges. i. 221 (1864); ? Oulianine, Neuropt. & Orthopt. of the Prov. of Moscow, p. 28 (1867); Ausser., Ann. d. Soc. Natur. Modena, Ann. iv. 136 (1869); Joly, Rev. d. Sc. Nat. Montpellier, v. 310, pl. vii. 17–18 (1876) [details].—*C. maderensis*, ! Hag., Ent. Mo. Mag. ii. 25 (1865).

*Cloëon rhodani*, Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 573 (1853); Hag., Ent. An n (1863) 31; !Etn., Ann. & Mag. of Nat. Hist. (3) xviii. 147 (1866).

*Baëtis rhodani*, !Etn., Trans. Ent. Soc. London (1871) 114, pl. v. 20, 20 a [details]; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 309 (1874); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 86 (1878); Palmén, Paar. Ausf. gänge d. Geschl. org. b. Insect. S. 64, 68, 71, taf. iii. 45 [anatom.] (1884).

*Subimago (living)*.—Wings either cinereous or dark brownish grey, with greenish grey neuration. Fore femur greenish grey, with a dark crescentic spot or an ill-defined light grey spot before its distal extremity, the tibia light sepia-grey, the tarsus dull black; hinder femora light greenish- or yellowish-white, the tibiæ greyish white, the tarsi dull black; setæ greenish grey, with reddish or warm sepia-brown joinings.

*Imago (living)*.—♂. Turbinate eyes intermediate in colour between deep sepia- and madder-brown above, much lighter at the sides; lower eyes deep sepia-brown. Thorax jet-black above. Abdomen in large examples greyish bistre- or umber-brown in segments 2-6 or 7, with the joinings opaque; the remaining segments of a richer umber- or bistre-brown, with ochraceous joinings; venter dark greenish grey, often with two short divergent sepia-grey lines, each followed by a dot near the base of almost every segment. Setæ greenish grey, with sepia-brown or dull red joinings. Forceps greyish or greenish grey, their third and fourth joints whitish, more or less. Femora light olive-green or dark greenish grey; tibiæ and fore-tarsus light grey; hinder tarsi light grey or black. Wings vitreous, the nervures very faintly tinged with bistre-grey.

*Variation*.—Small examples have segments 2-7 of the abdomen translucent light greyish, each of these having the usual three dorsal linear marks in the middle of its base and the spiracles faintly darker grey, and having the edge of the distal border of the segment in the middle of the back, and also a spot in the midst of the dorsum on each side, orange-fuscous. Legs greyish, the tibiæ in some lights appearing whitish with their tips dark grey, and the hinder tarsi dark grey.

♀. Very similar to the male; the abdomen opaque throughout. In specimens of either sex that have only just cast the subimaginal slough, the thorax is usually pitch-brown above; it becomes jet-black afterwards. Length of body 5·5-9; wing 5·5-9 ♂ and -12 ♀; setæ, ♂ im. 13-19, subim. 10·5, ♀ im. 16 mm.

*Hab.* Great Britain, in streams and rivers, ascending to upwards of 1000 ft. in Derbyshire; in the south this species is matured on sunny days in the depth of winter where the water has an average temperature at that season of about 51° F. Widely distributed on the Continent: the Vosges (M<sup>c</sup>Lach.); lowlands of Switzerland, *e. g.* Lake of Geneva (1230 ft.), Tirol (Brauer); also Corsica (Bellier). Common in Madeira up to 3000 ft. and in Gran Canaria, near Sta. Brigida and San Mateo up to about 4600 ft. The terminal joint of each of the forceps-limbs is small and globular.

BAËTIS BOCAGII, sp. nov. Plate LXIV. 13 (forceps).

*Subimago (living)*.—Wings tinted with griseous.

*Imago (living)*.—♂. Turbinate eyes dull light red; lower eyes dark olivaceous. Thorax jet-black above. Abdomen in segments 2-6 fusco-griseous, with the joinings of the segments and an abbreviated longitudinal line from the base on each side of the median

line of each of them darker; segments 7-10 fusco-lutescent; venter greenish grey, tinged with brown ochre in segments 8-10; the first two joints of the forceps lurid, varied with fuscous, the other two fumatose. Setæ smoky white, with rusty-reddish joinings. Fore femur greenish grey, the tibia and tarsus sepia-grey or dusky; hinder femora paler, the tibiæ and tarsi whitish grey or smoky, with black joinings. Wings vitreous; subcosta and radius of the fore wing, and other longitudinal nervures towards the base of the wing, light amber-yellow, becoming blackish in the outer part of the disk; cross veinlets likewise blackish. Length of body, ♂ im. 10, wing 10, setæ 19 mm.

*Hab.* Portugal. The streamlet near Bemfico, which passes under Alcantara, Lisbon; 23 May, 1880. The temperature of the water at the time was 66° F. Named out of compliment to the learned investigator of the Portuguese fauna, Senhor Barboza du Bocage.

BAËTIS GEMELLUS, sp. nov. Plate LXIV. 14 (forceps).

*Baëtis* † *rhodani*, var., ! Etn., Trans. Ent. Soc. London (1871) p. 114.

*Subimago (living)*.—Wings dark smoky grey in ♂, darker in ♀; setæ of a like colour, with rufescent joinings in ♂. Fore femur of ♂ dull yellowish tinged with grey, with a dark spot inside before the knee; tibia blackish grey or dusky; tarsus charcoal-black; hinder femora pale greenish smoky grey; the remainder of the hinder legs smoky grey, with the tarsal joinings black. Femora of ♀ light yellowish grey; tibiæ and tarsi smoky grey, with the tarsal joinings black.

*Imago (living)*.—♂. Turbinate eyes bright light red; lower eyes olivaceous or olivaceous-fuscous. Notum either light brownish ochre streaked with fuscous or pitch-brown, or else fuscous with the sutures raw-sienna yellow. Abdomen in segments 2-6 pellucid white, with the joinings and rounded lateral nebulæ above the pleuræ suffused with either yellowish fuscous or raw sienna; the remainder of the dorsum either raw sienna throughout, or only so in segments 9 and 10, when segments 7 and 8 are light brown-ochreous fuscous; segment 10 bright yellow beneath. Setæ smoky or dusky, with medium burnt-sienna red or black joinings. Fore femur and base of the tibia in some lights tinted with light amber-yellow, changing in other lights to a stronger yellow; the remainder of the tibia and the tarsus dusky or dull greenish grey, with darker joinings. Hinder femora either dull whitish amber, or whitish tinged with olive-green; tibiæ and proximal joints of the tarsi either whitish or light yellowish smoky white; the remainder of the tarsus dusky, with darker or black joinings; ungues black. Forceps smoky white or greyish fuscous; the basal joints raw sienna. Wings vitreous; the stronger longitudinal nervures slightly amber-tinted, and towards the base of the wing of a greenish grey tint; the costal projection of the hind wing slightly fuscous.

♀. Eyes pitch-black; the space between the ocelli, the basal joints of the antennæ, and a spot on each side intermediate between the eye and the insertion of the antenna, raw-sienna yellow; epistomum ochraceous, with fuscous carina. Abdomen fuscous above, with the terminal margins of the intermediate segments rufo-piceous, edged very narrowly in segments 2-5 with yellow-ochre, and with the sides of the dorsum lighter near the pleuræ; venter lighter than the dorsum, with the joinings darkened; the last two segments tinged with raw-sienna yellow. Legs somewhat as in the ♂, but darker;

the fore tibia olivaceous. In drying, the legs acquire yellowish amber tints. (The alpine condition.)

Length of body, ♂ 6–8·5, ♀ 6–11; wing, 6·5–11; setæ, ♂ im. 13–25, subim. 8·5, ♀ im. 11, subim. 8 mm.

*Hab.* Spring-water streams in the mountains of Switzerland, N. Italy, Savoy, and Central Italy: July to September. Thusis and Val Anzasca (M<sup>c</sup>Lach.); near Champéry, Valais, in streamlets having at altitudes of 3700–4000 ft., between 2 and 4 P.M. in August, temperature ranging from 54° to 62° and 68° F.; also at a spring in the same neighbourhood at Les Clous (4000 ft., 6·50 A.M., 13 August, 1879, water 45° F. [large specimen]): also near Samoëns (2280 ft., 5·30 P.M., 13 Sept., water 54° F.); also in Val Montjoie between Contamines and Notre Dame de la Gorge. Common in the Apennino Pistoiese near San Marcello, in streamlets tributary to the Limestone, both in the chestnut wood below Gavinana (2550–2750 ft.), and at a streamlet crossing the highway nearer San Marcello (2160 ft., 3·40 P.M., 27 July, '82, water 63° F.). The temperatures quoted give sufficient indications of the water-climate suitable to the species, and may be of use in the selection of sites for collecting. The Apennine specimens are just appreciably brighter in the colour of their bodies than Alpine examples; but the difference is very slight indeed.

BAËTIS ATREBATINUS, Etn. Plate LXIV. 15 (forceps).

*Baëtis atrebatinus*, ! Etn., Trans. Ent. Soc. London (1870) 4; *id.*, *op. cit.* (1871) 113, pl. v. 19, 19 a [detail].

This species (*living subimago & imago*) closely resembles *B. rhodani*, but is distinguishable therefrom by the almost complete suppression of the usual projection in front of the hind wing near the base of the costa, and by an acute prominent black point in a shallow rounded depression in the protuberant part of the segment [probably the point of the penis] above the forceps in the middle line of the venter. Length of body 7–8; wing 6–8; setæ, ♂ im. 11–13, subim. 8·5, ♀ im. 8–10, subim. 7·5 mm.

*Hab.* England. The Kennet near Reading, Berkshire; captured when in subimago and at rest upon herbage fringing the towing-path of the canal between the mill and the county bridge nearest the junction of the Basingstoke and Devizes railways: October.

BAËTIS TENAX, Etn. Plate LXIV. 16 (forceps).

*Baëtis tenax*, ! Etn., Trans. Ent. Soc., London (1870) 5; ! *id.*, *op. cit.* (1871) 116, pl. v. 22, 22 a [detail].

*Imago (living).*—♂. Turbinate eyes intense warm sepia-, or chocolate-brown; lower eyes sooty-black. Notum jet-black. Abdomen in segments 2–6 translucent, tinted with olive-brown, pale at the joinings and lighter towards the pleuræ, with the tracheal trunk slightly reddish-purple grey; the other segments opaque: venter light cinereous, tinged with orange in segment 9 between the forceps-limbs, and in part of segment 8, and ochreous in segment 10. Forceps-limbs whitish, sometimes darker at the base. Setæ white. Femora olivaceous or dark olive-grey, pale yellowish at the knees; fore tibia and tarsus cinereous; hinder tibiæ and tarsi smoky grey, with the tarsal joinings either

scarcely darker, or else narrowly black. Wings vitreous; neuration either pellucid whitish, or fuscous [perhaps according to the age of the specimen].

♀. Very similar. Length of body 6–8, wing 7–8·5, setæ, ♂ im. 14–16 mm.

*Hab.* England. Rills and streamlets on Ashbourne Green, Derbyshire, in June. Also at Woolbridge, Ringwood, Hants, in September. Distinguishable from *B. rhodani* by the minute dilatation or denticulation inside the extremity of the second joint of each forceps-limb, and the distinctness of the tubercle similarly situated in the first joint.

BAËTIS MELANONYX, Pictet. Plate LXIV. 17 (forceps).

*Cloë melanonyx*, Pict., Hist. Nat. Névropt. ii. Ephém. 258, pl. xl. 6 (1843–5).

*Cloëon melanonyx*, Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 574 (1853).

*Baëtis finitimus*, ! Etn., Trans. Ent. Soc. London (1871) 113, pl. v. 18, 18 a [detail].—*B. melanonyx*, *id.*, *op. cit.* (1871) 118 [after Pict.].

*Subimago (living)* ♀.—Wings smoky grey, with dull greenish grey or suffuscous neuration. Setæ dark smoky grey, with rubiginose joinings. Fore femur and tibia greenish grey, varied with black at the knee, and with a dark cloud near the extremity of the former; tarsus dark grey, with black joinings and ungues. Hinder femora smoky cretaceous, with a faint nebulosity before the extremity; tibiæ smoky grey; tarsus dusky, with the joinings and the lesser of the ungues black. Oculi olivaceous, with a movable black spot.

*Imago (living)*.—♂. Turbinate eyes chocolate-brown on the summit, and narrowly so at the base of the light yellow pedicel; lower eyes dull subolivaceous. Notum jet-black. Abdomen fuscous above, darker or more opaque at the tips of segments 2–6, and throughout segments 7–10; venter somewhat griseous in segments 2–6, lighter in segments 7–9, pale ochraceous in segment 10 and inside the basal joints of the forceps; the remainder of the forceps blackish basewards, but lighter distally. Setæ somewhat greyish, with darker joinings near the roots. Fore femur olive-grey, the tibia and tarsus dull blackish grey; hinder legs rather lighter, with the tarsal joinings narrowly black; coxæ olive-grey. Wings vitreous, with metallic gramineous (=medium green oxide of chromium) and light carmine reflections; pterostigmatic space of the fore wing slightly smoky or subopaque; neuration translucent, the finer nervures in some lights subpiceous, the stronger tinged with olive-grey.

♀. Eyes subpiceous. Thorax dull black, or pitch-black, with paler sutures; tegulæ sulphur-yellow. Abdomen either fuscous or pitch-black above, with the first three joinings conspicuously pale, the next three piceous, and the others rufo-piceous; venter either dark bistre-grey with pale joinings, or greyish, with the last two segments often somewhat ochraceous, traversed lengthwise by a pale median line, and having a dark rounded spot at the base on each side of that line in every dark segment. Setæ dusky, with darker joinings. Fore femur olivaceous; hinder femora light greenish grey; tibiæ and tarsi in some lights dusky, with black joinings; in other lights those of the fore leg appear pitch-black, and those of the hinder legs pitch-brown; wings vitreous, with the greater part of the neuration pitch-black; subcosta and radius olive-grey. Length of body, ♂ 5–7, ♀ 8·5–9, wing, ♂ 6–7, ♀ 8·5–11; setæ, ♂ im. 12–18, ♀ 13–18 mm.

*Hab.* A common alpine species in N. Italy, Savoy, and Switzerland: in the neighbour-

hood of Samoëns (3400–5100 ft.) and Champéry (4500–5760 ft.), in streams or torrents having temperatures ranging in August and the beginning of September from 42°–51° F. in the early morning, to 45° and 59° F. (rarely 62°) in the afternoon: also in the Engadine at Pontresina and (M<sup>c</sup>Lach. 13 August) the Val de Fain: also (M<sup>c</sup>Lach.) in July on the St. Gothard route, Val Bedretta, and at Gex, Ain, &c.; also Oberseisenthal (Meyer-Dür) and Val d'Entremont (Pict. in June).

**BAËTIS ALPINUS**, Pictet. Plate LXIV. 18 (forceps).

*Cloë alpina*, Pict., Hist. Nat. Névropt. ii. Ephém. 257, pl. xl. 5 (1843–5).

*Cloëon alpina*, Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 574 (1853).

*Baëtis amnicus*, ! Etn., Trans. Ent. Soc. London (1871) 117, pl. v. 24, 24 a [detail].—*B. alpinus*, *id.*, *op. cit.* (1871) 118 [after Pict.].

*Imago (living)*.—♂. Turbinate eyes chocolate-brown; lower eyes brown-black. Notum jet-black, with pale sutures. Dorsal segments of the abdomen fuscous, slightly paler at the joinings; venter mostly cinereous. Forceps black at the base, lighter distally. Setæ white or cinereous, with darker joinings near the roots. Fore femur greenish grey; tibia and tarsus smoky or dusky; hinder femora sometimes less of a greenish and more of an ochraceous tint, with a rufescent streak at the knee, the tibiæ commonly fawn-grey, and the tarsi dusky with black joinings. Wings vitreous, tinted slightly with extremely light brown-ochreous; neuration olive-black; pterostigmatic region of the fore wing somewhat obscured.

♀. Wings clear, with greenish grey neuration. Femora greenish grey or olivaceous; tibiæ, tarsi, and caudal setæ dusky. Length of body 7–10, wing 8–10; setæ, im. ♂ 16, ♀ 13 mm.

*Hab.* Common by mountain-torrents in Switzerland and Savoy; in the neighbourhood of Mt. Blanc at Barberine, Nant Bourant (4500 ft.), and Mottet in July; also at a stream from Mt. Brevent (Pict.) in August; also near the Chalets de Pitty, Samoëns (4700–5100 ft.) 8 A.M. 29 August, water 51° F., and near Les Clous, Champéry (4000 ft.). Also at La Rosa in the Bernina Pass (6000 ft.) 6:30 A.M. 25 August, water 51° F. Readily distinguished by the tint of the ♂ wings from *B. melanonyx*.

**BAËTIS BUCERATUS**, Etn. Plate LXIV. 19 (forceps).

*Baëtis buceratus*, ! Etn., Trans. Ent. Soc. London (1870) 5; ! *id.*, *op. cit.* (1871) 116, pl. v. 23, 23 a [detail].

*Subimago & Imago (living)*.—Very similar to *B. vernus* and *B. tenax*; chiefly distinguishable from them by the ♂ forceps. The forceps-limbs in *B. buceratus*, divergent from one another in the first and second joints, again converge, and are also strongly arcuate beneath; the second joint of each limb is more domed than in those other species, and the terminal joint more nearly oval. Length of body, ♂ im. 8–9, wing 8–9, setæ 10–16 mm.

*Hab.* England. The Kennet and Holybrook near Reading, Berkshire, in April and May.

**BAËTIS PUMILUS**, Burmeister. Plates XVI. 29 *e* (hind-wing) & LXIV. 20 (forceps).

? *Ephemer mutica* or [*Ephemer*], Linn., [Fn. Suec. ed. i. no. 752 (1746)]; *id.*, Syst. Nat. ed. x.

i, 547 (1758); *id.*, Fn. Suec. ed. ii. no. 1479 (1761); [Geof., Hist. Abrég. des Ins. . . . Paris, ii. 240, no. 7 (1764)] = *E. striata*, Linn., Syst. Nat. ed. xii. pars ii. 907 (1767); Fab., Syst. Ent. 304 (1775); *id.*, Sp. Ins. i. 385 (1782); *id.*, Mant. Ins. i. 244 (1787); Berkenh., Outl. of the Nat. Hist. of Gt. Brit. & Ireland, ed. 2, i. 150 (1789); Vill., C. Lin. Ent. iii. 20 (1789); Gmél., Linn. Syst. Nat. ed. xiii. i. pars v. 2630 (1790); Ol., Encycl. Méth. vi. 420 (1791); Fab., Ent. Syst. emend. iii. pars i. 71 (1793); Cederh., Fn. Ingricæ Prodr. 135 (1798); Lat., Hist. Nat. d. Crust. & Ins. xiii. 99 (1805); Stewart, Elem. Nat. Hist. Anim. K. ed. 2, ii. 226.—? *E. ciliata*, Ström, N. Saml. Kongl. Dansk. Vidensk. Selsk. Skrift. ii. 91 (1783); Wallengren, Christ. Vidensk. Forhandl. no. ii. 22 (1880).

*Cloë pumila*, Burm., Handb. d. Ent. Bd. ii. Abth. ii. 799 (1839); Pict., Hist. Nat. Névropt. ii. Ephém. 253, pl. xl. 2 (1843–5); Brau., Neuropt. Austr. 26 (1857); Karsch, Die Insectenwelt, v. 402 (1863); ! Hag., Ann. Soc. Ent. Fr. (4) iv. 39 (1864); Meyer-Dür, Mitth. Schw. Ent. Ges. i. 221 (1864); Ausser., Ann. d. Soc. Natur. Modena, An. iv. 136 (1869)—? *C. striata*, Pict., Hist. Nat. Névropt. ii. Ephém. 270 (1843–5); Oulianine, Néuropt. & Orthopt. of Prov. of Moscow, 28 (1867).

*Cloëon pumila*, Walk., List. of Neuropt. Ins. in Brit. Mus. part iii. 573 (1853).—? *C. striata*, *id.*, *op. cit.* 576 (1853).

*Baëtis pumilus*, ! Etn., Trans. Ent. Soc. London (1871) 118, pl. v. 25–25a [details]; ! *id.*, *op. cit.* (1873) 401 [mode of oviposition]; Meyer-Dür., Bull. Soc. Ent. Suisse, iv. 310 (1874); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 87 (1878).

*Subimago (living)*.—Wings tinted with charcoal blackish. Legs greenish grey with light black-grey tarsi. Setæ light black-grey.

*Imago (living)*.—♂. Turbinate eyes intense sepia-, or burnt-umber brown. Thorax jet-black above. Abdomen in segments 2–7 translucent white, the remainder yellowish pitch-brown above, umber-brown beneath. Forceps and setæ white. Legs white; the fore femur, the tarsi, and the extremities of the tibiæ light black-grey. Wings vitreous.

♀. Eyes olivaceous; vertex of head traversed lengthwise by a double median rufo-piceous stripe. Thorax black or pitch-brown above. Abdomen above reddish pitch-brown, with the joinings, and sometimes with an abbreviated longitudinal line from the middle of the base between two curved lines in nearly every segment ochraceous; venter paler, with a series of L-shaped warm sepia-brown marks or oblong rufo-piceous spots on each side of it. Setæ very light reddish brown-grey. Legs either almost uniformly pale grey, or else greenish grey with sepia-grey tarsi. Length of body 5–7; wing, ♂ 4–6, ♀ 6–8; setæ, ♂ im. 11–13, subim. 10, ♀ im. 7.5–10, subim. 7–10 mm.

*Hab.* Great Britain in streams and rivers. Widely distributed on the Continent, ranging from Scania and Norway (Wallengren) southwards to Portugal and Corsica (occurring at Cintra in April at about 380 ft., water 58° F.; at Cea in the Estrella in June at 1800 ft., water 56° F.; and at Villa Real, Traz-os-Montes in June at 1630 ft., water 58° F.) and eastwards to Armenia (Hag. Mus.). In Savoy and Switzerland it ranges from the lowlands up to about 5800 ft. in the neighbourhood of Champéry near the Chalets de Pas (5.15 P.M. 19 August, water 51° F.), and it is found in France, Germany, and Austria. The terminal joint of each of the forceps-limbs is oval or globular. The intermediate nerve of the hind wing is usually forked; and the fork contains a simple veinlet from the terminal margin,

BAËTIS NIGER, Linn. Plate XVI. 29 *f* (forceps).

*Ephemera nigra* or [*Ephemera*], Linn., Fn. Suec. ed. ii. no. 1478 (1761); *id.*, Syst. Nat. ed. xii.

pars ii. 907 (1767); Fab., Syst. Ent. 304 (1775); [Schæf., Icon. Ins. circa Ratisbon. indig. ii. tab. cliv. 1, 2? (1776)]; Schr., Enum. Ins. Austr. indig. 305 (1781); Fab., Sp. Ins. i. 385 (1782); *id.*, Mant. Ins. i. 244 (1787); Vill., C. Lin. Ent. iii. 19 (1789); Gmél., Linn. Syst. Nat. ed. xiii. i. pars v. 2629 (1790); Rossi, Fn. Etrusc. ii. 8 (1790); Ol., Encycl. Méth. vi. 419 (1791); Fab., Ent. Syst. emend. iii. pars i. 70 (1793); Cederh., Fn. Ingricæ Prodr. 135 (1798); Walck., Fn. Paris, ii. 9 (1802); Panzer in Explic. Schæf. Icon. cliv. (1804); Lat., Hist. Nat. Crust. & Ins. xiii. 98 (1805); Stewart, Elem. Nat. Hist. Anim. K. ed. 2, ii. 225 (1817); Steph., Ill. Brit. Ent. vi. 67 (1835); Ronalds, Fly-fish. Ent. ed. i. pl. ix. 16-17 (1836); Blanch., Hist. Nat. Ins. iii. 54 (1840).

*Cloë* † *diptera*, ! Ronalds, Fly-fish. Ent. ed. v. no. 16 (1856).

*Baëtis niger*, ! Etn., Trans. Ent. Soc. London (1870) 6; ! *id.*, *op. cit.* (1871) 119, pl. v. 26, 26a [detail].

*Subimago (living)*.—Wings black-grey. Legs of the ♀ dull greyish white; ♂ femora very light yellowish green (*prasinus*); an abbreviated line or streak at the tip of the fore femur dark, the tibiæ and terminal joints of the tarsi greyish white, and the remainder of the tarsi fawn-colour. Setæ of ♂ grey, of ♀ cinereous.

*Imago (living)*.—♂. Turbinate eyes reddish brown or light burnt-umber brown: lower eyes olivaceous. Thorax jet-black above. Abdomen in segments 2-7 translucent, and either white or light cinereous, with whitish or fuscous joinings, and with the tracheal trunks darker; segments 8-10 either pitch-brown, reddish brown, or yellowish brown above, and either whitish, greenish grey, or fuscous beneath; nearly every ventral segment has two short divergent dark lines at its base, each followed by a dot. Setæ white or greyish white, often with opaque joinings, or with some of the proximal joinings faintly reddish. Forceps with finger-like limbs, dark grey at the base and then light greyish white. Fore femur either light greyish white, or dull greenish white, or light yellowish green; the rest of the fore leg greyish, with the distal extremity of the tibia reddish brown; hinder femora white, slightly tinged distally with yellowish, greenish, or grey; the tibiæ dull whitish and the tarsi greyish white, or both of them of this latter colour, with the distal edges of the tarsal joints black and the ungues piceous. Wings transparent; their neuration whitish pellucid, the subcosta and radius at the wing-roots piceous.

♀. Eyes intense sepia. Dorsum of abdomen castaneo-piceous, with the terminal margins of the segments, and often with three short streaks at the base of each of segments 2-6, yellow ochreous: venter warm sepia, or burnt-umber brown, often with dark lateral L-shaped marks. Setæ either uniformly smoky or greyish white, or else greyish white with rufescent joinings. Legs greenish testaceous, with the tarsal joinings dusky. Length of body 5-7.5, wing 6-8; setæ, ♂ im. 9-11, subim. 9, ♀ im. 6-8.5, subim. 7 mm.

*Hab.* Rivers in England; May, June, and September. Also perhaps Sweden and Courland (Brauer). The second nervure of the hind wing is usually forked, as in *B. pumilus*.

#### NORTH AMERICAN SPECIES.

BAËTIS ———.

† *Cloëon* † *bioculata* [exenpl. *g*], ! Walk., List of Neuropt. in Brit. Mus. part iii. 573 (1853).

An undescribed species.

*Hab.* St. Martin's Falls, Albany River, Hudson's Bay (Brit. Mus.).

## BAËTIS POSTICATUS, Say.

‡ *Cloëon posticata*, Say, Godman's West. Quart. Rep. ii. 162 (1824); Le Conte, Complete Writings of T. Say, i. 172 (1859).

*Cloë posticata*, Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 53.

*Baëtis posticatus*, Etn., Trans. Ent. Soc. London (1871) 120.

*Imago*, ♂.—Eyes reddish brown; thorax black; abdomen greenish white, hyaline, the last three segments fuscous; setæ white. Legs white, the fore femur obscure. Wings hyaline. Length of body 8, setæ 19 mm. (After Say.)

*Hab.* Shippingsport, 21st May. Common. (Say.)

## BAËTIS HAGENI (renamed).

*Cloë* || *unicolor*, Hag., Smithson. Miscell. Coll. (1861) Synop. Neuropt. N. Am. 54; Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 380?; Hag., Proc. Ent. Soc. Philad. ii. 178 (1863) [nec *Cl. unicolor*, Curt. (1834)].

*Baëtis unicolor*, Etn., Trans. Ent. Soc. London (1871) 120.

*Imago* (*dried*), ♀.—Body bronze-brown; legs pale luteous; setæ white; wings hyaline. Length of body 4; exp. of wings 10; setæ 10 mm. (After Hagen.)

*Hab.* Washington (Osten-Sacken). The translator of Dr. Hagen's Synopsis wrote "brassy" for "bronze." Walsh may have confounded another species with Hagen's.

## BAËTIS RUBESCENS, Hag.

*Cloë* ‡ || *unicolor*, Provancher, Natural. Canad. viii. 267 (1876); *id.*, Fn. Ent. Canad. ii. fasc. i. 84 (1877).—*C. rubescens*, Hag. MS., *id.*, *op. cit.* ii. fasc. i. 82<sup>3</sup> (1877).

*Imago* (♀? *dried*).—Body reddish brown, the abdominal segments margined with black behind; setæ whitish; legs pale yellowish; wings hyaline, reddish at the base and along the costal margin. Long. .22 pouce=11.8 mm. (After Provancher.)

*Hab.* Not stated; probably Quebec. As this insect was taken by l'Abbé L. Provancher to be *Cl. unicolor*, Hag., which is a *Baëtis*, I infer that it also has 4 wings, and is referable to the same genus. But judging from the coloration of the mesothoracic wings, it might be a *Cloëon*, or even a *Callibaëtis*, if this genus ranges so far as Quebec.

## BAËTIS PROPINQUUS, Walsh.

*Cloë* ‡ || *vicina*, Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 380; *id.*, Proc. Ent. Soc. Philad. ii. 207, note 20 (1863).—*C. propinqua*, Walsh, *loc. cit.* (1863).

*Baëtis propinquus*, Etn., Trans. Ent. Soc. London (1871) 121.

*Subimago*.—Wings fumose, with rather coarse and dusky longitudinal neuration; the cross veinlets concolorous with the membrane. Tarsi sometimes dusky.

*Imago*, ♂.—Lower portion of the oculi attached to the hinder "corner" of the turbinate portion. Thorax and last 4 dorsal segments of the abdomen piceous; the intermediate abdominal segments whitish hyaline, each with a dot at the sides; venter pale hyaline, the last 4 joints opaque whitish. Setæ whitish, the joinings near the base often fuscous. Legs pale, except the fore femur, which is sometimes pale ferruginous;

tips of tarsi cloudy. Wings and neuration hyaline; the space included between the two nervures of the hind wing subopaque.

♀. Thorax, and abdomen above, ferrugineo-piceous, or sometimes ferruginous; venter reddish white. Fore femur always immaculate.

Length of body, ♂ 4-5, ♀ 3.5-5.5; exp. of wings 9-12; setæ, ♂ 7.5-10, ♀ 5-9 mm. [After Walsh.]

*Hab.* Rock Island, Ill.

#### BAËTIS PYGMÆUS, Hag.

*Cloë pygmæa*, ! Hag., *Smithson. Miscell. Coll.* (1861) *Synop. Neuropt. N. Am.* 54; *id.*, *Proc. Ent. Soc. Philad.* ii. 178 (1863).

*Baëtis pygmæus*, Etn., *Trans. Ent. Soc. London* (1871) 122.

*Imago (dried)*, ♀.—Thorax dark fuscous; "abdomen fusco-griseous" (Hag.). Wings vitreous, with brownish neuration; fore wings with 6 simple straight cross veinlets, but no granulations, in the pterostigmatic space. "Legs and setæ white" (Hag.). Length of body, ♀ 3, expanse of wings 6 mm.

*Hab.* The St. Lawrence. The type reached me in an extremely fragmentary condition. [No. 79 in Hag. Mus.]

#### CENTRAL AND SOUTH AMERICAN SPECIES.

#### BAËTIS SALVINI, sp. nov. Plate XVI. 29a (wings and forceps).

*Subimago (dried)*.—♀. Wings very light sepia-grey, with pitch-black neuration bordered with darker (Cologne earth) grey, the bordering transversely confluent here and there so as to form in the fore wing several (6-8) narrow fasciæ, some of which have a tendency to combine with one another in the vicinage of the most salient part of the curve of the terminal and inner margin; the marginal area contains usually 1 cross veinlet before the bulla, and 15-18 beyond it, which last are oblique, strong, and for the most part simple.

*Imago (dried)*.—♂. Thorax fusco-luteous above, the metanotum piceous. Abdomen discoloured, perhaps flavescent or else light olivaceo-fuscous, with the apical borders of the segments pitch-black. Setæ very light sepia-grey, with about every fourth joint darker, annulated at every joining with sepia-brown. Wings vitreous: the fore wing with pitch-black neuration, the stronger nervures fuscous towards the wing-roots; the membrane with a patch of that colour at the base of the wing, and most of the stronger cross veinlets bordered with the same, their borderings more or less confluent in the pterostigmatic space and the subjacent portion of the submarginal area. Fore femur light fuscous (light bistre-brown) banded with pitch-black near the middle and at its extremity; tibia and tarsus flavescent, the tibia just at the base and more broadly at its extremity, the tarsal joints annulated distally, and the ungues coloured throughout with

pitch-black. Hinder legs lighter in tint, but ornamented nearly in the same manner. Length of body, ♂ 10; wing, ♂ 12, ♀ 14; setæ, ♂ 26, subim. 20 mm.

*Hab.* Irazu, Costa Rica, 6000–7000 feet. (H. Rogers, Salvin and Godman Mus).

(?) *BAËTIS STELZNERI*, Weyenb.

*Cloë Stelzneri*, Weyenbergh, Tijdsch. v. Ent. xxvi. 1882–3, p. 170 (1883).

*Imago (living)*.—♂. Upper portion of oculi dark red, the lower blackish grey. Thorax darker than in the ♀, so are the legs; pleuræ greyish yellow.

♀. Thorax sepia-brown, traversed longitudinally throughout the notum by a darker median line or stripe, and with much darker wing-roots. Abdomen pearl-grey beneath, and somewhat darker on the back, the colour there approaching steel-blue. Setæ (? 2) pearl-grey, the joinings as good as invisible. Wings unclouded, with almost black neuration. Length of body 5·5, wing 6, setæ 7·5 mm.

*Hab.* Cordova, Argentine Republic; summer and autumn, scarce. (After Weyenbergh).—From what is remarked of the wings, I conjecture this to be a species of *Baëtis*.

#### INDIAN AND CINGALESE SPECIES.

*BAËTIS* —.

‡ *Cloëon debilis*, ! Walk., Trans. Ent. Soc. London, N. S. v. 199 (1860).

*Baëtis* || *debilis*, ! Etn., Trans. Ent. Soc. London (1871) 112 [nec ‡ *B. debilis*, Walk. (1853)].

*Imago (dried)*.—♀. “Fulva, capite nigro, abdomine testaceo; setis pedibusque albis, alis vitreis, venis albis.”—An insufficiently described species, with 5 or 6 simple, oblique cross veinlets in the pterostigmatic portion of the marginal area of the fore wing. Length of body 5; expanse of wings 12 mm.

*Hab.* Hindostan (Walk., in Brit. Mus.).

*BAËTIS FEMINALIS*, sp. nov.

*Imago (dried)*.—♀. Wings vitreous, with pale pitch-brownish neuration; 2–5, generally simple and straight, fairly strong cross veinlets in the pterostigmatic space of the fore wing, without any interjacent granulations. Body bright reddish brown, the thorax polished; penultimate dorsal segment pale ochraceous, the other segments at the joinings dark or piceous; setæ pale warm sepia-brown, with grey joinings. Fore femur, for the most part, reddish piceous-brown, its apical margin and extreme base pale dull yellowish white; the base of the tibia of the same pale colour, the rest of the tibia and the tarsus light sepia-brown; hinder legs pale sepia-grey, or whitish tinged with yellowish; the femora broadly banded with reddish piceous-brown near their extremities.

♂. Subsimilar, but having the abdomen from segment 2 up to the basal half of segment 6 translucent; with piceous joinings; the tibiæ, tarsi, and bases of the hinder femora more nearly whitish; the setæ rather paler; and the neuration of the wings paler than in the ♀. Length of body, ♂ 4·5; wing, ♂ 5·5, ♀ 6; setæ, ♂ about 13·5, ♀ 8 mm.

*Hab.* Rainbodde, Ceylon, at altitudes of not less than 4000 feet (Hagen Mus.). All

traces of hind wings in the 4 specimens (Nos. 34, 49, 50, 51) had disappeared, if they ever had existed at all.

#### BAËTIS CONSUETUS, Hagen.

*Cloë consueta*, ! Hag., Verh. zool.-bot. Gesells. Wien, viii. 477 (1858); Etn., Trans. Ent. Soc. London (1871) 131; Hag., *op. cit.* (1873) 403.

*Subimago (dried)*.—Wings transparent, tinted throughout with very pale smoky grey; neuration opaque light brown, the cross veinlets in certain postures seeming darker than the longitudinal nervures. Legs pale brownish-yellowish, the fore femur tinged with reddish brown towards its extremity. Setæ warm sepia-grey or fuliginous. Mesonotum very pale yellowish brown in the middle; the pleuræ fuscous; pectus and venter pale ochraceous; dorsum of abdomen discoloured, but dark and paler along the middle.

*Imago (dried)*.—♂. Wings vitreous; some of the longitudinal nervures yellowish at the base; the pterostigmatic space of the fore wing contains 2–5 simple straight cross veinlets, without any granulations between them. Hind wing trinerved. Mesonotum lutescent; sides of the thorax dark brown-ochre; pectus and venter ochraceous; dorsum of the abdomen varied with dark reddish brown and pale ochraceous,—the paler colour forms large blotches in the midst of segs. 2–7, and some longitudinal linear streaks near the spiracles, leaving on each side of these segments a broad dark longitudinal stripe continuous with that of the thorax; the joinings of these segments, and the whole dorsum of the subsequent segments dark reddish brown. Legs pale amber-colour; the fore femur indistinctly annulated with reddish brown close to or at its extremity.

♀. Very similar; but the dorsum of the abdomen is darker, with piceous joinings; setæ sepia-grey, with some of the joinings towards their roots darker. Tibia and tarsus of the fore leg sepia-grey. Length of body, ♂ 3–4, ♀ 4.5; wing, ♂ 4.5–5, ♀ 5–6; setæ ♂ subim. 9 mm.

*Hab.* Rainbodde, Ceylon, at altitudes of 4000 feet and upwards (Hagen Mus.). With the types of this species, and from the same locality, stood a single example of probably a different species, marked 41, characterized as follows:—

*Imago (dried)*.—♂. Wings vitreous, with pale yellowish-brownish perspicuous neuration; 4–8 slightly curved, cross-veinlets in the pterostigmatic space of the fore wings, linked together by a somewhat sinuous row of adventitious veinlets near the costa, which thus give rise to a series of cellules, but there are no granulations between the cross veinlets. Thorax polished, bright brown-ochreous. Abdomen in segments 2–6 translucent ochraceous white, pitch-brown at the joinings; segment 7 ochraceous; segments 8–10 brown-ochreous; venter pallid, subochraceous. Setæ sepia-grey, with dark joinings. Legs dull pale testaceous; fore femur tinged slightly with golden-brown, the tibia and tarsus fumatose. Commensurate with *B. consueta*.

#### BAËTIS SOLIDUS, Hagen.

*Cloë solida*, ! Hag., Verh. zool.-bot. Gesells. Wien, viii. 477 (1858); Etn., Trans. Ent. Soc. London (1871) 131.

*Subimago (dried)*.—Wings transparent, pale sepia-grey; neuration for the most part

translucent and concolorous, but sometimes subopaque; the subcosta and radius of the fore wing, the base of the costa, and the wing-roots, subopaque and pallid, or pale yellowish brown. Legs in ♀ lutescent, rather more dingy in colour in the ♂. Setæ pale warm sepia-brown, with opaque joinings. Thorax in ♂ luteous or lutescent, varied with paler; abdomen above luteous or brown-ochre, darker or more of a reddish brown at the sides of the segments and in the midst of their hinder extremities; venter ochraceous yellow.

*Imago (dried).*— ♂. Wings vitreous, with light brown neuration; 3-6, subregular, mostly simple, oblique cross veinlets in the pterostigmatic space of the fore wings, somewhat attenuated or tabescent towards the subcosta; between them, almost midway between this last and the costa, is extended a single series of granulated rudimental longitudinal veinlets, rarely branched, but somewhat irregular. Hind wing binerved. Thorax yellowish testaceous, varied near the peak of the mesonotum with flavescent. Dorsum of abdomen partially brown-ochre, with dark spots at the stigmata; segments 2-5 or 6 translucent at the sides and towards the base, their extreme hinder borders piceous; segments 9 and 10 pale. Venter and forceps pale yellowish ochraceous; the 8th segment and the forceps towards their extremities dark; setæ whitish, tinged with pale sepia-grey, and having several of their basal joinings dark reddish brown. Femora amber-colour, gradually darkened and more distinctly tinged towards their tips with reddish testaceous; tibiæ and tarsi testaceous, the ungues, and the extreme terminal margins of the intermediate joints of the hinder tarsi, rubiginose. Length of body 4; wing 4.5-5 mm.

*Hab.* Rainbodde, Ceylon, at altitudes of 4000 feet and upwards (Nos. 23, 27-30, and perhaps 52 in Hag. Mus.). The specimen numbered 52 has the neuration and terminal margin of the fore wings piceous; and the neuration is stronger than that of any of the other examples.

#### A NYMPH ALLIED TO *Centroptilum*, *generis incerti*.

NAMELESS NYMPH. Plate XLV. (whole figure and details).

Abdominal tracheal branchiæ all somewhat alike in form, ovate-lanceolate and acute, traversed lengthwise by an irregularly pinnately branched trachea. Antennæ defective in the type specimens, shorter than the head and thorax combined. Median caudal seta subequal to the others in length, which are about  $\frac{1}{2}$  as long as the body; the fringes are narrowed acuminate to the points of the setæ. Mandibles nearly as in *Baëtis*. Palpus of maxilla I. longer than the lacinia; the terminal joint minute, the others long and slender, the first about  $\frac{4}{5}$  as long as the second; the lacinia armed at the point with about two teeth, preceded on the inner edge by fasciculated setulæ of nearly uniform length. Labium and maxillæ II. nearly as in *Baëtis*; but the palpi are not indented at the joining of the oval-pointed terminal joint with the penultimate joint, which is well defined; the proximal joint of the same is subequal in length to the other two combined. Tongue truncate at the base, broadly emarginate in front; the median lobe dilated distally and mucronate; the much narrower paraglossæ slightly expanded, with curved lateral borders

that meet the apical margin at an acute angle. Hind tarsus, claw excluded, very nearly of the same length as the tibia; the leg, as a whole, rather longer than the fore leg. Length of body 8, setæ 4 mm.

*Hab.* Puno, Peru; from a spring (A. Agassiz, Mus. Comp. Zool. Cambridge, Mass.).

CENTROPTILUM, Etn., 1869.

*Illustrations.* *Adult* (details), Pl. XVII. 30, *a-c*, and LXIV. 21; (whole figure) see citations of Pictet (1843-5) under *C. luteolum* (*Cloë translucida*), and *C. lituratum*. *Nymph.*, Pl. XLVI.

*Adult.*—Hind wing oblique, elongate, and narrow, with the apex commonly obtuse, rarely acute, and usually with the costal projection acuminate [acute in *C. stenopteryx*]; neuration limited to 2 simple longitudinal nervures. Fore wing devoid of colour-ornamentation, free from cross veinlets in the marginal and submarginal areas as far from the great cross vein as the bullæ, and with the intercalar veinlets of the terminal margin in a large majority of the species single [paired in *C. Poëyi*]; neuration, as a whole, similar to that of species of *Cloëon* or *Baëtis*. Forceps-limbs of ♂ mostly after the pattern of *Cloëon*, which differs from that of the normal *Baëtis* in the greater relative plumpness of joint 2, in the slight terminal enlargement of joint 3, and in joint 4 being clavate or papilliform instead of oval; *C. tenellum* (Pl. XVII. 30 *c*) is the only known deviation from this type of forceps in the genus. The interval between the bases of the forceps-limbs varies in relative width with the species. Intermediate abdominal segments of ♀ subequal in length. Caudal setæ in ♂ im.  $1\frac{2}{3}$ -2, in ♀ im. about  $1\frac{1}{3}$ , in subim.  $1-1\frac{1}{2}$  as long as the body. Fore tarsus of ♂ rather longer than the tibia, which is about twice as long as the femur; its joints in diminishing sequence rank 2, 3, 4, 5, 1; fore tarsus of ♀ nearly  $\frac{9}{10}$  as long as the tibia, which is almost as long as the femur; its joints in shortening succession rank 2, 3, subequal to 5, 4, 1. Hind tarsus of ♂ about  $\frac{7}{8}$  as long as the tibia; the joints (longer in the ♀) rank 1, 4, 2, 3. *Nymph.*—Abdominal tracheal branchiæ acute, the foremost narrowly obovate-lanceolate, the others more broadly ovate, each traversed lengthwise by an irregularly pinnately branched trachea. Antennæ longer than the head and thorax combined. Outer caudal setæ almost  $\frac{1}{2}$  as long as the body, the median about  $\frac{1}{3}$  as long as it, all shortly tail-pointed in the typical species. Mandibles armed with slender fang-like teeth; endopodite absent, or represented by a minute tuft of hair. Palpus of maxilla I. slightly longer than the lacinia, 3-jointed, with slender joints of nearly equal length; the lacinia terminated by fang-like teeth, preceded on the inner edge by an even series of setulæ inserted at nearly equal intervals. Lacinia of maxillæ II. falcate, scarcely wider than the somewhat subulate lobes of the labium; proximal joint of the palpus rather shorter than the remainder, which are compressed; terminal joint squarely truncate, oblong, quadrangular, and barely more than  $\frac{1}{2}$  as long as the second. Tongue similar in form to a closed ecclesiastical biretta; the median lobe broader than the paraglossæ, and minutely mucronate. Hind tarsus, claw excluded, subequal in length to the tibia; the leg altogether about  $1\frac{1}{6}$  as long as the fore leg. *Habits*, those of *Baëtis*.

*Type.* *C. luteolum* (in *Ephemera*), Müller.

*Distribution.* Europe; Hudson's Bay Territory, Arizona, and Cuba.

*Etymology.* κεντρωτός and πτίλον, from the usual spur-like form of the costal projection of the hind wing.

The nymph of the typical species was identified by observation in the field; but probably I reared it also. The older description was based upon specimens in ill condition, still in my possession. The foremost tracheal branchiæ were described as "subulate;" but this was due to their having been deformed by the preservative fluid.

CENTROPTILUM LUTEOLUM, Müller. Pl. XVII. 30 a (wings, ♂, head & forceps).

*Ephemera luteola*, Müll., Zool. Dan. Prodr. 143 (1776).—*E. caudata*, Ström, N. Saml. Kongl. Dansk. Vidensk. Selsk. Skrift. ii. 91 (1783); Wallengren, Christ. Vidensk. Forhandl. No. ii. 21 (1880).

*Cloëon ochraceum*, ! Steph., Ill. Brit. Ent. vi. 68 (1835); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 578 [*C. ochracea*] (1853).—*C. hyalinatum*, ! Steph., Ill. Brit. Ent. vi. 69 (1835); Walk., List &c. 579 [*C. hyalinata*] (1853).—*C. albipenne*, ! Steph., Ill. Brit. Ent. vi. 69 (1835); Walk., List &c. 579 [*C. albipennis*] (1853).—*C. translucida*, Walk., *op. cit.* 574 (1853).—*C. halterata*, *id.*, 577 (1853).—*C. † bioculatum*, Hag., Ent. Ann. (1863) 34; ! Etn., Ann. & Mag. Nat. Hist. (3) xviii. 147, fig. [hind-wing] (1866).

*Cloë halterata*, Burm., Handb. d. Ent. Bd. ii. Abth. ii. 798 (1839); ! Ramb., Hist. Nat. d. Ins. Névropt. 299 (1842).—*C. translucida*, ! Pict., Hist. Nat. Névropt. ii. Ephém. 255, pl. xl. 3, 4 (1843-5).—*C. ochracea, hyalinata & albipennis*, Pict., *op. cit.* 271 (1843-5).

*Baëtis luteolus*, ! Etn., Ent. Mo. Mag. v. 88 (1868).

*Centroptilum luteolum*, ! Etn., *op. cit.* vi. 132 (1869); ! *id.*, Trans. Ent. Soc. London (1871) 108, pls. ii. 8 [part of fore wing] & v. 13, 13 a [details]; Hag. & Etn., *op. cit.* (1873) 400; Meyer-Dür, Bull. Soc. Ent. Suisse, iv. 310 (1874); Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 86 (1878).

*Subimago (living).*—Wings very faintly grey-tinted, sometimes very slightly tinged with the palest yellow-ochre. Femora light yellow-ochre, tibiæ cinereous, tarsi dusky. Setæ greyish white or cinereous.

*Imago (living).*—♂. Turbinate eyes bright light red; lower eyes subolivaceous. Notum either bistre-, or pitch-brown, or black. Abdomen vitreous in segments 2-7, spotted faintly with raw sienna (furfuraceous) on each side near the tips of the dorsal segments, or sometimes wholly of that colour thereabouts; the other segments opaque, rich brown-ochre, raw sienna, or bistre-brown above, with the distal edges of segments 8 and 9 yellow-ochreous; beneath pale, tinged with very light Mars-yellow distally. Setæ and forceps white. Femora cretaceous; tibiæ and tarsi greyish, or smoky white. Wings vitreous; longitudinal nervures faintly tinged with yellowish.

♀. Eyes olivaceous, greenish black, or black. Notum bistre- or olive-brown. Abdomen above either raw sienna (sometimes modified with light yellow-ochre) or Mars-yellow, or olive-brown, with dark subcutaneous tracheæ in segments 2-6; venter pale. Setæ white or greyish white. Femora either light greenish yellow, banded almost imperceptibly in the middle with reddish (this band is invisible in dried specimens), with the tibiæ and tarsi olive-grey; or femora light yellowish, tibiæ and tarsi greyish white. Length of body 5-7; wing 6-7.5; setæ, ♂ im. 10-14, subim. 7, ♀ im. 8-9, subim. 6 mm.

*Hab.* Europe from Hammerfest and Alten to Portugal and N. Italy: also N. America,

in Hudson's Bay Ter. [probably St. Martin's Falls, Albany river]: This species is abundant in Great Britain, and reaches maturity in the southern counties from April to November. It is found in Germany, Switzerland, and France (at Dijon, M<sup>c</sup>Lach.), in addition to the countries quoted above: it is common at Pallanza along the shore of the Lago Maggiore (640 ft.), and near Cintra in the valley N. of the town (385 ft.). The acute projecting point noticeable above the forceps [the limbs of which are nearly contiguous at the base], and the sharpness of the hind wing are preeminently distinctive of *C. luteolum*. The terminal joints of the forceps-limbs are straight. Female specimens are sometimes distinguishable from *Cloëon rufulum* only by their possessing hind wings.

CENTROPTILUM LACUSTRE, sp. nov.

*Imago (living)*.—♂. Very similar to *C. pennulatum*, but with the turbinate eyes red, and with the tips of the transparent abdominal segments less strongly coloured.

♀. Eyes light olive-grey. Body light brownish ochre; this colouring in segments 2-6 of the dorsum is restricted to a median triangle projecting forwards from the hinder border of each segment, leaving the remaining parts pale; their subcutaneous tracheæ are dark; segments 7-10 uniformly light brownish ochre; venter pale. Setæ white. Legs nearly colourless, but faintly tinged with yellowish at the tips of the femora. Wings vitreous; the pterostigmatic portion of the marginal area of the fore wing contains 6-9 simple cross veinlets. Length of body 5.5-6; wing 6-7; setæ, ♂ im. 12-14, ♀ im. about 10 mm.

*Hab.* Pallanza on Lago Maggiore (640 ft.); at the lake side, about sunset on the 18th July. The forceps and hind wing are very like those of *C. pennulatum*.

CENTROPTILUM PENNULATUM, Etn. Pl. XVII. 30 b (♂, head, legs, hind wings and forceps).

*Centroptilum pennulatum*, ! Etn., Trans. Ent. Soc. London (1870) 2; ! *id.*, *op. cit.* (1871) 139. pl. v. 14, 14 a; Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 85 (1878).

*Subimago*.—Wings a very little greyer than those of *C. luteolum*: distinguishable from that species chiefly by its greater stature.

*Imago (living)*.—♂. Turbinate eyes light cadmium-orange; lower eyes olive-grey or black. Pronotum dusky, or light luteo-fuscous; meso- and metanotum either light luteo-fuscous, raw sienna, or bistre-brown. First dorsal segment of the abdomen piceo-fuscous; segments 2-6 vitreous, tinged at the joinings very faintly with Mars-orange; segments 7-10 reddish brown-ochre or reddish chestnut-brown, modified with Chinese-orange above, but ochraceous white beneath. Setæ and forceps white. Legs white, with the tips of the femora yellowish white, and with the terminal tarsal joints faintly tinged with very light sepia-grey.

♀. Eyes olive-grey, or greenish black; vertex of head light yellow, with a broad median burnt-sienna stripe from the anterior ocellus to the occiput, and with the orbits of the ocelli black. Notum light dull brownish ochre modified with bistre-grey. Abdomen in dorsal segments 2-6 bistre-grey, in 7-10 reddish brown-ochre, with the usual abbreviated median line and two short divergent pale lines in segments 2-8, with the tips of segments 2-7 either brown-ochreous modified more or less with Mars-orange, or deep reddish brown, or narrowly piceous, and with streaks of the same colour pro-

duced forwards at the sides in the form of triangular spots; tracheæ dark; venter spotless, pale, coloured in segments 8 and 9 with light ochraceous tinged slightly by the pleuræ with Mars-orange and reddish. Femora whitish amber; tibiæ greyish white; tarsi dark grey, with black ungues. Setæ white. Wings vitreous; the marginal area of the fore wing, beyond the bulla, contains in the pterostigmatic region of ♀ 11-13 sub-simple and nearly straight cross veinlets; in that of ♂ are 7-8. Length of body or wing 8-9; setæ, ♂ im. 14-17, ♀ im. 11 mm.

*Hab.* Great Britain, from near Lumphanan in Aberdeenshire southwards; common near Thorncombe, Dorset, in June, and generally in trout-streams from August to October. Hind wing somewhat ligulate, with the tip elliptical. Forceps-limbs close together at the base; their terminal joints pyriform, slightly incurved, smaller, and narrower towards the base than in *C. luteolum*. The edge of the penis [or penis cover?] is saliently curved.

#### CENTROPTILUM NEMORALE, sp. nov.

*Imago (living).*—♂. Turbinate eyes intense Mars-yellow (*peropace testaceus* of Müller's code) on the summit, paler at the sides; lower eyes olive-grey. Notum very light fusco-ochraceous; the first dorsal abdominal segment more fuscous. Abdominal segments 2-6 translucent white, their dorsal terminal margins, like segments 7-9, brown-ochre; segment 10 rather yellower than these; venter in segments 7-10 whitish ochre. Forceps (the limbs are nearly in mutual contact at the base), setæ and legs translucent white; femora very faintly tinged with yellowish just at their distal extremities. Wings vitreous; in the pterostigmatic portion of the marginal area of the fore wing are 4-5 simple cross veinlets with indistinct rudiments of one or two others. Length of body 6.5; wing 7; setæ 14 mm.

*Hab.* Italy; in the chestnut-wood below Gavinana, San Marcello, Apennino Pistoiese, near a streamlet (2550-2750 ft.); captured, by beating, at about 10 A.M., 26 July. The hind wings and ♂ genitalia resemble those of *C. pennulatum*; but the colour of the turbinate oculi, and the smaller number of cross veinlets in the pterostigmatic portion of the fore wing suffice to distinguish *C. nemorale*.

#### CENTROPTILUM PULCHRUM, sp. nov.

*Imago (living).*—♂. Turbinate eyes bright chrome-lemon yellow; lower eyes light olive-grey or olive-green. Notum furfuraceous or raw sienna, with the peak of the mesonotum chrome-lemon. Abdomen in segments 2-6 perspicuous, narrowly tinged with raw sienna by the joinings at the tips; the other segments above either brown-ochre modified with Chinese orange, or else raw sienna, with the usual pale paired dorsal lines; venter in segments 7-10 very light brown ochre or yellow ochre in the middle. setæ translucent white; forceps dull whitish. Femora white; tibiæ and hinder tarsi greyish white; the smaller ungues black. Wings vitreous; in the pterostigmatic portion of the marginal area of the fore wing are 4-10 almost invariably simple cross veinlets.

♀ (*dried*).—The colour-differences of this sex are quite of the ordinary description,

and need not be detailed. Length of body, ♂ ♀ 5·5–8; wing 6–8·5; setæ, ♂ im. 11–16, ♀ im. 11 mm.

*Hab.* France; in a tributary of the Loire, near Brive (Haute Loire), 24th Sept.; the Garonne by the Pont d'Empalot, Toulouse, 21st Aug. The hind wing and ♂ genitalia resemble those of *C. pennulatum*; but the terminal joints of the forceps-limbs are rather stouter and shorter than those of that species, and are more like the terminal joints of the forceps of *Cloëon simile*.

#### CENTROPTILUM LITURATUM.

*Ephemera* † *culiciformis*, Scop., Ent. Carniol. 264 (1763).

*Cloë litura*, Pict., Hist. Nat. Névropt. ii. Ephém. 260, pl. xli. 1–3 (1843–5).

*Cloëon litura*, Walk., List of Neuropt. in Brit. Mus. part iii. 574 (1853).

*Centroptilum lituratum*, Etn., Trans. Ent. Soc. London (1871) 109.

*Subimago*.—Wings dull yellowish grey. Setæ fuscous (*brun*).

*Imago*.—♂. Turbinate eyes light cadmium or sulphur-yellow. Metathorax traversed lengthwise by a black streak, which does not quite reach the hind border; the mesothorax [? metathorax] has two dots of the same colour. Abdomen light rufo-fuscous, rather darker towards the tip, and with a row of spots on each side. Setæ lutescent, annulated with black. Fore and hinder legs uniformly lutescent. Wings vitreous with pale neuration.

♀. Eyes black. Body yellow-ochreous, with two little reddish lines on the mesothorax, and some spots on the sides of the abdomen. Length of body 8; setæ, ♂ im. 12 mm.

*Hab.* At the base of Mt. Salève, in autumn. [After Pictet.] The streak on the mesothorax distinguishes the ♂ of this species from *C. pulchrum*.

#### CENTROPTILUM STENOPTERYX, Etn.

? *Ephemera albipes* & *parvula*, Scop., Ent. Carniol. 264 (1763); Vill., C. Lin. Ent. iii. 22 (1789); Ol., Encycl. Méth. vi. 421 (1791).

*Centroptilum stenopteryx*, ! Etn., Trans. Ent. Soc. London (1871) 110, pl. v. 15, 15 *a* [details].

*Subimago* (*dried*).—Wings and setæ light sepia-grey.

*Imago* (*dried*).—Notum light brownish ochre, browner in the ♂. Body very much discoloured through age. Setæ white. Wings vitreous; the stronger nervures slightly tinted with dull yellowish amber near the roots; in the pterostigmatic portion of the marginal area of the fore wing are 6 or 7 cross veinlets, which are nearly always simple and straight, besides occasionally one or two rudiments at the costa; but one of the ♀ examples has most of them forked and anastomosing with each other. Length of body, ♂ 4, ♀ 4·5; wing 4–5·5; setæ, ♂ im. 9, ♀ im. 5 mm.

*Hab.* Carinthia (Zeller MS. in M<sup>c</sup>Lach. Mus.).

#### CENTROPTILUM TENELLUM, Alb. Plate XVII. 30 *c* (forceps).

*Centroptilum tenellum*, ! Albarda, Ent. Mo. Mag. xv. 128 (1878).

*Imago* (*dried*), ♂.—[Turbinate eyes *during life*, Roman sepia or clove-brown; lower eyes

black-brown.] Notum either fuscous or pitch black. Dorsal segments 1 and 7-10 of the abdomen either deep chestnut-brown or pitch-brown; segments 2-6 either translucent, light sepia or Cologne-earth grey with the joinings dark, or else cretaceous; venter in segments 7-9 light Roman sepia-brown. Setæ and forceps whitish. Legs translucent whitish; fore leg faintly tinted with brownish, varying with change of light to whitish amber; the femur with a well-defined pitch-brown band at the tip separated by a short clear space from an ill-defined greyer band a little beyond the middle; tibia brownish in the vicinage of the distal articulation; unguis in some lights brownish: hinder femora banded with pitch-brown at the knee only, the adjoining part of the tibia brownish at the articulation, the tarsal joinings and unguis also light pitch-brownish. Wings vitreous: the great cross vein and the bases of the nervures included between it and the thorax pitch-brown; in the pterostigmatic portion of the marginal area of the fore wing are 5 or 6 simple cross veinlets, and between them and the bulla are rudiments of 2 or 3. Length of body 3-4; wing 4.5; setæ, ♂ im. 7-8 mm.

*Hab.* Holland, near Arnhem (Van Medenbach de Rooy, 8th Sept.). I subsequently met with it there, between the town and the railway bridge below the town on 26th July, and at first mistook the species for *Baëtis niger*, on account of its coloration and its finger-like forceps-limbs.

#### AMERICAN SPECIES.

##### CENTROPTILUM POËYI, sp. nov.

*Imago (dried)*, ♂.—Thorax above lutescenti-fuscous or pitch-brown; abdominal segments 2-6 transparent whitish; the spiracles and tracheal trunks darker in individual specimens; segments 7-10 purple-sepia brown above, paler beneath; setæ white, with their joinings towards the base brownish. Wings vitreous; the principal longitudinal nervures brownish near the wing-roots; the costa, subcosta, and radius, very faintly brown amber; the terminal margin and finer nervures, in certain lights, brownish grey; about 6 nearly straight and simple cross veinlets in the pterostigmatic space; interneural veinlets of the terminal margin mostly in pairs. Legs whitish; the fore femur throughout, the hinder femora distally, slightly yellowish; fore tibia and tarsus light sepia-grey, hinder tarsi and unguis less distinctly so. Length of body 4, wing 4 mm.

*Hab.* Rangel Mountains, Cuba (Poëy & Ch. Wright) [Hag. Mus.]. The wings of a carded *subimago* are of a light sepia-grey.

A small undescribed species of *Centroptilum* from Arizona (1 ♀ im., 2 subim., in M<sup>c</sup>Lach. Mus.) has likewise paired interneural veinlets along the greater part of the terminal margin of the fore wing.

##### CLOËON, Leach, 1815.

*Illustrations.* *Adult* (details) Pl. XVII. 31a-d; (whole figures) see under *C. dipterum*, citation of Stephens (1835) and [*Cloë*] Pictet (1843-5). *Nymph* Pl. XLVII.; see also under *C. dipterum*, citations of [*Ephemer*] De Geer (1771), Goring and Pritchard (1829), Bowerbank (1833), Blanchard (1840), of [*Cloë*] Calori (1848), and of [*Cloëopsis*] Vayssièrè (1882); also under *C. rufulum* of [*Chloëon*] Lubbock (1863 & 1865).

*Adult.*—Hind wings absent. Wings, of some species only, in the ♀ or in both sexes, varied with colour in the marginal and submarginal areas, and provided with cross veinlets between the great cross vein and the bulla; but other species have the wings of the ♂ or of both sexes devoid both of colour and of cross veinlets in the parts specified; intercalary rudimentary veinlets of the terminal margin single in a large majority of the species; cross veinlets of the disk disposed, as in *Baëtis*, mainly in 3 dislocated series in front of the cubitus (5) and 2–3 behind, many of them thickened slightly in the females of some of the species. Forceps-limbs of ♂ 4-jointed; the basal joint short, relatively very stout, gibbous at the base and suddenly contracted near the distal joining on the inner side; the second joint less stout and larger at its base than at its further extremity; the third joint comparatively long and slender; swollen a little at the end; the fourth joint minute, clavate or papilliform. Penis not yet observed. Intermediate abdominal segments of ♀ subequal in length. Caudal setæ in im. ♂ about 2, in ♀ 1–1½ as long as the body, in subim. ♂ about  $\frac{2}{3}$ , ♀ about  $\frac{4}{5}$  as long as it. Fore tarsus of ♂ nearly  $1\frac{1}{3}$  as long as the tibia, which is almost of the same length as the femur; its joints in order of lessening length rank 2, 3, 4, 5, 1; fore tarsus of ♀ (exclusive of joint 1) little more than  $\frac{3}{4}$  as long as the tibia, which is about  $1\frac{1}{10}$  as long as the femur; its joints rank 2, 3 subequal to 5, 4,—1 being extremely short and intimately combined with the tibia. Hind tarsus of ♂ about  $\frac{3}{4}$  as long as the tibia; its joints, shorter than in the ♀, rank 1, 4, 3, 2.

*Nymph.*—Abdominal tracheal branchiæ all foliaceous and slightly oblique, and all double excepting the hindermost; each of the double ones is formed of two unequal divisions slightly connate at the base, containing somewhat palmately partite tracheæ with long branches and short branchlets; of these divisions the larger, broadly subrotundate, is more or less subtruncate along the costal border and displays a small contracted sinus at its posterior base; the smaller division exhibits a similar sinus thereabouts, and a wide shallow sinus or excision on the opposite side near the tip; the single one of each series is subrotundate, with a shallow recess in place of the basal sinus, and with the opposite margin towards the tip slightly retuse, and is supplied by a single trachea divided nearly to the roots into two main branches with unilateral branchlets. Antennæ longer than the head and thorax combined [in *C. rufulum* of equal length with the body]. Setæ subequal to each other and to the body in length, fringed for at least halfway to the tips from the roots, with the ends of the fringes gradually shortened to points, and then tail-pointed, the proportionate length of the fringeless tail-points varying with the species. Mandibles terminated by compressed denticulate teeth; endopodite absent. Palpus of maxilla I. longer than the lacinia, 3-jointed; first joint as long as the second, and almost twice as long as the third; the lacinia armed with slender fang-like teeth at the tip, preceded by two evenly arranged divergent series of setulæ along the inner edge. Lacinia of maxillæ II. falcate, narrower than the acutely lanceolate lobes of the labium; proximal joint of the palpus a little shorter than the remainder, which are dilated distally and slightly compressed; the terminal joint obliquely truncate at the end and acute at the extremity. Median lobe of the tongue obtusely rounded, broader than the paraglossæ. Hind tarsus, claw excluded, a little shorter than the tibia, and this scarcely more than  $\frac{1}{2}$  as long as the femur; the whole leg about  $1\frac{1}{8}$  as long as the fore leg. Resident in still or sluggish

water; two-brooded. In southern Europe *C. dipterum* inhabiting warm sites has been observed to be ovi-viviparous.

*Type.* *C. dipterum* (in *Ephemera*), Linn.

*Distribution.* Temperate and tropical regions of the northern hemisphere; Australia; southern Africa; the Argentine Republic, and Chili.

*Etymology* obscure.

The nymph has been reared; those of *C. dipterum*, *C. rufulum*, *C. simile*, and of one of the Portuguese species have been examined by me. Through some oversight, the proximal joint of the tarsus of the ♂ intermediate leg has been omitted in Pl. XVII. In the original camera-lucida drawing its length corresponds exactly with that of the homologous joint of the hind tarsus.

#### CINGALESE SPECIES.

##### CLOËON MARGINALE, Hagen.

*Cloë marginalis*, ! Hag., Verh. zool.-bot. Gesells. Wien, viii. 477 (1858) & ix. 206 (1859) [excl. ♀ im.]; Etn., Trans. Ent. Soc. London (1871) 132, note.

*Subimago (dried).*—Thorax dull luteous; abdomen dull pitch-brown above, lighter at the sides; venter testaceous; setæ sepia-grey with black joinings. Wings transparent, tinted throughout very faintly with light bistre-grey, excepting in the marginal and submarginal areas, which are fuscous; neuration light brownish. Hinder legs testaceous in opaque view, changing in transmitted light to yellow-amber; fore femur luteous. [Nos. 38 and 39 in Hag. Mus.]

*Imago (dried & fragmentary).*—♂. Thorax above fuscous or bistre-brown. Dorsum of abdomen in segments 8–10 either of a similar or else of a redder brown; segments 2–7 translucent whitish anteriorly, edged with bistre-brown at the tips, and extensively suffused with bistre-grey before the tips, the dark colouring appearing in some examples to project forwards in a pointed streak on each side from the tip of the segment; venter of a light colour, narrowly edged with a dark colour at the joinings, but apparently free from other markings. Forceps similar to those of *C. dipterum*; a small dark acute projecting point is visible above the interspace between the forceps-limbs, as in that species. Fore femur, in opaque view, light brown-ochreous, with a dark band before the tip; tibia and tarsus of a rather dark amber tint. Hinder legs in opaque view of a light yellowish amber tint, with dark ungues and sometimes faintly obscured tarsi, and with a faintly defined dark spot, or fine abbreviated longitudinal streak, a little before the tip of the femur; knee opaque. Wing vitreous, very faintly amber-tinted in the marginal and submarginal areas; the great cross vein pitch-brown, or rufo-piceous, towards the subcosta; longitudinal neuration light brownish amber; cross veinlets whitish. In the marginal area are no cross veinlets before the bulla, but usually 2 or 3 straight ones in the pterostigmatic region.

♀. Wing vitreous, coloured with light bistre-brown in the marginal and submarginal areas. Neuration light brownish, excepting such of the cross veinlets as are distributed in advance of the sector (4), which are whitish in most lights; those situated in the coloured areas have extremely narrow translucent edging. The marginal area contains

no cross veinlets before the bulla, and usually 2–5 straight ones in the pterostigmatic space. Length of body or wing, ♂ im. 4–4.5, ♀ im. 5.5 mm.

*Hab.* Rainbodde, Ceylon, at altitudes of 4000 ft. and upwards (Hag. Mus. & M<sup>c</sup>Lach. Mus.). The ♀ imago (No. 40, Hag. Mus.) formerly attributed to this species is a *Teloganodes tristis*.

CLOËON, sp. (nameless).

*Subimago (dried)*, ♂.—Mesothorax dark brown-ochre in the middle, lighter at the sides; body discoloured, reddish brown or reddish piceous. Wings transparent, uniformly pale warm sepia-grey; neuration translucent, brown; some of the interneural adventitious veinlets in the neighbourhood of the pabrachial and anal nervures spring from the terminal margin in pairs; 4 cross veinlets in the pterostigmatic space, and 7 in the nearer portion of the marginal area (*i. e.* before the bulla). Fore leg with the femur luteous, the tibia and tarsus lutescent, and the extreme terminal edges of the tarsal joints darker: hinder legs very pale lutescent; the femur banded with greyish before the tip, and marked with a grey spot or dot on the outer side just by its extremity. Length of body 5, wing 6 mm.

*Hab.* Rainbodde, Ceylon, at upwards of 4000 ft. (No. 33 in Hag. Mus.).

CLOËON BIMACULATUM, sp. nov., Etn. MS., in the writing of Pl. XVII. 31 *d* (wing ♀ im.).

*Imago (dried)*.—♂. Thorax above piceous; abdomen discoloured; setæ whitish or brownish white, with black joinings and annulations. Fore femur reddish brown, the tibia and tarsus lighter and rather yellower; hinder femora brownish amber, the tibia and tarsus nearly of the same colour. Wings transparent with light brownish longitudinal neuration (excepting the costa, subcosta, and radius, which are dull light yellowish in tint, and only faintly coloured) and white cross veinlets; at the base of the costal area is a reddish brown spot extending to the wing-roots; in the pterostigmatic region a light bistre-brown spot, containing a clear space and traversed by white cross veinlets, occupies the marginal and submarginal areas to their extremities; the space intervening between these two spots along the front of the wing is faintly tinged with light yellowish brown: in the marginal area are about 4 cross veinlets between the great cross vein and the bulla, and 7 or 8 beyond this, all simple.

♀. Very similar. The cross veinlets in the front portion of the wing thickened as in *C. dipterum*, ♀. Length of body 5–5.5; wing 5.5–6; setæ, ♂ 13 mm.

*Hab.* Ceylon (Thwaites, in M<sup>c</sup>Lach. Mus.).

#### EUROPEAN SPECIES.

CLOËON DIPTERUM, Linn. Pls. XVII. 31 *a* (forceps and ♀ fore-leg and hind feet), XLVII. 22 (caudal setæ, nymph).

*Ephemerella diptera*, or [*Ephemerella*], [Réaum., Mém. pour serv. à l'hist. des Ins. vi. pl. xlv. 1 (1742); ? Pontop. (1753 & 4), and Naturhist. Dan. p. 223, pl. xvii. (1765)]; Linn., Fn. Suec. ed. ii. no. 1477 (1761); *id.*, Syst. Nat. ed. xii. pars ii. 906 [excl. obs.] (1767); [De G., Mém. d. Ins. ii. pars ii. 656, pl. xviii. 1–9 (1771)]; Fab., Syst. Ent. 304 (1775); *id.*, Sp. Ins. i. 385 (1782); Retz., Gen. & Sp. Ins. no. 184 (1783); Fab., Mant. Ins. i. 244 (1787); Raz., Hist. Nat. du Jorat, p. 210 (1789); Vill., C. Lin. Entom. iii. 20 (1789); [Zsch., Mus. Lesk. i. 150, no. 19 (1789)]; Gmél., Linn. Syst. Nat. ed. xiii. i.

pars v. 2630 (1790); Ros., Fn. Etrusc. ii. 9 (1790); Ol., Encyc. Méth. vi. 420 (1791); Fab., Ent. Syst. emend. iii. pars i. 71 (1793); Schr., Fn. Boica, ii. pars ii. 199 (1798); Lat., Hist. Nat. Crust. et Ins. xiii. 99 (1805); Shaw, Gen. Zool. vi. pars ii. 253 (1806); Lat., Gen. Crust. et Ins. iii. 184 (1807); Cuv., Règn. An. ed. 1, iii. 430 (1817); Lamarck, Hist. Nat. An. s.-vertèb. ed. 1, iv. 221 (1817); Sam., Ent. Comp. p. 259 (1819); Cuv., Règn. An. ed. 2, v. 244 (1829); Zet., Ins. Lap. col. 1046 (1840); Voigt, Lehrb. d. Zool. v. 311 (1840); Blanch., Hist. Nat. Ins. iii. 55 (1840); Dufour, Mém. par divers savans, Inst. de France, viii. 580 note (1841); Lat., Nouv. Dict. d'hist. Nat. x. 349 (1847); Verloren, Mém. Couron. Acad. Roy. Belg. xix. 49, pl. i. (1847); Blanch., Cuv. Règn. An., ed. Crochard, xiii. 92 (1848); Carus, Icon. Zootom. tab. xv. 6 [anatomy] (1857).—*E. annulata* & *E. † striata*, Mull., Zool. Dan. Prod. 143 (1776).—*E. † marginata*, Gor. & Prit., Nat. Hist. Obj. for Micros. [\*ed. i.] ed. iii. 61–9, pl. ii. 4–6 (1829); Bowerb., Ent. Mag. i. 239–44, pl. ii. 1–6 (1833); Lacord., Introd. à l'Ent. ii. 77 (1838); Brullé, Blanch. Hist. Nat. Ins. i. p. xxiv. (1840) [nymph].—*E. † culiciformis*, Fonscol., Ann. Soc. Ent. Fr. (2) iv. 49 [misprinted *calciformis*] (1846).

*Cloëon pallida*, Leach MS., Brewst. Edinb. Encyc. ix. 137 (1815); Sam., Ent. Comp. 259 (1819).—*C. marmoratum* [♀ im.] & *obscurum* [subim.], Curt., Lond. & Edinb. Phil. Mag. (3) iv. 121 (1834).—*C. cognatum*!, † *dimidiatum*!, & *consobrinum*!, Steph., Ill. Brit. Ent. vi. 69 (1835); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 579 [misprint. *cognata*] (1853) [♂ im.].—*C. virgo*!, Steph., Ill. &c. p. 70 (1835); Walk., List &c., p. 580 (1853) [♂ im.].—*C. dipterum*, Leach MS., Brewst. Edinb. Encyc. ix. 137 (1815); Curt., Lond. & Edinb. Phil. Mag. (3) iv. 121 (1834); ! Steph., Ill. Brit. Ent. vi. 68, pl. xxix. 3 (1835) [misprint. *diptera*]; Walk., List &c. p. 575 (1853); Hag., Ent. Ann. 1863, p. 29; Etn., Ent. Mo. Mag. v. 87 (1868); *id.*, Trans. Ent. Soc. Lond. (1871) p. 102, pl. v. 10 [forceps]; Hag., *op. cit.* (1873) p. 399 [nymph]; Meyer-Dür., Bull. Soc. Ent. Suisse, iv. 311 (1874); ! M<sup>c</sup>Lach., Trans. Ent. Soc. Lond. (1875) 171; Palmén, Morphol. Trach.-Syst. SS. 1–21 & 28, taf. i. 7–9 [anatom.] (1877); Rostock, Jahresb. d. ver. f. Naturk. Zwickau (1877) p. 80 (1878); Palmén, Paar. Ausf. gänge d. Geschl. org. b. Insect. S. 64 [anatom.] (1884).

*Cloë diptera*, Burm., Handb. d. Ent. Bd. ii. Abth. ii. 798 (1839); ! Pict., Hist. Nat. Névropt. ii. Ephém. 266, pl. xliii. (1843–5); Schn., Stet. Ent. Zeit. vi. 340 (1845); Calori, Nouv. Ann. Sc. Nat. Bologna (2) ix. 38–53, pls. ii.–iii. [viviparition] (1848) [translat. Joly, Bull. Soc. d'Étud. Sc. Nat. Nimes, 5<sup>e</sup> ann. No. 8 [Sep. pp. 1–18] pls. ii, iii. (1877)]; Brau., Neuropt. Austr. 26 (1857); Leunis, Synop. Naturgesch. Thierreichs, ed. 2, p. 636 (1860); Karsch, Die Insectenwelt, v. 400–2 (1863); Gerstäck., Handb. d. Zool. ii. 59–61 (1863); Hag., Ann. Soc. Ent. Fr. (1864), p. 39; *id.*, Ent. Mo. Mag. ii. 25 (1865); Ed. Pict., Névropt. d'Espag. 25 (1865); Oulianine, Neuropt. & Orthopt. prov. Moscow, p. 27 (1867); Ausser., Ann. del. Soc. Natur. Modena, Ann. iv. 135 (1869); ! Joly, Bull. Soc. d'Ét. Sc. d'Angers, 1876 [Sep. p. 42] note D [vivipar.] (1876); ! *id.*, Bull. Soc. d'Étud. Sc. Nat. Nimes, 5<sup>e</sup> Ann. no. 8 [Sep. pp. 21–25] notes B–I (1877); ! *id.*, Bull. Soc. d'Étud. Sc. d'Angers, 1878–80, pp. 169 & 172 (1880); Ciaccio, Rendicont. del. session. del. Accad. d. Scien. ec. di Bologna (1880) [anatom.].—*C. affinis*!, Ramb., Hist. Nat. Névropt. 298 (1842) [♂ im.].—*C. cognata* & *virgo*, Pict., Hist. Nat. Névropt. ii. Ephém. 272 (1843–5) [♂ im.].—*C. apicalis*!, Costa, Atti d. R. Acad. d. Sc. fisic. e mathemat. di Napoli, ix. 34 (1882) [♂ subim.].

*Chloëon dipterum*, Lubbock, Trans. Linn. Soc. xxv. pl. lix. 19–21 (1865).

*Cloëopsis diptera*!, Etn., Ann. & Mag. Nat. Hist. (3) xviii. 146 [excl. var.] (1866).

*Subimago* (*living*), ♀.—Wings light blackish grey or dusky. Oculi dark fusco-olivaceous. On each side of the venter, in segments 2–7 in the ♀ (2–8 in the ♂) is a rubiginose longitudinal line; the lines are represented by two dashes at the base of the 9th segment in the ♀.

*Imago* (*living*).—Wings colourless in the ♂, ornamented in the ♀ with amber-colour along the costa; the marginal area in the ♂ is free from cross veinlets as far as the

pterostigmatic space, but this contains 3-5 simple and usually straight cross veinlets, and sometimes rudiments at the costa of 2 or 3 others interspersed between these; in the ♀ there are about 6 before the bulla, and 10 with a few rudiments beyond it. The interval between the basal joints of the forceps-limbs in the ♂ is moderately wide, and behind [or above] it is a dark minute subconical point [penis?]; the terminal joints of the forceps-limbs are proportionally shorter than in other European species.

♂. *Variation 1.* Turbinate eyes dull light reddish, or reddish clove-brown, above; at the sides sulphureous or flavescent: lower eyes traversed by a dark line; above it either brown-black or greyish clove-brown, with a movable dark spot; below it and towards the orbit paler. Notum pitch-black or jet-black. Dorsum either piceous or fuscous or rufo-fuscous throughout, with the distal edges of the segments narrowly ochraceous or whitish; or else only so in segments 7-10, and in segments 2-6 partly translucent, each of these segments being whitish or cinereous towards the base and of the prevalent ground-colour distally, the dark colour extending forwards as a triangular projection on each side almost to the base of the segment, and sometimes also as a tapering streak in the middle of the back; venter dark cinereous with whitish joinings, usually marked with two longitudinal linear stripes in every segment excepting the last; but these stripes are sometimes reduced to mere spots in the joinings. Setæ white or greyish white, with black joinings and annulations, the latter often coinciding with every alternate joining towards the base of the seta, and with every fourth or fifth joining afterwards, but sometimes the alternation is uniform throughout. Legs variable in colour: the fore legs either dull whitish tinged with cretaceous in the distal portion of the femur, and with cinereous in the tibia and tarsus; or with the femur greenish grey and the tibia and tarsus blackish grey; the femur in either case has a rufescent spot or a pitch-brown annulation near its distal extremity: hinder legs whitish or cretaceous, the femoral marking often indistinct, the distal edges of the first, second, and third tarsal joints (or sometimes the whole of the third joint) and all but the extreme base of the fourth joint, black or dark grey. Wing-neuration sometimes almost colourless excepting at the wing-roots, usually piceous. Forceps cinereous, with the proximal joint fuscous.

♂. *Variation 2.* Differs from the preceding chiefly in being below the average in size, and in having segments 2-7 of the dorsum greyish anteriorly and rubiginose at the tips, with a triangular streak recurrent on each side from every dark apical border.

*Hab.* Belgium.

♂. *Variation 3.* Turbinate eyes bright yellow (*flavus*). Tergum of thorax brown-ochreous, the peak of the mesonotum light yellow-ochreous preceded by a pair of short brown-purple dashes tapering forwards. Abdomen in segments 2-7 translucent white, with some fine linear streaks along the spiracular line, a spot on each side of the dorsum of the 5th segment, a corresponding tapering stripe on each side of the 6th segment meeting a narrow half-effaced marginal band lying along the middle of the distal edge of the segment, a trifold spot on the 7th segment formed by a more strongly marked corresponding band and lateral stripes in conjunction with a median longitudinal stripe, the stripes extending to the base of the segment, and all but the extreme lateral portions of the dorsum in segments 8 and 9, Indian red; the 10th segment and the 9-7th ventral

segments very light yellow-ochre or yellowish white, with the usual pair of linear streaks in the 8th segment and two corresponding spots at the base of the forceps in the 9th segment, Indian red. Setæ white, with some of the joinings narrowly greyish. Legs and wing-neuration whitish, the femora faintly tinged with yellowish distally, their reddish markings reduced to an almost invisible dot in the hinder femora, and an almost obliterated band in the fore femur.

*Hab.* Italy, at Legnano (25 July).

♂. *Variation* 4. Turbinate eyes dull yellow-lake. Notum piceous. Otherwise very similar to Vars. 1 and 3.

*Hab.* Tessin; above Locarno (1670 feet, 15 May 1884), several examples.

♀. Rather variable in general coloration; sometimes luteous or lutescent, with a rosy suffusion, sometimes of a rosy fawn-colour or rosy-grey, and liable (whatever the prevalent tint may be) to a more or less extensive infiltration of chlorophyll in parts of the head, thorax, and abdomen, and in their appendages. Eyes olivaceous, traversed by two dark stripes; vertex of head with a red or red-purple stripe on each side from the lateral ocelli along the orbits of the oculi to the occipital margin; a quadrangular double spot of the same colour in the middle of the pronotum. Meso- and metanotum sometimes variegated with light fuscous, sometimes uniformly luteous or piceous. The 9th dorsal abdominal segment is either lighter or darker in colour than the others; segments 2-8 have reddish or piceous markings on a lighter ground-colour, viz. :—a longitudinal tapering median streak from the base to about the middle of the dorsum of the segment, or a continuous linear stripe down the middle of the back; also sometimes a transverse marginal band across the tip of the segment (but this is exceptional); also an unequally bifid spot on each side extending from the base to the tip of the segment (or at least as far as the distal joining), the longer upper division of which tapers upwards and backwards either as a curved linear stripe, or more usually, as a curvilinear trilateral, while the smaller lower and linear division runs nearly horizontally a little above the spiracular line; the curved stripes last mentioned coalesce with the distal median marginal band (when that is present) and, being met by the corresponding stripes of the contiguous segments, form together with them a kind of chain pattern along the back. All of the ventral segments (excepting the last two) are bilineated longitudinally with reddish or piceous, but the 9th segment has two dots at its base in the place of the stripes; the former segments commonly have an abbreviated longitudinal dark line on each side at the base, close to the spiracular region, which is sometimes joined by a narrow band to the adjacent linear stripe so as to form an L-shaped mark. Setæ usually coloured as in the ♂, or with the ground-colour reddish white; but, in some examples, at a short distance from their origin they become more strongly annulated, the dark colour occupying the whole of every alternate joint and some portion of the extremities of the other joints. The legs are more strongly marked than in the ♂, and when tinged with yellowish the fore femur is of a gamboge or yellow-ochre changing to light brown ochre in dead specimens; the hinder femora are of a light amber-colour, and the tibiæ and tarsi are of an extremely light brown-ochre or testaceous hue. The wing-membrane from the costa to the radius, and in the distal extremity of the area enclosed between

the radius and the sector, is of a brown amber-colour, or light fuscous, excepting along the borders of the cross veinlets, where it remains pellucid and white; the costa, subcosta, and radius are concolorous with the membrane, excepting sometimes the subcosta and the radius near the wing-roots, where, with the great cross vein, they are often fuscous or piceous; the cross veinlets in advance of the sector, including those also in the submarginal and marginal areas, are opaque white; the remainder of the neuration is piceous, excepting sometimes that the cross veinlets nearest the wing-roots and posterior to the pabrachial nervure (7) are also white; the cross veinlets in the disk of the wing are much stouter than the nervures in this sex. Length of body, ♂ 5-10, ♀ 8-11; wing, ♂ 6-11, ♀ 9-12; setæ, ♂ im. 13-20, subim. 9-14, ♀ im. 12-15, subim. 12 mm.

*Hab.* Europe, from Scania and Norway (Wallengren) southwards to the borders of the Euxine and Mediterranean; Madeira, in pools left in the lower parts of the beds of streams in the neighbourhood of Funchal (22 Nov. 1880), first collected by Wollaston; p. 21 Teneriffe, common near the Jardin Botanico, Orotava (15 Dec. 1880); Egypt (Savigny, and F. Walker!); Armenia (Hag. Mus.); Japan (M<sup>c</sup>Lach. Mus.). In Great Britain, clean ponds that acquire a rather high summer temperature are frequented by this species; at Paris, tanks for Nymphæaceæ and other water-plants in the Jardin des Plantes are its favourite resorts. Hitherto instances of viviparation on the part of *C. dipterum* have been observed only in the warmer parts of Italy and France.

The occurrence of species closely related to *C. dipterum* in N.W. India, and in the Knysna, S. Africa, was recorded by me in Trans. Ent. Soc. London (1871), p. 103; there is also one in Australia.

CLOËON SIMILE, Etn. Plates XVII. 31 *b* (adult wing, ♂ legs and forceps), XLVII. no. 2 (details of nymph).

*Cloë* || *obscura*, ! Ramb., Hist. Nat. d. Ins. Névropt. 297 (1842).

*Cloëon* || *obscurum*, ! Etn., Trans. Ent. Soc. London (1871) 104.—*C. simile*, ! *id.*, *op. cit.* (1870) 2; ! *id.*, (1871) 103, pls. ii. 7 & v. 11 [details]; Rostock, Jahresh. d. Ver. f. Naturk. Zwickau, 1877, 81 (1878).

*Subimago (living)*.—Wings mouse-grey, tinged with yellowish in a slight degree along the costa and at the base; the nervures somewhat raw sienna in colour. Setæ piceous. Oculi of ♂ subolivaceous.

*Imago (living)*.—♂. Turbinate eyes olivaceous or dark greenish sulphureous; lower eyes either pitch-black or greenish black. Notum either jet-black or fuscous. Abdomen pitch-brown above; venter cinereous, faintly tinged with yellowish towards the tip. Setæ rusty white, with reddish joinings. Forceps greenish white; the limbs nearly contiguous at the base; penis-cover (or penis?) gently curved distally, not acute like that of *C. dipterum*. Legs olivaceous with greyish or blackish tarsi; the fore tibia greenish grey. Wings vitreous; the subcosta and radius of the fore wing somewhat straw-colour or bright amber-yellow; the pterostigmatic portion of the marginal area contains numerous (about 9-11) cross veinlets, slightly irregular in their curvature and sparingly conjoined; there are none before the bulla in either sex.

♀. Eyes black. Head castaneous in the vicinage of the ocelli, with two longitudinal

lines or stripes of the same colour upon the vertex; the facial carina has two small piceous tubercles on each side. Abdomen luteo-fuscous or raw umber above, with the terminal edges of the segments testaceous or very light brown-ochreous, and with dark subcutaneous tracheæ; venter olivaceous, with the last two segments tinged somewhat with straw-colour or light yellow-ochre. Legs olive-green, with darker tibiæ and tarsi. Length of body 9–10; wing, ♂ 8, ♀ 10–11; setæ, ♂ im. 14–15, subim. 9, ♀ im. 10–14, subim. 7–9 mm.

*Hab.* Great Britain, in still water and in sluggish streamlets, during September and October. France, Autun (M<sup>c</sup>Lach.). Portugal, at Almodovar, Alemtejo (600 ft., 7 May), water 65° F.; São Marcos da Serra (580 ft.); and Silves, Algarve (about 130 ft., 16 May). Also in Switzerland at the Statzer-See, near St. Moritz in the Engadine (about 6000 feet, 16 August; M<sup>c</sup>Lach.). The name *obscurum* was preoccupied in this genus by Curtis [under *C. dipterum*].

CLOËON CONCINNUM, sp. nov.

*Imago (living).*—♂. Turbinate eyes dull light yellow or chrome-lemon (*flavus*); lower eyes olive-grey. Notum raw sienna or furfuraceo-luteous. Abdomen in segments 6–10 concolorous above with the notum, with paler joinings; segments 2–5 dirty white, suffused with the same colour as the remainder, the main tracheæ conspicuously dark; venter in segments 8–10 somewhat ochraceous. Setæ and forceps whitish; the limbs of the latter almost contiguous at the base. Hinder femora yellowish white; hinder tibiæ and tarsi smoky white or whitish sepia-grey; fore leg rather darker. Wings vitreous. *When dried* the neuration acquires a faint dull amber tint in certain lights; the pterostigmatic region of the wing, likewise very faintly amber-tinted and of slightly turbid translucidity, contains usually 11–13 rather irregular cross veinlets (of which a few are forked towards the costa and some anastomose with one another), seldom so small a number as 7–9 (counted at the subcosta): the fewer the cross veinlets, the more they are branched and anastomose; there are none before the bulla in either sex.

♀ (*dried*).—Very similar to the ♂. The cross veinlets of the pterostigmatic portion of the marginal area, more regular in this sex, are usually 10–12, seldom 8 in number; and the membrane thereabouts is more transparent than in the ♂; between the strictly pterostigmatic region and the bulla are sometimes a few (about 4) indistinct rudiments of cross veinlets. In dried examples of either sex the legs become more opaque than those of living specimens; femora sublutescent in opaque view, changing in transmitted light to light yellowish-amber; fore tibia and tarsus of ♂ in some lights olive-grey; hinder tibiæ whitish amber in transmitted light, nearly concolorous with the femora in other lights; hinder tarsi of ♂ rather yellower than the tibiæ, with the terminal joint either brown-ochreous or olive-grey, and black ungues; tarsi of ♀ often suffused with green. Setæ dull whitish, with faintly opaque joinings; in ♂ examples the setæ sometimes become faintly tinged with light brown-ochre. Length of body 7.5–8; wing 8–9; setæ, ♂ im. 14–16, ♀ im. 11 mm.

*Hab.* Portugal: the stream near Porcalhota, at the junction of the road from Mafra with that between Lisbon and Cintra (480 ft., 1st June 1880, shortly before sunset, water

66° F.). Distinguishable from *C. simile* by the colour of the legs and the bright colour of the  $\sigma$  oculi; and from *C. rufulum* by having the  $\sigma$  forceps-limbs close together at their insertion, by the greater irregularity of the pterostigmatic cross veinlets &c. In the absence of the subimago, and without direct comparison of dried examples with Rambur's type, it is impossible to pronounce an opinion as to the likelihood or otherwise of this species being identical with the following.

CLOËON SUBINFUSCATUM, Rambur.

*Cloë subinfuscata*, ! Ramb., Hist. Nat. d. Ins. Névropt. 298 (1842).

*Cloëon? halterata*, var., Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 577 (1853).—*C. subinfuscatum*, ! Etn., Trans. Ent. Soc. London (1871) 104.

*Subimago (dried)*.—♀. Wings tinted with dark ivory-black-grey, with luteous longitudinal nervures; the pterostigmatic portion of the marginal area contains about 12 sparingly forked cross veinlets; there are none before the bulla. Thorax lutescent; legs rather light brown-ochre. The joinings of the setæ dark. Length of body, ♀ 9; wing 11 mm.

*Hab.* Provence (*Ramb.*).

CLOËON RUFULUM, Müller. Plates XVII. 31 *c* (forceps), XLVII. no. 1 (nymph and details).

*Ephemera rufula*, Müll., Zool. Dan. Prodr. 143 (1776).—*E. † culiciformis* and *† striata*, Blanch., Hist. Nat. des Ins. iii. 55 (1840).—*E. † bioculata*, Blanch., Metamorph. &c. des Ins. p. 127, fig. [misdrawn] (1868).—*E. † vulgata*, Gegenbaur, Grundz. d. Vergleich. Anat. 438, fig. 112 $\Delta$  (1870) [tracheal syst.], reproduced in Balfour, Comp. Embryol. i. 339, fig. 188 $\Delta$  (1880).

*Cloëon dimidiatum*, Curt., Lond. & Edinb. Phil. Mag. (1834) 121; Hag., Ent. Ann. (1863) 32.—*C. dimidiata*, Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 580 (1853).—*C. russulum*, ! Etn., Trans. Ent. Soc. Lond. (1871) 105, pl. v. 12 [detail]; Hag. & Etn., *op. cit.* (1873) 400; Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 81 (1878).

*Cloë † pumila*, ! Ramb., Hist. Nat. d. Ins. Névropt. 298 (1842).—*C. dimidiata*, Pict., Hist. Nat. Névropt. ii., Ephem., 272 (1843-5).—*C. † bioculata*, Blanchard, Metamorph. &c. des Ins. p. 127, fig. (1868).

*Cloëon dimidiatum*, Lubbock, Trans. Linn. Soc. Lond. xxiv. 61-67, pls. xvii., xviii. (1863), and *op. cit.* xxv. 477-92, pls. lviii., lix. (1865).

*Cloëopsis † diptera*, var., ! Etn., Ann. & Mag. of Nat. Hist. (3) xix. 401 (1867).

*Subimago (living)*.—Wings extremely light greyish or greyish white, often tinged with bright green [green oxide of chromium] along the stronger nervures. Setæ light greyish.

*Imago (living)*.— $\sigma$ . *Variation* 1. Turbinate eyes Roman-sepia brown. Thorax jet-black above. Abdomen dark fuscous, with pale yellowish joinings, and with the tracheal ramifications black. Setæ white, with dull reddish joinings. Forceps white, light blackish grey distally. Legs pale greenish-yellow, with light dusky tarsi.

$\sigma$ . *Variation* 2. Turbinate eyes dull lemon-yellow, or dull sulphur-yellow; lower eyes fuliginose, or olive-grey, or glaucous. Thorax above pitch-brown, or fusco-luteous, or brown-ochreous, or almost raw-sienna yellow. Abdomen in segments 2-6 or 7 translu-

cent white, with the edges of the dorsal vessel, a spot on each side of it on every joining, and a cloud over the tracheal ramifications, dull reddish; the tracheal trunk pitch-black; segments 7-, or 8-10, above, either pitch-brown, or fusco-luteous, or fuscous, or almost burnt-sienna red, sometimes with the joinings ochraceous; venter in segments 7-10 ochraceous white, sometimes with a pair of abbreviated dark lines beneath the ganglionic cord at the base of each segment but the last, and with a dark line immediately beneath the spiracular ridge. Forceps and setæ white. Legs either wholly white, or with the fore femur greenish grey, the fore tibia and tarsus grey or greyish white, the hinder femora white tinged with very light yellow or sulphureous, and the hinder tibiæ and tarsi dull white. Wings vitreous; the marginal area in its pterostigmatic portion contains 6-8 oblique cross veinlets, sometimes sparingly forked near the subcosta; there are none before the bulla in either of the sexes.

♀ (*living*).—Eyes cæsius, or dark olive-grey, or light greenish grey, or brown-black. Vertex of head light yellow, with a double longitudinal median reddish or brown-ochreous stripe from the frons to the occipital margin. Thorax above sometimes very light dull brown-ochre, sometimes very light yellowish, sometimes bistre-brown, sometimes jet-black; the peak of the mesonotum often tinged with bright green. Abdomen sometimes fuscous, sometimes olive-grey, sometimes in such examples tinged distally with light brown-ochre, and sometimes uniformly of this last colour: the lighter segments (2-7) either have each a small spot in the middle, two at the apical margin, and an indistinct curved line on each side of the back, or have a small spot in the middle of the back, and a larger triangular spot on each side distally, of the same yellowish or furfuraceous colour; the subcutaneous tracheæ, and a streak close by every spiracle, are black. Venter lighter than the dorsum, and sometimes paler anteriorly than in the hinder segments, sometimes reddish white. Setæ white. Fore femur sometimes greenish- or olive-grey; hinder femora greenish white; tibiæ and tarsi white, with the terminal tarsal joints cinereous. Wings vitreous, often tinged at the base with bright green. Length of body 5-9; wing 6-10; setæ, ♂ im. 13-15, subim. 9, ♀ im. 10-12, subim. 6-8 mm.

*Hab.* Europe from Scania (Wallengren) and Great Britain to Switzerland and southern France; profusely abundant in Holland near Gouda &c. and in Belgium; common in Saxony (Rostock); also at Basle (M<sup>c</sup>Lach.), near Visp in Canton Valais; and in the neighbourhood of Orthéz in the Basses Pyrénées. The forceps-limbs are wider apart at the base than in our other native species, and their terminal joints more slender. The identity with this species of the Chinese specimen referred to below is open to question.

#### CLOËON SINENSE, Walker [Catalogue-name only].

‡ *Cænis sinensis*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 584 (1853).

*Cloëon* ‡ *russulum*, ! Etn., Trans. Ent. Soc. London (1871) 105, var. 2 [part.].

*Hab.* Northern China. A single adult ♂ in the British Museum, insufficiently described, is very similar to, if not identical with, *C. rufulum*.

## AMERICAN SPECIES.

## CLOËON MENDAX, Walsh.

*Cloë mendax*, Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 381.

*Cloëon mendax*, Etn., Trans. Ent. Soc. London (1871) 106.

*Subimago*, ♂.—Wings and their neuration subopaque and slightly dusky. Setæ pale. Turbinate eyes pale; lower segment of oculi blackish (Walsh).

*Imago*, ♂.—Pale ferruginous; sternum and venter pale greenish hyaline, the latter opaque at the tip. Legs pale, tips of tarsi cloudy. Wings and neuration hyaline; isolated veinlets of the terminal margin all single. The ♀ sometimes has the thorax tinged with green, and is always paler above. (After Walsh.)

♀ (*dried*).—Body light yellowish ochraceous above, sometimes very light, and commonly liable to infiltration of chlorophyll, especially at the roots of the setæ, the peak of the mesonotum, the wing-roots, the knees, and the tarsi. Venter whitish ochraceous; the main tracheæ of the abdomen often blackened. Setæ white. The marginal area of the wing has no cross veinlets between the great cross vein and the bulla; in the pterostigmatic space are 4–8 cross veinlets (usually 6) from the costa, mostly simple, rather oblique, and almost straight, very rarely anastomosing with one another to any extent, many of which do not reach the subcosta; and usually, between them, a few rudiments of others issue from the costa. Length of body 4–5, wing 5–6 mm.

*Hab.* Rock Island, Ill. (Walsh); Denham, Mass. (M<sup>c</sup>Lach. Mus.); Detroit, Mich. (Mus. Comp. Zool., Cambridge, Mass.). May and June.

## CLOËON VICINUM, Hagen.

*Cloë vicina*, Hag., Smithson. Miscell. Coll. (1861) Synop. Neuropt. N. Am. 54; *id.*, Proc. Ent. Soc. Philad. ii. 178 (1863).

*Cloëon vicinum*, Etn., Trans. Ent. Soc. London (1871) 107.

*Imago (dried)*.—♂. Thorax fulvous (Hag. 1861) or reddish brown (*id.* 1863); abdomen whitish hyaline, with the last 3 segments fuscous above; setæ whitish. Wings colourless. Legs whitish, the fore legs fulvous at the base.

♀. Body yellowish white; setæ and legs whitish; wings hyaline. Length of body 4; expanse of wings 10; setæ, ♂ 10, ♀ 6 mm. (After Hagen.)

*Hab.* Washington (Osten-Sacken).

## ? CLOËON DUBIUM, Walsh.

*Cloë dubia*, Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 380; Hag., Proc. Ent. Soc. Philad. ii. 178 (1863).

*Cloëon dubium*, Etn., Trans. Ent. Soc. London (1871) 106.

Mr. Walsh diagnosed this species from *Baëtis propinquus* (which it closely resembles) by its smaller dimensions &c.

*Imago*.—♂. Thorax and last 4 dorsal segments piceous: these last, beneath, opaque whitish; the intermediate abdominal joints transparent whitish, each with a dark dot on each side, whose centre is hyaline. Legs pale, the tips of the tarsi cloudy. Wings

and their neuration colourless; the intercalary veinlets of the terminal margin in pairs.

♀. Thorax, sternum, and abdomen above pale ferruginous; venter pale yellowish or greenish; femur of the fore leg always more or less ferruginous. Length of body 2·5–4; expanse of wings 8–10·5; setæ, ♂ 4·5–5·5, ♀ 3–4·5 mm. (After Walsh.)

*Hab.* Rock Island, Ill. (Walsh).

? CLOËON OLDENDORFFII, Weyenbergh.

*Oxycypha Oldendorffii*, Weyenb., Tijdschr. v. Ent. xxvi. 1882–3, p. 173, pl. x. 6 (1883) [wing].

*Imago (living).*—Eyes dark brown; head and thorax glossy sepia-brown, the colour changing to fallow-grey on the scutellum [schildje] and passing into a greyish brown on the dorsum of the abdomen. Underside of the body of a very light colour. Setæ translucent, light grey. Legs grey. Wings vitreous, with dark neuration; the submarginal area in the figure is shaded, and two straight cross veinlets, remote from one another, are shown in the pterostigmatic space. Rudimentary intercalary veinlets of the terminal margin of the mesothoracic wing paired. No mention is made of hind wings. Length of body 5–5·5, wing 4·75, setæ 6 mm.

*Hab.* Cordova, Argentine Republic; in the autumn, found at rest on walls. (After Weyenbergh.)

CALLIBÆTIS, Etn., 1881.

*Illustrations.*—*Adult* (details), Pl. XVI. 28 *a–d*; (whole figures) see citations of Pictet (1843–5) under *C. undatus* and *C. fasciatus*. *Nymph*, Pl. XLVIII.

*Adult.*—Hind wing oblique, widened rapidly in front from the roots to the costal protuberance, usually rather broad, and oblong, with the tip ellipsoidally rounded off; costal protuberance large and very obtuse; neuration limited to three main longitudinal nervures, a few rudimentary intercalars from the terminal margin between the second and the third of these, and (at least in the marginal area) a considerable number of cross veinlets. Fore wing in the majority of the species variegated in one or both of the sexes in front, and sometimes in the disk; but in others without colour-ornamentation; cross veinlets numerous throughout the whole of the marginal area, and either pluriserial in the disk or arranged in a few dislocated series, as in *Baëtis*; rudimentary intercalary veinlets of the terminal margin single or paired, according to the species. Forceps-limbs of ♂ conformable to those of *Cloëon*. Penis not observed hitherto. Of the ♀ abdominal segments 6–9 are a little the longest. Caudal setæ of ♂ im. 2–2½, ♀ im. 1½–1¾ as long as the body. Fore tarsus of ♂ about 1½ as long as the tibia, which is nearly 1⅓ as long as the femur; its joints in diminishing succession rank 2 subequal to 3, 4, 5, 1. Fore tarsus of ♀ about ¾ as long as the tibia, which is about as long as the femur; its joints in order of lessening length rank 2 subequal to 5, 4, 3, 1. Hind tarsus of ♂ about ½ as long as the tibia; its joints rank 1, 4, 2, 3. *Nymph.*—Abdominal tracheal branchiæ all double, with unequal divisions: the first and second are each formed of a large somewhat oblong lamina obtusely rounded at the tip, contracted transversely in some measure about midway from the roots, and slightly contorted, connate with a smaller underlying division

placed obliquely with regard to the larger; the next four are each composed of a large subovate lamina, with a flap turned over on one side close to the base, which constitutes the much smaller division; the seventh has the larger lamina narrowly ellipsoidal and a much smaller turned-over flap than the others; each of the larger laminae is supplied with a single main trachea with long branches and short branchlets. Antennæ about as long as the head and thorax combined. Setæ subequal to one another and about  $\frac{2}{3}$  as long as the body, fringed for about  $\frac{5}{9}$  of their length, with the fringes gradually shortened to a point, and then tail-pointed. Mandibles terminated by slender, compressed fangs, with a tuft of hair in place of the endopodite. Palpus of maxilla I. longer than the lacinia, slender, apparently 2-jointed, with joints of very nearly equal length; lacinia armed at the tip with slender fangs, and with other slender fangs mingled with hair along the inner edge. Lacinia of maxilla II. obtusely falcate, rather shorter than, but nearly of equal width with, the obtusely lanceolate lobes of the labium: proximal joint of the palpus stout, compressed, narrowed slightly and evenly from the base distally; second joint about thrice as long as the third joint, slightly gibbous at the base on the inner side as far as the oblique line of muscular attachment; third joint almost as broad at the base as the end of the second joint, and subacute at the tip. Tongue somewhat similar in form to a closed ecclesiastical biretta; median lobe subrotund, bluntly mucronate, and broader than the rounded paraglossæ. Hind tarsus, claw excluded, little shorter than the tibia, which is not quite  $\frac{2}{3}$  as long as the femur; the whole leg not much longer than the fore leg.

*Type.* *C. pictus* (in *Baëtis*), Etn.

*Distribution.* America from Canada to the Argentine Republic and Chili; also [undescribed sp.] Australia.

*Etymology.* *καλός* and *Baëtis*, a proper name, with reference to the beauty of many of the species.

The generical identification of the nymph was ascertained by examination of the hind wings of one of the alcoholic specimens received from Dr. Hagen, subsequent to the photolithographing of Pls. XVI., XVII. It then became evident that the genus had better be ranked at the close of the section, instead of at the beginning.

*CALLIBÆTIS HAGENI* (renamed), Etn. MS., in the writing of Plate XVI. 28 *a* (wings and part of femur).

*Baëtis* || *tessellata*, ! Hag., *Smithson. Miscell. Coll.* (1861) *Synop. Neuropt. N. Am.* 50; Etn., *Trans. Ent. Soc. London* (1871) 84 [note to *Lept. colombia*], and 150, note; Hag., *op. cit.* (1873) 395.

*Subimago* (*dried*).—Wing-membrane cinereous, or blackish grey; cross veinlets white, and narrowly bordered with white; the pale borders of a few that may happen to be close together side by side near the base or the middle of the wing are occasionally confluent, but only sparingly so; in some lights the longitudinal nervures also in great measure appear to be whitish, especially towards the terminal margin. Legs sublutescent, with the tarsi somewhat blackened. Setæ pale sepia-grey, with black joinings.

*Imago* (*dried*).—♀. Wings ornate; femora densely, minutely, and inconspicuously dotted; tarsi to a large extent black.—Body piceous; the dorsal sutures of the thorax

paler and yellowish; the abdomen discoloured, but rather uniformly coloured and ornamented throughout; its integument densely, minutely, and irregularly rugulose on the back, and foveolate ventrally; setæ white with black joinings (but these are reddish in imperfectly developed setæ). Wings vitreous, brilliantly iridescent; the fore wing ornamented with piceous, broadly along the costa, very narrowly along the terminal margin, and very variously in the disk; the costal markings may be described as a longitudinal stripe, deeply and irregularly eroded posteriorly, and varied diversely in different specimens with pellucid spots enclosing the cross veinlets; the terminal margin is white or pellucid at the terminations of the longitudinal nervures, but elsewhere pitch-brown, and the interneural veinlets arising from it are similarly dark, and sometimes are enveloped in little nebulae of the same colour, or spots; the irregular spots of the disk are in connection with dark portions of the longitudinal nervures; these are mostly white, banded with piceous, only the costa, subcosta, and radius being piceous throughout; cross veinlets opaque white; the marginal area contains about 8 cross veinlets before, and 13 within the pterostigmatic space, mostly simple, though a few are forked. Femora fuscolutescent, minutely and densely punctulate with darker, especially towards their distal extremities; tibiæ slightly paler, darkened at their distal joinings; basal joint of the tarsus almost concolorous with the tibia, but the extremity of the tibia, together with the rest of the tarsus, is dull black. Length of body, ♀ 12; wing 12; setæ about 17 mm.

*Hab.* Puget Sound and other parts of Washington Territory (Hag. and M<sup>c</sup>Lach. Mus.) and California (M<sup>c</sup>Lach. Mus.).

CALLIBÆTIS FERRUGINEUS, Walsh. Plate XVI. 28 *b* (wings ♀ im.).

*Cloë* † *undata*, ! Hag., Smithson. Miscell. Coll. (1861), Synopt. Neuropt. N. Am. 53 [part].—*C. ferruginea*, Walsh, Proc. Acad. Nat. Sc. Philad. (1862), 379.—*C. fluctuans*, *id.*, *loc. cit.* (1862); Hag., Proc. Ent. Soc. Philad. ii. 178 (1863).

*Baëtis fluctuans*, Etn., Trans. Ent. Soc. London (1871), 122.—*B. (?) undatus*, *id.*, *op. cit.* (1871), 123 [part]; Hag., *op. cit.* (1873), 402 [part].—*B. ferrugineus*, Etn., *op. cit.* (1871), 124; Hag. & Etn., *op. cit.* (1873), 402 [part].

*Subimago (dried)*.—Wing-membrane sepia- or bistre-grey; cross veinlets white, narrowly bordered with transparency in a manner very similar to those of *C. Hageni*; longitudinal neuration for the most part pale and similarly edged with transparency, the costa, subcosta, and radius of the fore wing (and, in parts, some of the other nervures) darkened uniformly with the ground-colour of the membrane. Legs sublutescent; the apical borders of the first three tarsal joints, and the extremity or sometimes the whole of the terminal joint, also the fore tibia, brown. Setæ pale sepia-grey, their joinings either opaque or blackened.

*Imago (dried)*.—Wings colourless in the ♂, ornate in the ♀; femora usually quite free from dots, and then normally pale lutescent in both sexes; or in the ♂ whitish, but clouded with pale lutescent before their extremities; sometimes in the ♂ they are dotted minutely in part or throughout; tarsi of the ♂ in great measure white.—♂. Thorax normally piceous or fusco-piceous; abdomen normally with the dorsum uniformly rufo-

piceous or intense warm sepia, and the venter light reddish white, densely and rather uniformly dotted with dull dark reddish, and generally with the several pairs of subganglionic streaks well defined; but the bases of the dorsal segments above the dorsal vessel are sometimes marked each with a pale streak. Forceps-limbs white, excepting the basal joint, which is yellowish and irrorated with reddish. Setæ white, sometimes with their joinings towards their insertion opaque. Wings vitreous throughout; the marginal area of the fore wing contains about 6 faint simple cross veinlets before the bulla, and 7-12 better defined beyond it; and the intervals of these last in the pterostigmatic space are occupied by variously disposed, more or less plentiful, granulations; most of the inter-neural veinlets of the terminal margins are in pairs. Femora pale, somewhat lutescent, slightly darkened a little before the tip, or more nearly white, and in some specimens dotted with minute inconspicuous pale reddish specks; fore tibia usually white, with its extreme tip brown, but in one example sepia-grey with the tip piceous; fore tarsus white, sometimes with brownish unguis; hinder tibiæ and tarsi white, sometimes slightly tinged with yellowish, with the unguis, and most commonly the joinings also, light red, or piceous.

*Variation, ♂ im. (dried).*—Thorax above fuscous, varied with flavescent, and slightly dotted with darker near the insertion of the fore wings. Abdomen above closely punctulate with black, somewhat fusco-griseous, varied with reddish and greyish white; the whitish markings comprise in each segment a streak from the base of the segment along the dorsal vessel, a larger triangular spot at the base of the segment that terminates a little before its dark apical border, and another rounded impressed spot at the base of the segment, adjacent to the spiracular line, forming regular series of markings; venter whitish, tinged faintly with reddish, closely and minutely punctulate with reddish, more coarsely and sparsely punctulate with black, with a short small black acutely triangular streak at the base of each of segments 3-8, adjacent to the spiracular line, and indistinct traces of the usual series of pairs of curved linear streaks adjacent to the ganglionic cords.

♀ (*dried*).—Body variously coloured during life [ranging, according to Walsh, from whitish brown mingled with brown to pale brown with the sixth abdominal segment brown], mostly piceous afterwards; surface very similar in detail to that of the body of *C. Hageni*. Setæ white, with black joinings. Wings usually ornamented with pale piceous, in nearly the same manner as those of *C. Hageni*; but sometimes the disk of the fore wing is spotless; the costa, subcosta, and radius are whitish and translucent in the pellucid spots; there are about 6-9, mostly simple, cross veinlets before, and 12-14 beyond the bulla in the marginal area of the fore wing. Femora pale lutescent, or pale luteous; the coxæ, tibiæ, and tarsi much paler; the last tarsal joint, and the apical borders of the others, as dark as the femora, and ochreous brown. Length of body 6-9.5; wing 6-9; setæ, ♀ im. 10.5-12, ♂ 15-17 mm. (*teste* Walsh).

*Hab.* Widely distributed in N. America; Red River; Quesnel Lake, British Columbia; Vancouver's Island; Washington Territory; Montana; Oregon (M<sup>o</sup>Lach. Mus.) and The Dalles, Or. (23 June, 1882, S. Henshaw, Hag. Mus.); San José, Cal.; Colorado; Rock Island, and Normal, Ill.; also New York. Two ♂ im. from Montana have a small cloudy

fuscescent spot at the junction of the radius (3) with the subsequent two nervures of the fore wing, and in the hinder legs the ungues, the last two tarsal joints, together with the extremities of the other joints and that of the tibia, are black-brown: in one of them the 10th dorsal segment of the abdomen is pale. [Numerous specimens in Hag., and in M<sup>c</sup>Lach. Mus.]

CALLIBÆTIS —, sp. nov. ?

*Imago (dried)*, ♂.—Wings ornate in this sex, as strongly and nearly in the same manner as those of *C. ferrugineus*, ♀ [compare Pl. XVI. 28 *b*]. Neuration of hind wing less sparse than in that species, closely resembling that of the hind wing of *C. montanus* [*loc. cit.* 28 *d*]. Legs much darker in colour than those of *C. ferrugineus*; the fore leg quite as dark as that of *C. Hageni*, being, in opaque view, either light pitch-brown, or warm sepia-brown, with the trochanter and base of the femur rather lighter; hinder legs very light yellowish brown, almost whity-brown, marked in the femur with very few and very indistinct round dark dots, the tarsi dusky or corvinous, with the ungues and the terminal edges of the joints black. Abdomen intense warm sepia-brown above, inclining to pitch-brown in parts, and varied with much lighter grounding similar in tint to the predominant light yellowish-brown of the venter; the dorsal joinings of a light colour; the sides of the dorsum are distinctly shagreened, or impresso-punctate, with pitch-brown; the venter is more densely impresso-punctulate with intense warm sepia-brown, and has depressions corresponding in size and situation with the pairs of abbreviated longitudinal streaks at the bases of the segments. Forceps whitish; the basal joints of the limbs uniform with the venter in colour and stippling. Setæ dusky, with black joinings. Wings vitreous; longitudinal neuration of the fore wing fuscous, varied in places with white; cross veinlets white, excepting sometimes a few of those contained within the dark markings adjacent to the costal margin, which markings are varied with various rounded pellucid spots in the customary manner; the marginal area contains about 10 nearly straight, oblique cross veinlets in the pterostigmatic region, partly conjoined by a longitudinal line of irregular granulations; the terminal margin itself is uniformly dark, and the interneural veinlets upon it are mostly in pairs. Length of body or wing 6·5–7; setæ 13–16 mm.

*Hab.* Colorado (M<sup>c</sup>Lach. Mus.). In the absence of the subimago one can hardly decide whether this should be regarded as a distinct species or not.

CALLIBÆTIS PICTUS, Etn. Plate XVI. 28 *c* (wings and two femora).

*Bætis pictus*, !Etn., Trans. Ent. Soc. London (1871), 122, pl. v. 27 [hind wing]; Hag., *op. cit.* (1873), 402.

*Callibætis* [type] *pictus*, !Etn., Ent. Mo. Mag. xvii. 196 (1881).

*Subimago (dried)*.—Wing-membrane sepia-grey, transparent; neuration (including cross veinlets) brownish, the cross veinlets sometimes narrowly and indistinctly edged with dim obscurity. Legs pale dull yellowish brown, the femora spotted, the tarsal joinings and ungues brown. Setæ sepia-grey, with dark joinings.

*Imago (dried).*—Wings colourless in ♂, ornate in ♀; femora marked with a row of 6–8 or more round spots, and with a few dots (most distinctly so in the hinder legs), sometimes confluent in part; tarsal joinings, ungues, and the last 1–3 joints blackish- or reddish-brown.—Body greatly discoloured; thorax above pitch-brown in ♂, dark lutescent in ♀; abdomen closely punctulate above, and still more so beneath; the venter and some parts of the dorsum rosy whitish-brown, with the punctulations dark red-brown; the remainder of the dorsum pitch-brown. Setæ white or reddish white, sometimes banded with grey; the joinings greyish in the ♂, black in ♀. Wings vitreous; pterostigmatic space slightly fuscous in ♂; in ♀ the marginal and submarginal areas, and the base of the fore wing are marbled with light umber-brown somewhat faintly and more evenly than in the two preceding species, the disk and terminal margin are also irregularly clouded with faint tints of a like colour; neuration pitch-brown, the terminal margin in ♀, and nervures 1–4 in both sexes, white here and there; cross veinlets dark in ♂, white in ♀; the marginal area in ♂ has no cross veinlets before the bulla, but has 6–8 beyond it; in ♀ there are 6–9 very faint before, and 11–16 beyond it, which are mostly simple, and have no granulation interposed between them. Length of body 5–6·5; wing 5·5–7; setæ, ♂ im. about 14, ♀ about 15 mm.

*Hab.* Widely distributed in the southern parts of N. America; California, at Brooklyn, San José, San Raphael (31 March, Osten-Sacken), and San Gerónimo (20 April, *idem*); Texas in Bosque Co. (Belfrage); Guatemala (5000 feet); and Aceytuno (5100 feet). [Many specimens in M<sup>c</sup>Lach, Mus. and Mus. Comp. Zool. Cambridge, Mass.

A very small undescribed species of *Callibætis* (in M<sup>c</sup>Lach, Mus.) from Florida has whitish grey wings. The fore wing of the ♀ is faintly amber-tinted in the marginal and submarginal areas; but in the ♂ the membrane is devoid of ornamentation. I have seen only 7 immature examples.

#### CALLIBÆTIS UNDATUS, Pictet.

*Cloë undata*, Pict., Hist. Nat. Névropt. ii. Ephém. 264, pl. xli. 5 (1843–5); Hag., Smithson. Miscell. coll. (1861) Synop. Neuropt. N. Am. 5 [part.].

*Cloëon undata*, Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 575 (1853).

A Mexican species, insufficiently described, and figured questionably; but perhaps admitting of re-identification by collectors at some future time. Two kinds of *Callibætis* captured in Cuba by Poey, Gundlach, and Chas. Wright, are represented in Dr. Hagen's collection, but too imperfectly for description. Pictet alludes to a species from the same island.

#### CALLIBÆTIS MONTANUS, sp. nov. Etn. MS. in the writing of Plate XVI. 28 d (wings & femur).

*Imago (dried)*, ♀.—Fore wings vitreous, ornamented in the marginal, submarginal, and the next adjoining areas with light raw umber-brown (fusco-luteous), the same colour extending across the base of the wing in proximity to the wing-roots, and varying in intensity distally, as well as in the proximal portion of the marginal area: neuration of a like colour, or lutescent, excepting the rudimentary cross veinlets preceding the bulla

in the marginal area, which are more or less whitish; before the bulla are 6 or 7 rudimentary cross veinlets, beyond it about 7 rudimentary and 7 well-defined simple and almost straight cross veinlets: the intercalary veinlets of the terminal margin are mostly single. Legs, in opaque view, somewhat of a dull light Vandyke-brownish grey, stippled or irrorated minutely and densely in the femora with very light burnt-umber brown; tarsal joinings also of this latter colour; terminal tarsal joints darkened; ungues black. Body discoloured; notum testaceous, irrorated on each side with brown-ochre, and traversed lengthwise by a median brown-ochreous stripe intersected by a light yellowish line. Setæ white, with the joinings and basal joints lutescent. Length of body, ♀ 6; wing 8 mm.

*Hab.* Central America; Aceytuno (5100 ft.) [in M<sup>c</sup>Lach. Mus.).

### CALLIBÆTIS FASCIATUS, Pictet.

*Cloë fasciata*, Pict., Hist. Nat. Névropt. ii. Ephém. 262, pl. xli. 4 (1843-5) [whole figure].—*C. Lorentzii*, Weyenb., Tijdsch. v. Ent. 1882-3, p. 167, pl. x. 4 (1883) [wings].

*Cloëon fasciata*, Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 575 (1853).

*Baëtis fasciatus*, Etn., Trans. Ent. Soc., London (1871) 123.

*Subimago (dried)*, ♂.—Wings transparent, very light brownish- or fawn-grey, striped and spotted with light brown: fore wing mottled along the costal border, and traversed obliquely, from the costa in the neighbourhood of the bulla to the anal curve of the inner-terminal margin, by a fascia somewhat irregular in outline, but broadest and sub-angulated near the costa; between this fascia and the wing-roots are two large spots extending at least from the costa to the præbrachial (6) nervure, and in the disk, midway towards the wing-roots, a small spot contiguous with, or intersected by, the long intercalary nervure that follows the anal (8) nervure: along the costa beyond the fascia are a large flexuous spot, followed by a smaller straighter spot, and several other small ones, all of irregular form and apt to be more or less confluent with one another; and near the terminal margin an irregularly broken fascia extends from just below the tip of the wing almost as far backwards as the termination of the first-mentioned fascia. The markings are dark-edged throughout the wing, and in the marginal area are broken up by clear spaces bordering the cross veinlets. Legs pale dull brownish-lutescent; the fore tarsus, and the joinings and extremities of the hinder tarsi fuscous. Setæ light sepia-grey, with reddish joinings. Thorax light dull brownish-lutescent. Abdomen faded, dark above, paler beneath; each of the first six ventral segments is marked with a pair of abbreviated, longitudinal, linear, black dashes, each followed by a black dot, and also with a reddish spot at the middle of the terminal margin. [After Pictet, and a ♂ subim. in Hag. Mus.]

*Imago (living)*.—♂. Upper portion of eyes dark reddish brown. Thorax and legs grey; the former somewhat darker above, and more yellowish in colour at the sides. Abdomen above reddish brown, sometimes nearly blood-red, or suffused with dark brown on the back, with very dark tips to the segments; venter similar in colour to the sides of the thorax. Setæ translucent, with darker joinings, especially towards the roots; the joints shorter than in *C. Sellacki*. Wing-markings somewhat darker in tint than those of that

species, but of a similar colour: front margin of the fore wing mottled, in the manner prevalent in the genus, as far as the radius (3); posterior to this nervure, from the neighbourhood of the bulla of the subcosta, a curved narrow fascia extends transversely to about the anal angle; this fascia is partly confluent with an irregular blotch of moderate dimensions, seated upon the pabrachial (7) nervure and spreading on both sides to the neighbouring intercalary nervures, but not nearly to the terminal margin; the same fascia is preceded by a blotch at the wing-roots, and another smaller blotch in the vicinage of the conjunction of the sector (4) and cubitus (5), and is united to the latter by a narrow projection of the colouring along the cubitus: immediately after the fascia is a large subtriangular blotch, which extends outwards along the radius as far as the commencement of the pterostigmatic region of the wing, and transversely from the radius to the sectorial intercalary next to the cubitus; this blotch contains a clear space; a band of colouring, parallel with the terminal margin, extends from the sector (4) to the præbrachial (6), and touches the lowest extremity of the last-mentioned blotch. The rudimentary intercalary veinlets of the terminal margin of the fore wing are paired. Hind wings similar to those of *C. Sellacki*, but somewhat clouded.

♀. Eyes olive-brown. Abdomen light yellow, or at most brownish yellow. Wing-nervures brownish. [Weyenbergh; abstract translation.] Length of body 6-7; wing 5.5-9; setæ, ♀ im. from 8 to 9 mm. and upwards.

*Hab.* Brazil (Pict.); Cordova, Argentine Republic (Weyenbergh & Hag. Mus.). In autumn; comparatively scarce; not associated with *C. Sellacki* (Weyenb.). Dr. Hagen's specimen was no longer with me when Prof. Weyenbergh's paper arrived. This species is smaller than the following, and has the cross veinlets of the fore wing rather differently arranged (*cf.* Weyenbergh's figures).

#### CALLIBÆTIS SELLACKI, Weyenbergh.

*Cloë Sellacki*, Weyenb., Tijdschr. v. Ent. xxvi. 1882-3. p. 164, pl. x. 3 (1883) [wings].

*Imago (living).*—♂. Eyes dark brown above. Thorax yellowish green, with a broad longitudinal median green stripe on the notum, which often appears sepia-colour edged with darker. Abdomen very light brown above, darker or reddish brown at the tips and in the midst of the segments, and with oblong black spots at the stigmata; venter very pale, with colourless forceps. Setæ [whitish?] annulated distinctly at the joinings with light sepia-colour towards their roots, but less distinctly so towards their extremities. Legs light brown, with the femora almost colourless above. [? towards their bases]; fore legs of ♂ almost yellow. Wings ornate in both sexes: neuration light brown. The light brown markings of the fore wing are mottled, in the usual manner, with rounded clear spots enclosing single cross veinlets along the costal border, and occupy a very large proportion of the remainder of the wing posterior to the radius; they comprise a blotch at the wing-roots, nearly contiguous with another protuberance from the said border, which just overlaps the præbrachial (6) nervure, followed closely by a broad transverse fascia, nearly in the middle, which crosses the wing and terminates at the anal angle; that fascia is followed directly, at the costal border, by two abbreviated confluent bands, which by their combination compose a large irregularly triangular

blotch that encloses a clear space; another irregular band extends some distance in proximity to the terminal margin and subparallel therewith. At the terminal margin, the interneural veinlets are single. Hind wings perfectly clear.

♀. The markings of the wings correspond somewhat with those of the other sex; but the bands are more perfectly defined, though fainter in colour, and both they and the blotches are broader; hence the clear spaces are much smaller. Posteriorly the whole of the wing-membrane has a smoky tint. Eyes pearl-grey, each traversed horizontally by a black line; the remainder of the head and thorax yellow-grey, with the 'appendicular organs' almost colourless. Length of body 8-10; expanse of wings 16; length of setæ, ♂ im. 15, ♀ im. 12 mm.

*Hab.* Cordova, Argentine Republic; commonly, but not exclusively, in the autumn. [After Weyenbergh, abstract translation, and partly based upon his figures.]

### GROUP III. OF THE GENERA OF THE EPHEMERIDÆ.

*Adult.*—At the fore-wing roots the anal (8) communicates with the pabrachial (7) nervure by a well-defined channel of circulation in the membrane; and the first axillar (9<sup>1</sup>) nervure, detached from its own group of nervures, either meets or is very closely approximated to the anal nervure at the base of the wing. [In *Bætisca* it is subparallel with the anal, but nearer to it than to the second axillar nervure.] Legs all functional; hinder tarsi distinctly 5-jointed [the fifth joint in *Coloburus* is less distinct than is usual]; ungues rather small. Contour of ♂ oculi either evenly rounded or obsoletely ascalaphoid. *Nymph.*—the structure of the palpi varies with the Series.

#### *First Series of Group III.*

*Adult.*—Anal-axillar interspace [p. 81, l. 6 *from bottom*] of the fore wing curvilinear-trilateral, subtended by the outer half of the inner margin and the anal angle [in *Bætisca* closed by the terminal margin, and narrowly sublinear in form]; the intercalary nervures of this interspace, varying in number with the individual, constitute simple or divided branchlets of the anal [in *Bætisca* the second axillar (9<sup>2</sup>)] nervure, and as a rule are entirely free from cross veinlets distinctly recognizable as such. The structure of the thoracic spiracles of many of the genera (owing to their valves being closed in the dried examples exclusively obtainable for examination) has not been ascertained in a manner sufficiently satisfactory for descriptive purposes, and is therefore taken only tacitly into account here. Pronotum of ♀, when well developed, transverse, longitudinally carinate, appressed closely to the mesonotum, and more or less broadly reflexed at the sides to a maximum not exceeding double its minimum extent. Forceps-basis of ♂, and the homologous ventral lobe of ♀, usually well developed; but the latter is small in *Siphylurus* and absent in *Oniscigaster*. Oculi of ♂ either evenly contoured or obsoletely ascalaphoid; anterior ocellus rather smaller than the others. *Subimago* quiescent many hours; its posture has been observed in only a few of the genera. *Nymph.*—Palpi of both pairs of the maxilla triarticulate. Abdominal tracheal branchiæ, when exposed, foliaceous, fringeless, and without fasciculated fibrils at the base; those

of *Bætisca* are concealed by a large notal shield when the insect becomes adolescent, and their structure is peculiar.

*Section 10 of the Genera.*—Type of *Siphylurus*. *Adult.*—In the fore wing, the first axillar nervure (9<sup>1</sup>) meets the inner margin at or before the middle; the anal nervure (8) terminates close to the anal angle and receives several simple or divided branchlets [intercalaries] from the outer half of the inner margin. Pronotum well developed. *Nymph.*—Palpus of maxilla I. as long as the lacinia, or longer. Pronotum and sutures of the mesonotum well defined. Terminal margins of the fore wings free.

The affinity between the genera of this section and those of the type of *Baëtis* has already been remarked upon at page 154. *Bætisca*, ranked apart in Section 11, is rather similar to genera of the *Siphylurus* type in aspect.

The relative dimensions of legs, setæ, or segments, indicated in the definitions of the genera, are employed, in the absence of whole figures, to convey an approximately definite idea of the aspect of typical examples of the insects concerned, so far as this may be dependent largely upon those proportions. But yet the descriptions must not be interpreted rigidly in these particulars; because the generical likeness of species can be maintained and be appreciated at a glance, where the standard proportions have been departed from in some points.

Nymphs of only three of the genera of this section are known; that of *Chirotonetes* (as it is supposed) has tracheal branchiæ on segments 1-7 of the abdomen, all of which are single obovate lamellæ; *Siphylurus* has similarly situated tracheal branchiæ, but those of segments 1 and 2 are double. *Oniscigaster* has tracheal branchiæ on segments 1-6 only, of which all but the foremost are produced each on the inner side into a curiously foliated lobe.

#### TABULATION OF THE GENERA OF THE *Siphylurus* TYPE.

Tibiæ of the hinder legs longer than, or at least subequal in length to, the tarsi. Proximal joint of the hind tarsus

shorter than the 2nd joint. Tarsal claws mutually

dissimilar. Costal dilatation of the hind wing acute. In ♀ abdomen the ventral lobe of segment 9 is bifid and acutely excised; pleuræ of segments 7 and 8 squarely truncate, each with a minute spinule at the point, those of segment 9 produced each into a short acute triangular tooth. Diminishing gradation of tarsal joints:—fore tarsus ♂ 2, 3, 4, 5, 1, ♀ 5, 2 subequal to 3, 4, 1; hind tarsus ♂ and ♀ 5, 2, 1 subequal to 3, 4 [in ♀ Pl. XVIII. 32 b, 5, 2 subequal to 3, 1, 4] ..... *Coloburus*.

alike, narrow and hooked. Costal dilatation of the hind wing obtuse. In ♀ abdomen, the ventral lobe of segment 9 is

roundly emarginate with acute points; pleuræ of segments 7 and 8 squarely truncate, of segment 9 narrowly dilated outwards and produced each into a short acute tooth behind. Gradation of tarsal joints:—fore tarsus ♂ 1, 2, 3, 4, 5, ♀ 5, 1, 2, 3, 4; hind tarsus ♂ 5, 2, 1 subequal to 3, 4, ♀ 5, 1 subequal to 2, 3, 4..... *Chirotonetes*.

acutely excised, with short acute points; pleuræ of segments 7-9

- squarely truncate. Gradation of tarsal joints:—fore tarsus ♂ 3 and 2 subequal to 4, 1, 5, ♀ subim. 2, 1, 3, 4, 5; hind tarsus ♂ 2, 5, 1, 3, 4, ♀ subim. 2, 1, 5, 3, 4. [Pl. XX. ? 34 b] ..... *Metamonius*.
- subequal to the 2nd joint. Tarsal claws mutually dissimilar. Costal dilatation of the hind wing almost right-angled. In ♀ abdomen the ventral lobe of segment 9 is subtriangular with the vertex retuse; pleuræ of segments 7–9 squarely truncate. Gradation of tarsal joints:—fore tarsus ♂ 2, 3, 4, 1, 5, ♀ 2, 1, 3, 5, 4; hind tarsus ♂ and ♀ 2, 1, 5, 3, 4.—[Pl. XVIII. ? 34 a] ..... *Ameletus*.
- longer than the 2nd joint. Tarsal claws mutually alike, narrow and hooked. Costal dilatation of the hind wing obtuse. ♀ unknown. Gradation of tarsal joints:—fore tarsus 1 equal to 2, 3, 4, 5; hind tarsus 1, 2, 5 subequal to 3, 4 ..... *Dipteromimus*.
- Tibiæ of the hinder legs shorter than the tarsi. Proximal joint of the hind tarsus longer than the 2nd joint. Tarsal claws mutually alike. Costal dilatation of the hind wing obtuse. In ♀ abdomen the ventral lobe of segment 9 is very short, parabolic or obtusely triangular; pleuræ of the segments 7–9 obtuse behind. Gradation of tarsal joints:—fore tarsus ♂ 2 equal to 3 and subequal to 4, 1, 5, ♀ 1, 2, 5, 3, 4; hind tarsus ♂ 1, 2, 3 subequal to 5, 4, ♀ 1, 2 subequal to 5, 3, 4..... *Siphurus*.
- dissimilar. Costal dilatation of the hind wing very small and obtuse. In ♀ abdomen the ventral segment 9 is lobeless; pleuræ of segments 1–6 truncate behind, of 3–6 slightly dilated posteriorly, those of 7–9 broadly dilated laterally and produced posteriorly each into a short acute tooth. Gradation of tarsal joints:—fore tarsus ♂ 1, 2, 3, 4, 5, ♀ 1, 2 subequal to 5, 3, 4; hind tarsus ♂ and ♀ 1, 5, 2, 3, 4..... *Oniscigaster*.

## COLOBURUS, Etn. 1868.

*Illustrations*.—*Adult* (details) Pls. XVIII. & XIX. a–c.

*Adult*.—Fore leg of ♂ about as long as the body [when dried  $1\frac{1}{10}$  as long]; tarsus about as long as the tibia, and this about  $1\frac{5}{8}$  as long as the femur; diminishing sequence of tarsal joints 2, 3, 4, 5, 1, the first joint nearly  $\frac{1}{8}$  as long as the second. Fore leg of the typical ♀ about  $\frac{7}{11}$  as long as the body; tarsus about  $\frac{3}{8}$  as long as the tibia, which is about  $1\frac{1}{2}$  as long as the femur; tarsal joints in lessening length rank 5, 2 subequal to 3, 4, 1, the first joint about  $\frac{1}{2}$  as long as the second. In an undescribed N. American species [Pl. XVIII. 32b] the ♀ tarsus is about  $\frac{4}{7}$  as long as the tibia, and this about  $1\frac{3}{4}$  as long as the femur. Hind tarsus of the typical ♂ about  $\frac{5}{12}$  as long as the tibia, and this about  $1\frac{1}{2}$  as long as the femur; the first joint is about  $\frac{2}{3}$  as long as the second, but both of them are short. Ungues in every tarsus each unlike the other. Hind wings well developed, oblong-oval, with the dilatation of the marginal area acute in front, and with relatively scanty neuration in the narrow axillar region. In the ♀ abdomen the relative lengths of the 2nd–9th dorsal segments may be formulated approximately thus:—5, 8,

10, 12, 13, 13, 11, 8, 5; the first segment is thoracoid. The squarely truncate pleuræ of segments 7 and 8 are minutely mucronate; those of segment 9 are produced posteriorly each into a short acute triangular point. Forceps-basis of  $\sigma$  divided almost completely into two broad divisions; the limbs 3-jointed, the proximal joint subcylindrical, slightly enlarged or gibbous at the extreme base, and not much longer than the remaining joints combined. Ventral lobe of  $\varphi$  bifid and acutely excised. Penis-lobes narrow, obliquely pointed; orifices of the seminal ducts placed in proximity to the extreme points of the lobes; their armature is not obvious in dried specimens, but may resemble in some degree that of the penis-lobes of *Siphilurus*. Median caudal seta rudimentary, only  $\frac{1}{10}$ - $\frac{1}{4}$  as long as the outer setæ; these are about twice as long as the body in the  $\sigma$ , and  $1\frac{1}{2}$  as long as it in the  $\varphi$ . Oculi of  $\sigma$  contiguous, or nearly so, above, obsolete ascalaphoid, with the upper segments hemispherical and the lower relatively very small. Vertex of  $\varphi$  head transverse; the occipital border raised in the middle above the level of the posterior orbits of the oculi. Median ocellus smaller than the others; not isolated, but situated upon the foremost prominence of the upper surface of the head. Pronotum of  $\varphi$  broadly reflexed upon the mesopleuræ, and in the middle deeply excavated behind. *Nymph* unknown.

*Type.* *C. humeralis* (in *Palingenia*), Walker.

*Distribution.* New Zealand and (undescribed sp.) N. America.

*Etymology.*  $\kappa\omicron\lambda\omicron\beta\omicron\upsilon\rho\omicron\varsigma$ , in allusion to the rudimentary median seta.

COLOBURUS HUMERALIS, Walker. Plate XVIII. 32 *a* (wings, legs, and  $\sigma$  genitalia).

*Palingenia humeralis*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 552 (1853).

‡ *Bætis remota*, *id.*, *op. cit.* part iii. 564 (1853).

*Coloburus* [type] *humeralis*, ! Etn., Ent. Mo. Mag. v. 89 (1868); ! *id.*, Trans. Ent. Soc. London (1871), 132, pls. iii. 1 & vi. 6-6 *b* [detail].

*Subimago* (*dried*).—Wings very light grey, with rather darker narrow mouse-grey borders to the cross veinlets in the greater part of the disk; but in the fore wing the cross veinlets of the first three areas (excepting those of the pterostigmatic space) and also those in the first  $\frac{1}{3}$  of the wing's length between the cubitus (5), præbrachial (6), and pobrachial (7) nervures are more distinctly edged with sepia-brown; the wing-roots and great cross vein, together with the bases of the principal nervures, are of a dull, very light ochreous tint; but elsewhere the neuration is dull piceous. Setæ light warm sepia- or Vandyke-brown; the joinings opaque in some examples.

*Imago* (*dried*).— $\sigma$ . Notum either pitch-brown or fuscous. Abdomen rufo-piceous or opaque burnt-umber. Setæ pitch-brown. Fore legs in opaque view pitch-brown; hinder femora and tibiæ in opaque view very light raw-umber- or yellowish-brown, changing in transmitted light to pale yellowish amber; hinder tarsi dull bistre-brown. Wings vitreous, tinged in proximity to the wing-roots with light raw-umber, and in the pterostigmatic region of the fore wing from the costa to the radius with light bistre-brown; neuration pitch-brown, with the roots of the longitudinal nervures light raw-umber; cross veinlets of the fore wing edged narrowly with warm sepia-brown between the cubitus (5) and pobrachial (7) nervures in the first  $\frac{1}{3}$  of the wing's length, and between the costa and sector (4) in its first  $\frac{1}{2}$ ; those of the pterostigmatic portion of the marginal area branch near the costa and mostly anastomose with one another.

♀ Very similar to the ♂. Fore leg in opaque view pitch- or dark bistre-brown, with the end of the tibia darker. Hinder legs in opaque view light bistre-brown, with tarsi of a duller colour; in one example the colour is more of a raw-umber; in transmitted light the bistre changes to light raw-umber and to brownish amber, and the raw-umber of the exceptional specimen to yellow-amber. The cross veinlets of the pterostigmatic portion of the marginal area of the fore wing branch about midway between the costa and the subcosta. Length of body 10–11 [shrunken]; wing, ♂ 13, ♀ 14–16; setæ, ♂ im. 15–20 & 2, subim. 14 & 1, ♀ im. 15 & 1, subim. 14 & 1 mm.

*Hab.* New Zealand; common at Christchurch (Fereday) and Otago [Brit. Mus. & M<sup>c</sup>Lach. Mus.].

COLOBURUS HALEUTICUS, Etn. Plate XVIII. 32 *c* (penis), XIX. 32 (fore wing).

*Coloburus haleuticus*, ! Etn., Trans. Ent. Soc. London (1871), 133, pl. vi. 7, 7 *a* [detail].

*Imago (dried)*, ♂.—Notum raw-sienna [furfurosus]. Abdomen rufo-fuscous above, rather darker at the joinings; pleuræ testaceous; venter rufo-lutescent. Setæ fuscous; forceps testaceous, tinged distally with piceous. Fore legs rufo-piceous; hinder legs light brownish ochre. Wings vitreous, with pitch-black neuration, excepting that the membrane and nervures close to the wing-roots are suffuscous, and the marginal and submarginal areas of the fore wing in the pterostigmatic region are greenish grey. Length of body, ♂ im. 11; wing 15; setæ 20 and 5 mm.

*Hab.* Australia; probably near Melbourne [M<sup>c</sup>Coy]. Well distinguished by the shape of the penis.

CHIROTONETES, Etn. 1881.

*Illustrations.* *Adult* (details), Pls. XVIII. 33 *d–e* & XIX. 33 *a, b, ?c*. *Nymph*, Pl. XLIX.

*Adult*.—Fore leg of ♂ from about  $\frac{2}{3}$  to  $\frac{9}{11}$  as long as the body; tarsus scarcely longer than the tibia, which is nearly  $1\frac{5}{8}$  as long as the femur; diminishing sequence of tarsal joints 1, 2, 3, 4, 5, the first nearly  $1\frac{1}{6}$  as long as the second joint. Fore leg of ♀ nearly as long as the body [when dried about  $\frac{8}{10}$  as long]; tarsus about  $\frac{5}{8}$  as long as the tibia, and this about  $1\frac{1}{2}$  as long as the femur; sequence of tarsal joints 5, 1, 2, 3, 4, the first  $1\frac{1}{5}$  as long as the second. Hind tarsus of ♂ nearly  $\frac{3}{4}$  as long as the tibia, and this about  $\frac{5}{8}$  as long as the femur; sequence of joints ♂ 5, 2, 1 subequal to 3, 4; ♀ 5, 1 subequal to 2, 3, 4. Ungues mutually alike; those of the ♂ fore tarsus terminate each in a narrow obtuse squamiform point, creased lengthwise in the middle and concave beneath; those of the hinder tarsi and of the ♀ fore tarsus are narrow and unciniate. Hind wings well developed, obtusely oblong-ovate, with the summit of the dilatation of the marginal area obtuse; axillar region largely developed and with abundant neuration, of which a large portion is composed of numerous long branchlets of the hindermost axillar nervure. In Pl. XIX. 33 *b* the functions of the first axillar (9) have been usurped by the intercalar nervure intervening between it and the second axillar. In the ♀ abdomen the relative lengths of segments 2–10 may be formulated thus:—8, 11, 12, 12, 13, 11, 11, 5; the first segment is thoracoid; the pleuræ of segments 7 and 8 are squarely truncate; those of segment 9 are very narrowly dilated laterally, and are each produced posteriorly into a short acute tooth; the ventral lobe of the 9th segment

is roundly emarginate with acute points. Forceps-basis of ♂ variously excavated or excised according to the species; forceps-limbs 3-jointed, with the proximal joint gibbous or slightly enlarged at its extreme base, and longer than the remaining joints combined. Penis of various form, without apparent stimuli. Median caudal seta sometimes totally aborted, and sometimes extremely rudimentary in the same species; outer setæ about twice as long as the body in both sexes. Oculi of ♂ obsoletely ascalaphoid, contiguous above; their inner orbits concave. Vertex of ♀ head longer than broad, very little broader in front than behind, with the occipital border only slightly raised and projected little beyond the level of the posterior orbits of the eyes. Median ocellus rather smaller than the others and isolated, occupying a small shallow depression in front of and below the anterior edge of the upper surface of the head. Pronotum of ♀ somewhat narrowly reflexed upon the mesopleuræ; its posterior margin opposite the interspace between the eyes is almost straight, but minutely emarginate in the middle, and retires to form a shallow recess thereabouts. *Nymph* [*generical identification doubtful*].—Abdominal tracheal branchiæ borne by segments 1–7, all obovate and single. Antennæ shorter than the head and pronotum, about 14-jointed at maturity. Stipes of the mandibles unusually short; endopodites absent; fangs slender, two in number. Lacinia of maxilla I. unusually short and broad, beset on the crown with numerous slender curved pectinate spines [somewhat in the same manner as that of *Thraulius* is crowned with a tuft of hair], and ciliated for some distance from the point along its inner edge; palpus equal in length to the lacinia, its first joint nearly of the same length as the second, and longer than the third joint. Lacinia of maxillæ II. somewhat falci-form, much narrower than the lobes of the labium; these are unusually broad, trilateral, with the outer side saliently rounded off and the other sides nearly straight, and are spinulose along their distal borders. Paraglossæ roundly expanded distally, and longer than the subrotund median lobe of the tongue. Abdominal pleuræ narrowly dilated, and with short acute points behind. Hind leg nearly of the same length as the fore leg; tarsus (claw excluded) about as long as the tibia. Setæ subequal in length to one another, and  $\frac{1}{2}$  as long as the body; median seta plumose, the others ciliated on the inner side; their fringes taper towards the points.

*Type.* *Ch. ignotus* (in ‡ *Baëtis*), Walker.

*Distribution.* Continental Europe, in large rivers; N. America; Sumatra (undescribed sp.).

*Etymology.* χειροτονητής, *one that stretches out the hands*, from the attitude of the imago in repose.

*Synonymous* with ‡ *Baëtis* (B), Walsh, 1862, and || *Isonychia*, Etn., 1871.

The nymphs referred here provisionally were sufficiently matured to show that the tarsi of the imago are 5-jointed; and so far as their wing-neuration could be ascertained, there was nothing adverse to their being placed here. Length of body 9, setæ 4.5 mm. Five specimens collected by Mr. Hubbard at Trenton Falls, N. Y., on 20th May, 1874 [the typical set], and one captured by Lieut. Carpenter near Denver and Colorado Springs in the Foot Hills, Color., in 1873 [Mus. Comp. Zool. Cambridge, Mass.], are the materials studied.

CHIROTNETES IGNOTUS, Walker. Plate XIX. 33 *b* (wings, ♂, head, and forceps).

‡ *Baëtis ignota*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 571 (1853).

|| *Isonychia ignota*, ! Etn., Trans. Ent. Soc. London (1871), 135, pl. vi. 29.—*I. ferruginea*, ! Albarda, Ent. Mo. Mag. xv. 128 (1878); ! Etn., *op. cit.* xvi. 36 (1879).

‡ *Siphilurus*, *sp.* —, ! Rostock, Jahresb. d. Ver. f. Naturk. Zwickau, 1877, p. 88 (1878).

*Subimago* (*living*), ♂.—Eyes subolivaceous. Wings somewhat fawn-colour, becoming (*when dried*) dull light brownish ochre or yellowish brown, bordered narrowly along the terminal margin with ivory-black grey, and marked in the anterior wing with two or three evanescent dusky nebulae or abbreviated transverse streaks from the fore margin, due to the grouping of the cross veinlets, which are very narrowly edged with black (or *when dried* with light grey); neuration yellowish (like the membrane), with the exception of a few cross veinlets in the marginal and submarginal areas between the great cross vein and the bulla, which are black.

*Imago* (*living*), ♂.—Eyes light red or brownish red, with the orbits ochreous, and with a movable black round spot or curved streak. Notum pitch-brown or (*when dried*) rufo-piceous. Abdomen purple-brown above (*when dried* dull Venetian-red brown), with the joinings of the segments very narrowly brownish, the terminal segments rather paler than the others, and the edges of the pleuræ ochraceous; venter spotless, unless (as in *dried* examples) marked in segments 2–8 with a median light brownish Venetian-red triangular spot pointing forwards and extending from the hinder margin to the base of the segment, leaving on each side a pale triangular space of the lighter ground-colour. Setæ whitish, but piceous near their insertions, with this darker colour gradually shaded off. Forceps dusky, paler at their joinings. Fore leg piceous; the tibia and tarsus pitch-black, excepting the bases of the tarsal joints and the ungues, which are pale. Hinder legs lutescent straw-colour, or (*when dried*) bright amber-yellow, with the terminal tarsal joint and the outer claw dusky. Wings vitreous, with almost pellucid neuration, some of the longitudinal nervures being sometimes very faintly amber-tinted.

♀. Very similar to the ♂. Vertex of head and pronotum pale; the mesothoracic sutures in front of the wing-roots yellow-ochreous. Venter paler than in the ♂; segments 2–7 marked on each side with a black dot beside the spiracle, and each with large twin acute obtriangular light subochraceous spots enclosing a chalice-shaped or cup-like purple-brown spot in the vicinage of the ganglion (often obliterated *when dried*). Setæ ochroleucous, purple-brown at the roots. Fore tarsus dusky, with the tips of the joints black; hinder tarsi very narrowly edged at the joinings with reddish; the terminal joint and ungues dusky. Length of body or wing 12–13; setæ, ♂ im. 27, subim. 12, ♀ im. 20 mm.

*Hab.* Western Europe, from Holland to Southern France; Arnhem, Vasserbeck (Van Medenbach de Rooy); South Holland (Van Walcheren); Rotterdam (Fransen); Amboise (Lelièvre); Saxony (Rostock); Mariensee (5th September, M<sup>c</sup>Lach. Mus.). Also Toulouse; common at gas-lamps at the lower extremity of the Ile du Grand Ramier by the Pont suspendu de St. Michel (17–20th July); in flight after sunset near the Pont d'Empalôt (3rd September).

CHIROTONETES MANCUS, Etn. Plate XIX. 33 *a* (wings and legs).

|| *Isonychia manca*, ! Etn., Trans. Ent. Soc. London (1871), 134, pls. iii. 4 [wing] & vi. 5, 5 *a* [detail].

*Subimago* (*dried*).—Wings light sepia- or Cologne-earth grey, lighter for some distance inwards from the inner margin, with narrow dark borders to most of the cross veinlets. Setæ somewhat of a dull light yellowish ochre.

*Imago* (*dried*).—♀. Head and notum of a colour inclining to light yellow-ochre or light Roman-ochre, modified or toned down in a slight degree with light brownish; the markings of the upper surface of the head comprise narrow piceous orbits of the ocelli; a conspicuous triangular streak or piceous spot on each side of the vertex, which extends from the base of the posterior ocellus, and in contiguity with the orbit of the oculus, nearly halfway towards the occiput; and a broad faintly defined median longitudinal brown-ochreous stripe on the vertex, intersected lengthwise by a line of the lighter ground-colour. Abdomen light rufo-piceous; venter spotless; setæ whitish yellow-ochreous, sometimes with the joinings opaque, or light reddish, towards the roots. Wings vitreous, with very light brownish neuration; in some lights the cross veinlets show out more strongly than in other lights. Fore femur in opaque view rufo-piceous; tibia less translucent than the femur, but otherwise concolorous with it; tarsus in opaque view light Vandyke-brown throughout in most of the specimens, but in some of them the first joint to a large extent is lighter and more translucent than the remainder. Hinder legs in opaque view dull greenish yellow, approaching yellow-lake, changing in transmitted light to pale yellow-amber; the ungues sometimes slightly brownish.

♂. Undescribed; the specimens of this sex referred to this species in 1871 are *Ameletus dissitus*. Length of body, ♀ *im.* 7–12; wing 9–13; setæ 15–22 mm.

*Hab.* North America; W. Texas (Belfrage) and Montana (M<sup>c</sup>Lach. Mus.), May to July.

CHIROTONETES ARIDUS, Say. Plate XVIII. 33 *e* (genitalia ♂).

‡ *Baëtis arida*, Say, Journ. Acad. Nat. Sc. Philad. viii. 42 (1839); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 562 (1853); Le Conte, Complete Writings of T. Say ii. 412 (1859); Hag., Smithson. Miscell. Coll. (1861) Synop. Neuropt. N. Am. 46; ! Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 370; Hag., Proc. Ent. Soc. Philad. ii. 170 (1863); ! Walsh, *op. cit.* ii. 191, notes 8 & 192, note 11 (1863).

‡ *Siphilurus aridus*, Etn., Trans. Ent. Soc. London (1871) 129 [after Walsh].

*Subimago* (after Walsh).—“Wings clouded with dusky, especially towards the tips; the hind wings broadly bordered with fuscous along the terminal margin; neuration dusky, the cross veinlets edged with fuscous. Fore legs fuscous, excepting at the base of the first and sometimes of the second tarsal joints.”

*Imago*.—♂ (*dried*). “Head light ferruginous, with the orbit of the anterior ocellus black behind, and those of the posterior ocelli black on the inner sides. Thorax and abdomen piceous above, except the last segment; segments 2–9 occupied severally on each side by a pale ferruginous triangular or semicircular spot extending halfway from the base; venter piceous in the middle throughout its length; setæ pale greenish white; forceps sometimes fuscous towards the tips. Wings hyaline, with pale greenish hyaline

neuration, tinged sometimes with fuscous towards the costa [Walsh, 1863], or at the extreme base of the costa [*id.*, 1862]. Fore leg, as a rule, about as long as the body, variable in coloration; femur obscure greenish at the base, fuscous in its terminal half; tibia varying from a pale greenish with both its extremities obfuscated, to a uniformly dark fuscous or brown black; tarsus fuscous, with the basal halves of the joints pale. Hinder legs greenish white, with the tips of the tarsi a little cloudy. [After Walsh.]—The forceps-basis terminates distally in a shallow sinus, which leaves on each side of the distal border a short, moderately broad projection terminated by the forceps-limb. Penislobes obliquely acuminate.

♀. Eyes in life ferruginous, bisected by a broad yellowish band. Vertex yellow, sometimes with a yellowish vitta. Body, when different in markings from the ♂, almost uniformly ferruginous. Wing-nervures pale fuscous, excepting those meeting the inner margin of the fore wing. Fore leg entirely fuscous, excepting the basal halves of the tarsal joints, which are pale. Length of body 9–13; wing, ♂ 10·5–12, ♀ 11–15; setæ, ♂ im. 18–23, subim. 12–14, ♀ im. 17–26, subim. 10–14 mm.

*Hab.* North America; Rock Island, Ill. (Walsh); Washington, D.C. (Hag.); Indiana (Say), about the middle of June.

#### CHIROTNETES INTERMEDIUS, sp. nov.

*Imago (dried), ♂.*—Notum intense raw-umber brown, rather lighter in the middle in advance of the peak of the mesonotum (perhaps in consequence of pinning). Abdomen intense burnt-carmine purple, marked with yellowish white on the dorsum and venter; the dorsal markings are in segments 2–8, a large spot at the base of every segment on each side, and a very small indistinct spot or abbreviated streak in the middle of the base; the lateral spots of the dorsum increase successively in size posteriorly, those in segments 2–4 are somewhat rounded behind, and those of segments 5–8 (oblique, subtriangular and obtuse) extend from the base to about  $\frac{3}{4}$  of the length of the segment, and leave in the hinder lateral angles of the dorsum triangular patches of the dark ground-colour in continuity with the colouring of the hinder border; in the corresponding ventral segments the anterior lateral angles are occupied each by a small yellowish white triangular spot; segment 10 and the forceps-limbs light dull yellowish brown, mingled with reddish purple; forceps-basis and the nearer portions of the setæ light reddish purplish, the joinings of the setæ thereabouts opaque, or burnt-carmine, the remainder of the setæ uniformly dull yellowish white. Forceps-basis similar in form to that of *Ch. siccus*; but a difference from that species is noticeable in the penis, the lobes being more rounded at the tip, and less broad, so that their form is recognizable within the gap in the forceps-basis. Fore leg about  $\frac{2}{3}$  as long as the body; the femur and tibia in opaque view pitch-brown, except the inner side of the former from the base to about the middle, which is translucent light raw-umber; in oblique view the pitch-brown becomes lighter; tarsus in opaque view light brownish Indian-red, changing in oblique light almost to light burnt-sienna; in transmitted light the ungues, first tarsal joint, and the pale part of the femur are equally translucent whitish amber, the tibia and remainder of the tarsus opaque, and the femur is largely tinged with reddish purple. Hind legs in

opaque view very light yellow-ochre, with the ungues and, in a less degree, the distal edges of some of the tarsal joints light purplish brownish; in transmitted light the ochre changes to very pale amber. Wings vitreous, with bistre-, or light pitch-brown neuration; the principal nervures towards the base, and (in some lights only) the costa, subcosta, radius, and some other of the longitudinal nervures, to a larger extent paler. Length of body or wing 12, setæ upwards of 17 mm.

*Hab.* North America; Arizona (M<sup>e</sup>Lach. Mus.).

CHIROTONETES SICCUS, Walsh. Plate XVIII. 33 *d* (genitalia ♂).

‡*Baetis sicca*, ! Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 371; Hag., Proc. Ent. Soc. Philad. ii. 170 (1863); ! Walsh, *op. cit.* ii. 191-2, notes 10, 11 (1863).

‡*Siphilurus siccus*, Etn., Trans. Ent. Soc. London (1871) 130 [after Walsh].

*Subimago* hardly distinguishable from that of *Ch. aridus*; but in the present species the ♂ oculi are contiguous during life.

*Imago*.—♂. Head light ferruginous. Thorax and abdomen piceous above, spotless; setæ pale greenish white, usually with the joinings narrowly fuscous, but sometimes only so at the base; forceps a little darker towards the tips. Wings hyaline, with fuscous neuration. Fore leg usually about  $\frac{2}{3}$  as long as the body, rarely as long as it, variable in coloration, commonly piceous, with the tip of the tibia and the base and tip of the 1st tarsal joint (which elsewhere is conspicuously pale) black or fuscous, and with the remainder of the tarsus entirely fuscous, excepting rarely the basal halves of joints 2 and 3, which in one example are pale. Hinder legs pale greenish, with the extreme tips of the tarsi cloudy. [After Walsh.]—Forceps-basis deeply, broadly, and somewhat squarely excised behind, in such a way that the projections terminated by the forceps-limbs are longer than broad; the margin of the basis in the middle of the excision is produced into a short subacute salient projection, which is concave beneath. Penis-lobes broad, obliquely truncate, moderately acute at their outer distal angles.

♀. Very similar to the ♂. Fore tarsus pale fuscous, with the first joint conspicuously pale. Length of body 8.5-11.5; wing, ♂ 9-11.5, ♀ 11-13; setæ, ♂ im. 19, ♀ im. 15 mm.

*Hab.* North America; Rock Island, Ill. (Walsh), appearing a month later than *Ch. aridus*. Also North Carolina (M<sup>e</sup>Lach. Mus.).

CHIROTONETES (?) ORNATUS, Etn. MS., in the writing of Plate XIX. 33 ? *c* (genitalia ♂).

This species must be dealt with and described in the Supplement as one of undetermined genus. My discrimination of generical differences in the present Section (the type of *Siphilurus*) has been matured very recently; whereas the drawings and description of the insect were made in the year 1876, and I have not subsequently seen a specimen. The plate was lithographed in 1882.

description - p. 321

METAMONIUS, gen. nov.

*Illustrations.* *Adult* (details), Pl. XX. ? 34 *b*.

*Adult*.—Fore leg of ♂ about  $1\frac{1}{3}$  as long as the body; tarsus a little more than twice

as long as the tibia, and this nearly  $1\frac{1}{8}$  as long as the femur; gradation of tarsal joints in order of diminution 3 and 2 each subequal to 4, 1, 5; the first scarcely more than  $\frac{1}{2}$  as long as the second joint. Hind tarsus about  $\frac{3}{4}$  as long as the tibia, and this subequal in length to the femur; sequence of  $\sigma$  tarsal joints 2, 5, 1, 3, 4: the first joint  $\frac{4}{5}$  as long as the second. Ungues mutually alike in every tarsus, narrow and uncinatè. Hind wings well developed, ovate-trilateral; the dilatation of the marginal area moderately obtuse in front; the axillar region narrow, and with scanty neuration. In the  $\text{♀}$  subimago the relative lengths of the abdominal segments counting from the 2nd to the 10th may be formulated thus:—5, 12, 12, 12, 15, 17, 11.5, 11.5, 9; segment 1 is thoracoid. The pleuræ of segments 7–9 are squarely truncate [7 appears to be branchiate in the nymph]; the ventral lobe of segment 9, acutely excised, has short acute points. Forceps basis of  $\sigma$  angularly and widely emarginate; forceps-limbs, as in *Siphilurus*, 4-jointed, with a short basal joint tuberculate on the inner side distally, and with a curved sub-cylindrical second joint longer than the remainder. Penis-lobes narrow, somewhat like those of *Siphilurus*. Median caudal seta rudimentary, about  $\frac{1}{8}$  as long as the others, which in  $\sigma$  are about  $1\frac{1}{2}$  as long as the body. Oculi apparently ascalaphoid, and contiguous above in the  $\sigma$ ; anterior ocellus rather smaller than the others. *Nymph* unknown.

*Type.* *M. anceps*, sp. nov. (in ? *Siphilurus*, Etn. MS. 1883, in writing of Pl. XX.).

*Distribution.* S. America.

*Etymology.* μεταμώνιος, borne by the wind.

#### METAMONIUS ANCEPS, sp. nov.

*Siphilurus* (?) *anceps*, ! Etn. MS., in the writing of Pl. XX. 34 b (wings & legs).

*Subimago* (*dried*).—Wings light sepia-grey, with piceous or pitch-brown neuration; in some lights only, the longitudinal nervures appear light warm sepia-brown, and the cross veinlets black; cross veinlets narrowly edged with darker grey. Setæ sepia-grey, with dark joinings.

*Imago* (*dried*),  $\sigma$ .—Notum brown-ochreous. Abdomen in opaque view either light raw-umber, or else reddish brown; segments 3–8 paler on each side from the base nearly to the terminal border; in some examples the pale spaces in segments 3–6 are each obtusely triangular and translucent, and a dark triangle of the ground-colour occupies the hinder lateral angle below the space [but the pallor of these species may be partly due to *Psocidæ*], and the corresponding spaces in segments 7 and 8 are very pale yellowish ochre. Venter bordered laterally with very pale yellowish ochre, leaving in the midst a broad longitudinal dark burnt-umber or purplish brown stripe. Setæ warm sepia-grey, with opaque joinings. Legs, in opaque view, light raw-umber; the knee and tip of the tibia of the fore leg, and the knees and tarsal joinings of the hinder legs dark raw-umber or bistre-brown. Wings vitreous, with the pterostigmatic region of the fore wing almost imperceptibly dusky; neuration pitch-black, the cross veinlets in the pterostigmatic portion of the marginal area of the fore wing sparingly conjoined near the costa. Length of body 10–13; wing,  $\sigma$  13–14,  $\text{♀}$  17; setæ,  $\sigma$  im. 17 & 2, subim. 10 & 2 mm.

*Hab.* Chili (Reed, in M<sup>c</sup>Lach. Mus.). The adult  $\text{♀}$  is not represented.

## AMELETUS, gen. nov.

*Illustrations.* *Adult* (details), Pl. XVIII. ? 34 *a* and LXIV. 22-24.

*Adult.*—Fore leg of ♂ as long as the body; tarsus nearly  $1\frac{5}{8}$  as long as the tibia, and this nearly  $\frac{9}{10}$  as long as the femur; the joints in diminution rank 2, 3, 4, 1, 5, and the first is about  $\frac{1}{2}$  as long as the second joint. Fore leg of ♀ between  $\frac{1}{2}$  and  $\frac{2}{3}$  as long as the body; tarsus very nearly of equal length with the tibia, which is about  $\frac{9}{10}$  as long as the femur; the joints in decreasing length rank 2, 1, 3, 5, 4, and the first is very nearly  $\frac{6}{7}$  as long as the second joint. Ungues mutually dissimilar in each tarsus. Hind wings well developed; dilatation of the marginal area angular in front; axillar region moderately narrow, and with rather scanty neuration. In the ♀ abdomen the segments are proportioned somewhat as in *Chirotonetes*; the first is thoracoid. Pleuræ squarely truncate in segments 7-9; ventral lobe of the ninth segment subtriangular, with the apex retuse. Forceps-basis of ♂ widely and angularly excised; its posterior corners by the inner sides of the proximal joints of the limbs are shortly produced; the limbs are 4-jointed, with a short basal joint tumid interiorly, and with the next joint, longer than the remainder, slightly gibbous on the inner side at the base. Penis-lobes narrow, with terminal superior stimuli, as in *Siphururus*. Median caudal seta completely aborted; outer setæ about as long as the body in both sexes. Oculi of ♂ obsolete ascalaphoid, contiguous with each other above. Vertex of ♀ head a little longer than broad, distinctly wider in front than behind; occipital margin level with the posterior orbits of the eyes. Median ocellus of ♀ much smaller than the others, isolated in a small deep depression in advance of and below the anterior edge of the upper surface of the head. Pronotum of ♀ broadly reflexed upon the meso-pleuræ; its posterior margin (viewed from above) somewhat evenly arched and not receding in a very marked degree in the middle.

*Nymph* unknown.

*Type.* *A. subnotatus*, sp. nov.

*Distribution.* N. America. and Europe

*Etymology.* ἀμέλητος, neglected, or overlooked.

AMELETUS DISSITUS, sp. nov. Plate LXIV. 22 (forceps-basis).

|| *Isonychia* † *manca* ♂ im., ! Etn., Trans. Ent. Soc. London (1871) 134, pl. vi. 5 [excl. ♀] (genitalia *misdrawn*).

*Imago (dried)*, ♂.—Predominant colour of the body bright brown-ochre (perhaps ferruginous in life); pronotum piceous; metanotum piceous behind; dorsal segments 2-8 of the abdomen bordered distally with pitch-brown, each with extensions of the same colouring forwards at the sides in the form of triangular spots, which, at least in segments 6-8, occupy the hinder lateral angles of the dorsum and extend to the base of the segment; the ninth segment has corresponding streaks from the hind border. Ventral segments rather lighter than the dorsum, and seemingly marked each with a light pitch-brown blotch at the base in the middle: forceps-basis, posterior to the oval depression, light yellowish; forceps-limbs piceous. Setæ medium warm sepia-brown

with opaque joinings. Fore leg, in opaque view, pitch-brown; hinder legs in some lights bronze-brown, in other lights dull yellowish with the femora tinged with bistre-brown, and in transmitted light brownish yellow. Wings vitreous, very faintly tinted with greenish grey; neuration piceous. Length of body or wing, ♂ 10–12·5; setæ, ♂ im. 17–18 mm.

*Hab.* North America; California (Edwards; M<sup>c</sup>Lach. Mus.); San Geronimo, Cal., April 20 (Osten-Sacken; Mus. Comp. Zool. Cambridge, Mass.).

AMELETUS SUBNOTATUS, sp. nov. Plate XVIII. ♀ 34 *a'* (legs) and LXIV. 23 (forceps-basis).

*Siphururus?* † *femoratus*, ! Etn. MS., in the writing of Pl. XVIII. *loc. cit.*

*Subimago (dried)*, ♂.—Wings light sepia-grey with pitch-brown neuration, the latter colour varying with change of light to bistre-brown; cross veinlets margined with sepia-brown. Setæ warm sepia-brown, with opaque joinings.

*Imago (dried)*.—♂. Body pitch-brown; metanotum pitch-black; the dorsal segments of the abdomen appear to be largely occupied with pale light brownish yellow subtriangular blotches, one on each side in segments 2–7, which leave in each of them the terminal border, a median longitudinal stripe, and a triangle that extends along the pleura from the hinder lateral angle to the base, of the dark ground-colour; pleuræ narrowly concolorous with the venter, which is rather paler than the light dorsal blotches, and is marked in segments 2–6 with two short dark dashes from the base of the segment, and a dark dot on each side of the median tract nearly midway between the base and tip; the ninth ventral segment, of a light brown-ochreous tint, has indications of two corresponding dark streaks at the base in the form of triangular spots, and is bordered laterally with pitch-brown as far as the joining of the forceps-basis; the depressions of the forceps-basis are shaded with bistre-brown; forceps-limbs light bistre-brown. Setæ raw-umber brown at the base, lighter distally. Fore leg in opaque view dark rufo-piceous, banded with pitch-black before the knee, the general colour changing in other lights to dark bistre-brown. Hinder legs in opaque view light bistre-brown, varying towards light raw-umber with change of posture; femora banded with pitch-brown before the knee; tarsi browner than the tibiæ in certain lights, especially the terminal joint and unguis. Wings vitreous; the fore wings close to the wing-roots, and the hind wings to a slightly larger extent at the base, clouded with intense bistre- or pitch-brown; longitudinal neuration, in opaque view light pitch-brown, in oblique view light raw-umber (excepting the stem of the præbrachial, which in most postures remains pitch-brown) and in transmitted light translucent piceous; cross veinlets in opaque view intense pitch-brown, bordered narrowly with pitch- or bistre-brown, which bordering gives rise to small specks in the fore wing, viz.:—one near the bulla of the radius (3), one at the proximal extremities of each of the two pairs of shorter sectorial intercalary nervures, one at the fork of the præbrachial (6), and another near the proximal termination of the intercalary nervure contained within that fork: the pterostigmatic portion of the marginal area contains about 17 branched cross veinlets (counted at the subcosta), which, mutually anastomosing, form a rather dense reticulation, preceded towards the bulla by about 5 more distant simple cross veinlets.

♀. Wings free from the basal discoloration, and nearly so from the specks noted in ♂, but yet with dark-bordered cross veinlets. Fore leg in opaque view pitch-brown, in some lights intense bistre-brown, paler at the base and at the knee, but not dark-banded. Hinder femora raw-umber brown, with a single ill-defined dark band before the knee. Setæ light Cologne-earth brown, with the joinings and bases of an intense shade of the same colour or piceous. Abdomen discoloured: the median dorsal stripe apparently is represented by a longitudinal line on each side of the track of the dorsal vessel, and the lighter blotches seem to be less conspicuous than in the ♂: instead of the ventral dashes and dots of the other sex, the ♀ has only small conspicuous twin oval dark-edged spots in the places of the ganglia. Length of body 11-12; wing, ♂ 13, ♀ 14; setæ, ♂ im. about 17, ♀ im. 13 mm.

*Hab.* Colorado (M'Lach. Mus.).

*AMELETUS EXQUISITUS*, sp. nov. Plate LXIV. 24 (forceps-basis).

*Imago (dried)*, ♂.—Mesonotum brown-ochreous; metanotum pitch-brown. Abdomen in segments 2-6, and sometimes in a large part of 7, translucent at the sides: the dorsum in these segments, in a large measure tinged with a rich brown-ochre, is bordered along the terminal margin with light pitch- or with Vandyke-brown, this darker colour occupying the hinder lateral angles of the segments so as to form a series of right-angled triangular spots extending each from the hind margin of the segment to the point of origin of the segmental tracheæ; the tracheæ themselves are slightly brownish; again from the dark terminal border in every segment two slender streaks issue basewards, one on each side of the median track, which in ill-marked specimens are represented by small triangular spots only, at the border in question. The remaining dorsal segments are more opaque than the preceding, but are marked in a nearly corresponding manner with the same darker colour, excepting the terminal segment, which is almost uniformly of the lighter colour. Venter in segments 2-6 translucent, and (like the translucent portions of the dorsum) of a somewhat light bistre-grey colour; in segments 7-9 very light brownish ochre; the ganglia brownish, and the forceps-basis tinged at the lateral borders with bistre-brown. Forceps-limbs pitch-brown. Setæ warm sepia-brown, dark at the joinings throughout, and also dark near the roots. Fore leg in opaque view pitch-brown, with the knee yellowish brown. Hinder femora bistre-brown in opaque view, with a dark præapical band; the tibiæ and tarsi in opaque view light bistre- or raw-umber brown, with the ungues opaque, or sometimes the tarsi are sepia-brown; in transmitted light the tibiæ and tarsi acquire a yellowish tint, seldom approaching brownish or dark yellowish umber. Wings vitreous, tinted almost imperceptibly with bistre-grey throughout; the pterostigmatic portion of the fore wing transparent bistre-brown: neuration in opaque view dark bistre-brown, in oblique view almost raw-umber, but somewhat of a redder brown; in transmitted light translucent rufo-piceous; cross veinlets of the pterostigmatic portion of the marginal area of the fore wing branched evenly near the costa, and regularly anastomosing with one another. Length of body, ♂ im. 14, wing 16: setæ defective.

One specimen, perhaps a dwarf of the same species, measures :—length of body, ♂ im. 8, wing 10 mm.

*Hab.* North America ; larger examples Washington Territory ; smaller example Mt. Hood (M<sup>c</sup>Lach. Mus.).

DIPTEROMIMUS, M<sup>c</sup>Lach. 1875.

*Illustrations.* *Adult* (details), Pls. XX. 35 [N.B.—The hind wing is defective] & LXIV. 25.

*Adult.*—Fore leg of ♂ about  $1\frac{1}{7}$  as long as the body ; tarsus twice as long as the tibia, and this about  $\frac{8}{9}$  as long as the femur ; decreasing sequence of tarsal joints, 1 equal to 2, 3, 4, 5. Hind tarsus about  $\frac{7}{9}$  as long as the tibia, which is  $\frac{9}{10}$  as long as the femur ; its joints rank 1, 2, 5 subequal to 3, 4, and the first joint is about  $1\frac{1}{2}$  as long as the second. Ungues all narrow and uncinatæ. Fore wing unusually narrow and long in its proportions, rapidly narrowed to the roots in its proximal  $\frac{1}{3}$ , and elliptical beyond that. Hind wings very rudimentary, trilateral and elongate, with the marginal area obtusely rounded off in front. ♀ unknown. Forceps-basis shallowly, widely, and angularly excised ; forceps-limbs 4-jointed, the basal joint very short resembling a gibbous enlargement of the second, which is longer than the remainder, curved, and bordered on its inner side with a narrow membranous expansion. Penis-lobes narrow, unarmed. Median caudal seta aborted in two specimens, but present in another and then (so far as as can be inferred from the remnant preserved) at least half as long as the outer setæ ; these are minutely pubescent, and are upwards of twice as long as the body. Oculi of ♂ obsoletely ascalaphoid, probably contiguous above during life ; anterior ocellus rather smaller than the others.

*Nymph* unknown.

*Type.* *D. tipuliformis*, M<sup>c</sup>Lach.

*Distribution.* Japan.

*Etymology.* δῖς, πτερόν, and μῖμος, from its similarity in aspect to a *Tipula*.

DIPTEROMIMUS TIPULIFORMIS, M<sup>c</sup>Lach. Plates XX. 35 (wings, legs, and genitalia ♂,) & LXIV. 25 (hind wing refigured).

*Dipteromimus tipuliformis*,! M<sup>c</sup>Lach., Trans. Ent. Soc. London (1875), 170.

*Imago (dried)*, ♂.—Pronotum, hinder parts of the mesonotum, metanotum, and the thickened hind border of the first abdominal segment yellow ochreous ; the anterior parts of the mesonotum either raw-umber or pale reddish brown. Abdomen in segments 1–6 translucent, the dorsum bistre- or light greenish grey, passing into brownish ochre posteriorly in segments 6–9, and marked on each side in segments 2–7 with angulated piceous stripes ; the foremost stripe lies wholly on the dorsum in segments 1 and 2, the portion in the first segment meeting that in the second segment a little above the hinder lateral angle of the former segment at a very obtuse angle ; the other stripes lie partly along the pleura in one segment and partly in the dorsum of the next segment, in this manner :—the portion in the anterior segment commences at the anterior lateral

angle of the ventral arcus, is very narrow, and terminates in the hinder-lateral angle of the dorsum of the same segment, where it is met by a much broader stripe, which, for a short space, follows the terminal border or joining upwards, and then is suddenly diverted into the next segment, through which it passes obliquely, and subparallel with the lower moiety of the next stripe, to the terminal border of that segment; in segments 5-7 the borders of the dorsal vessel are perhaps faintly darkened, and there may be a fine indistinct longitudinal streak from the base on each side of it, such as is common in the Ephemeridæ; segment 10 is yellow-ochreous. Venter in the translucent segments pale yellowish horn-colour; in the opaque segments extremely pale yellowish ochre; perhaps free from markings, excepting the streaks, already referred to, by the pleuræ. Forceps-limbs reddish brown. Setæ pitch-, or intense burnt-umber brown. Wings vitreous, almost imperceptibly tinted with bistre-grey; neuration in opaque view for the most part pitch-black; the costa, subcosta, and the intervening cross veinlets of the fore wing pitch-, modified with madder-brown; the finer longitudinal nervures pale near the wing-roots, and the stronger nervures raw-umber brown thereabouts; in transmitted light the neuration as a whole becomes pitch-brown. Fore leg in opaque view raw-umber brown; the femur lighter than the remainder, excepting just at the knee. Hinder femora, in opaque view, very light raw-umber, with the knee pitch-brown; tibiæ and tarsi darker than the femora and of a yellower tint that approaches brown-ochre. Length of body 11-14; wing, ♂ 13-16; outer setæ (of the larger example) upwards of 24 mm.

*Hab.* Japan (Von Siebold, Leyden Mus.); Yamato, 16th June, and Tokio, 27th Sept. (G. Lewis, M<sup>c</sup>Lach. Mus.).

#### SIPHLURUS, Etn. 1868.

*Illustrations.* *Adult* (details), Pl. XX. 34 c-e [excl. XVIII. ? 34 a, & XX. ? 34 b]; (whole figure) see citation under *S. flavidus* [‡ *Baëtis*], Ed. Pict. (1865). *Nymph.* Pl. L.; also poorly represented in Rösels, Insect. Belust. ii. pl. xii. 4-6 (1749), and De Geer, Mém. Sav. Etr. Acad. Paris, ii. 468, pl. xvii. 1 (1755).

*Adult.*—*In normal species* the fore leg of ♂ the is usually nearly ( $\frac{1}{2}$ ) as long as the body; tarsus about  $2\frac{7}{11}$  as long as the tibia, and this  $\frac{1}{4}$  as long as the femur; decreasing gradation of the tarsal joints,—2 equal to 3 and subequal to 4, 1, 5; the first joint  $\frac{7}{5}$  as long as the second. Fore leg of ♀  $\frac{2}{3}$  as long as the body; tarsus very nearly  $1\frac{1}{2}$  as long as the tibia, and this almost  $\frac{7}{10}$  as long as the femur; its joints in diminishing sequence rank 1, 2, 5, 3, 4, and the first is about  $1\frac{2}{7}$  as long as the second joint. Hind tarsus of ♂  $1\frac{1}{2}$  as long as the tibia, and this about  $\frac{3}{5}$  as long as the femur; its joints rank 1, 2, 3 subequal to 5, 4, and the first is about  $1\frac{2}{5}$  as long as the second joint. Ungues all narrow and uncinatæ. Hind wings well developed, obtusely ovate-trilateral; dilatation of the marginal area obtusely rounded in front; axillar region somewhat ample and well supplied with neuration. In the ♀ abdomen the relative lengths of segments 2-10 may be formulated thus:—5, 9, 10, 12, 12, 15, 17, 15, 9; the first is thoracoid. Pleuræ in segments 7-9 obtuse behind; ventral lobe of segment 9 very short, parabolic or obtusely

triangular. Forceps-basis entire, or only slightly retuse, produced shortly between the bases of the limbs and there split along the sides to admit the edges of their proximal joints when the forceps close. Forceps-limbs 4-jointed; 1st joint short, slightly compressed, broader than the second, and forming a prominent projection inwards; 2nd joint the longest. Penis-lobes narrow and shortly beaked; the orifice of the seminal duct on the inner side of the beak is immediately interposed between the point of the lobe and a small moveable appendage [stimulus], which together form the beak. Median seta aborted; lateral setæ of ♂ about  $1\frac{3}{5}$ , of ♀ about  $1\frac{1}{2}$  as long as the body. Oculi of ♂ obsoletely ascalaphoid, contiguous above during life. Vertex of ♀ head about as broad as long, very little wider in front than behind; the occipital border almost level with the posterior orbits of the oculi. Median ocellus of ♀ much smaller than the others, isolated in a small deep depression in front of and below the anterior edge of the upper surface of the head. Pronotum of ♀ broadly reflexed upon the mesopleuræ, and with a shallow curved median recess behind, which is not always distinguishable as a recess when viewed from in front.

A long-legged species in N. America [*S. typicus*] has the fore leg of the ♂ about  $1\frac{1}{2}$  as long as the body; tarsus about thrice as long as the tibia, and this  $\frac{1}{3}$  as long as the femur; tarsal joints (as, *a priori*, probable in so attenuated a tarsus) slightly inconstant in their relative lengths, but the first joint is equal in length to the second. Fore leg of ♀ about  $\frac{10}{11}$  as long as the body; tarsus about  $1\frac{3}{5}$  as long as the tibia, and this  $\frac{7}{9}$  as long as the femur; the proportions of the first tarsal joint to the second are as 17 to 13. Hind tarsus of ♂ about  $1\frac{2}{5}$  as long as the tibia, and this about  $\frac{5}{6}$  as long as the femur; its joints rank in lessening length 1, 2 subequal to 5, 3, 4, and the first is about  $1\frac{1}{7}$  as long as the second joint. Median seta aborted; outer setæ in ♂ nearly twice as long as the body; in ♀ about  $1\frac{2}{3}$  as long as the same. In other particulars this species is normal.

During repose the *subimago* stands upon all of its feet, with the wings erect and setæ divergent.

*Nymph.*—Very similar to *Cloëon*, but readily distinguished therefrom by having only the foremost two tracheal branchiæ on each side double, and by the endopodites appended to the mandibles.—Abdominal tracheal branchiæ foliaceous and diversiform, borne by segments 1–7 and inserted each in a notch, close to the projection of the pleura, in the posterior margin of the dorsum; those of the first two segments formed each of two laminae narrowly connate at the base, the others of single laminae; their tracheæ multipartite, except sometimes those of the hindermost. In nymphs of advanced grade the venation, so to speak, of these organs is a useful aid to the discrimination of species; the figures in Pl. L. illustrate sufficiently the kind of differences noticeable. Antennæ at maturity about 14-jointed, not longer than the head and pronotum combined. Mandibular lobes strong and fang-like; the endopodite well developed; stipes well-proportioned. Palpus of maxilla 1. longer than the lacinia, finger-like [in fig. 1 the articular membrane of the proximal joining is shown as if distended by glycerine]; the first joint a little longer than the second and longer than the third, the extremity of which is acute; lacinia narrow, oblique at the point, crowned with a tuft of hair and

beset with ciliæ intermingled sparsely with spines for some distance from the point along its inner edge, and with a small tuft of hair immediately below; the spines are not symmetrical in both maxillæ of the first pair. Lacinia of maxillæ II. nearly of equal breadth with the lobes of the labium, which nearly conform to quadrants of a circle; proximal joint of the palpus compressed and somewhat dilated inside before its extremity; second joint slightly curved towards the base, enlarged distally and obliquely truncate, equal in length to the third and half as long as the first joint; third joint acutely subovate. Paraglossæ rounded distally, narrower and shorter than the median lobe of the tongue, which is widely retuse at the tip. Hind leg rather longer than the fore leg; tarsus (claw excluded) about as long as the tibia. Dorsum smooth; pleuræ of the intermediate abdominal segments narrowly dilated oniscoidally, their outer edges nearly straight for some distance from their points, and gently receding in a convex curve anteriorly. Setæ subequal in length; the median plumose; the outer ciliated inside and approximately  $\frac{6}{11}$  as long as the body; in some species the fringes are conterminous with the setæ, in others these are tail-pointed.

*Type.* *S. flavidus* (in †*Baëtis*), Ed. Pictet.

*Distribution.* Europe, N. America, and Japan, in streams, rivers, and lakes; species more numerous in America, Northern Europe, and in mountainous regions than elsewhere.

*Etymology.* σιφλόε, defective, and ούρά, tail, from the atrophied condition of the median caudal seta.

Subsequent to De Geer, no author appears to have noticed the nymph of *Siphilurus* for upwards of a century. Dr. Hagen met with it in Prussia, but did not identify the species or genus. The generical determination of the nymph was accomplished by observation of *S. lacustris* in North Wales at the lakelet on Snowdon in the year 1868.

#### EUROPEAN SPECIES.

SIPHLURUS FLAVIDUS, Ed. Pictet.

†*Baëtis flavida*, ! Ed. Pict., Synop. Névropt. d'Esp. 24, pl. iii. 1-6 (1865).

*Siphilurus* [type] *flavidus*, ! Etn., Trans. Ent. Soc. London (1871), 125, pl. v. 30 [detail after Pict.].

*Imago (dried).*—♂. Notum and abdomen somewhat brown-ochreous, the latter with longitudinal fuscous [brunes] markings on the hinder segments; the venter is marked with a series of strongly curved horseshoe-like or U-shaped lines pointing forwards. Setæ brown-ochraceous, with fuscous joinings. Wings vitreous, with a general faint yellowish tint, and a well-pronounced yellowish stain at the base and in the pterostigmatic portion of the fore wing. Legs yellowish ochre, with fuscous joinings. p. 321

♀. Very similar, but paler. Length of body 12; wing, ♂ 12.5, ♀ 14.5 mm.

*Hab.* San Ildefonso, Segovia, Spain, in July (chiefly after Ed. Pictet).

SIPHLURUS ARMATUS, Etn. Plate XX. 34 e (forceps).

*Siphilurus armatus*, ! Etn., Trans. Ent. Soc. London (1870) 6; ! *id.*, *op. cit.* (1871) 126, pl. vi. 1, 1 a [detail].

*Imago (dried)*, ♂.—Thorax luteo-piceous above. Abdomen fuscous above, with the joinings paler towards the sides; venter lutescent or ochraceous, with U-shaped dark marks in the hinder segments. Forceps piceous. Setæ either of the very lightest warm sepia-grey, or faintly tinged with fulvous; the joinings fuscous. Fore legs piceous; hinder legs lutescent or ochraceous. Wings vitreous tinted with greenish grey; their neuration piceous. Length of body 14–15; wing 15–16; setæ, ♂ im. 24–25 mm.

*Hab.* England and Ireland: Killarney (M<sup>e</sup>Lach. Mus.); Bishop's Wood, Hampstead, Middlesex (Wormald), in July.

SIPHLURUS LACUSTRIS, Etn. Plate XX. 34 *d* (head ♂, legs, and forceps).

*Siphlorus lacustris*, !Etn., Trans. Ent. Soc. London (1870), 7; !*id.*, *op. cit.* (1871), 126, pl. vi. 2 [detail].

*Subimago (living)*.—Wings cinereous or very light sepia-grey.

*Imago (living)*, ♂.—Eyes dark sepia-brown above, dark greenish grey beneath. Thorax jet-black above, pitch-brown when dried. Abdomen piceo-fuscous above, with ochraceous joinings; venter dark greenish-grey, becoming fulvescent in the last three segments, which are marked each with a dark U-shaped streak, represented in every anterior segment by two dark longitudinal stripes, convergent towards the base of the segment. In dried examples of what I suppose to be the same species the venter becomes yellowish brown, with pale joinings, and the dark markings are sometimes absent. Forceps-limbs bistre-brown. Setæ sepia-brown at the base and greenish grey elsewhere, with opaque joinings; when dried light burnt-umber brown. Legs yellowish brown in dried examples; in life the fore femur is black-green, the tibia and tarsus greyish black, and the hinder legs are dark greenish grey. Wings vitreous, with piceous neuration; the pterostigmatic region of the fore wing is faintly tinted with pale greenish.

♀. Similar, but with sepia-brown setæ, and with the hinder tibiæ and tarsi light brown-ochraceous. Length of body or wing 12–15; setæ, ♀ im. 17–20, subim. 11; ♀ im. 16–18 mm.

*Hab.* Great Britain: Llyn Llydaw, Snowdon; streamlets or small burns in the neighbourhood of Corse, near Lumphanan, Aberdeenshire; in August. Also the Giffre, near Samoëns, Savoie (2280 ft.), in September; also near San Marcello in the Apennino Pistoiese (about 2500 ft.) in August.

SIPHLURUS LINNÆANUS, Etn.

*Siphlorus Linnæanus*, !Etn., Trans. Ent. Soc. London (1871), 127, pl. vi. 3, 3*a* [detail].

*Imago (dried)*, ♂.—Thorax above bistre-brown in front, varied with light reddish ochre behind. Abdomen along the middle of the back broadly fuscous, darker at the tips of the segments, light ochraceous at the sides, the dark colour extending forwards at the sides in segments 2–9 so as to restrict the paler colour to a triangular patch above the spiracular line; venter in segments 2–8 light ochraceous marked with black, viz.:—with the joinings of segments 2 and 3, and in each of segments 2–8 a short triangular streak from the middle of the base, pointing backwards, followed by a transversely placed pair

of dots, and flanked in segment 8 by a longitudinally elongate spot, in segments 7-4 by an obliquely elongate spot, and in segments 3-2 by an oblique linear stripe from the posterior angle to the base, on each side; segment 9 and the forceps-basis red-brown. Setæ whitish brown-ochre, with the joinings intense sepia-brown. Fore tibia and tarsus dark reddish brown, the femur lighter, banded before the tip with dark reddish brown; hinder legs light brown-ochraceous, the femora with dark median bands. Wing vitreous, perhaps suffused with a faint bistre-grey tint (but this appearance may be due to the overgrowth of mould); longitudinal neuration pitch-black, the nervures towards the base of the wing becoming somewhat of a bistre-brown; the cross veinlets in the pterostigmatic portion of the fore wing simple. Length of body, ♂ 13; wing 14; setæ 26 mm.

*Hab.* Unknown. (Linn. Mus.) This may be an American species; but there is one rather like it in the Italian Alps, in the neighbourhood of Monte Adamello.

I have seen several other European species of *Siphilurus*.

#### NORTH-AMERICAN SPECIES.

*SIPHLURUS OCCIDENTALIS* (renamed). Plate LXIV. 26 (forceps-basis).

‡ *Heptagenia* ‡ *brunnea*, ! Hag., Ann. Rep. U. S. Geol. & Geograph. Survey of the Terr. 1873, part iii. Zool. 581 (1875) [♀ im. only].

*Subimago* (*dried*).—Wings very light sepia-grey, with pitch- or dull raw-umber brown neuration; longitudinal nervures pale at the base. Setæ pitch-brown with opaque joinings.

*Imago* (*dried*).—♂. Notum pitch-brown, sometimes almost rufo-piceous along the median suture of the mesonotum. Dorsum of the abdomen bistre-brown, varied with dull light ochraceous, nearly in the same manner as in *S. typicus*; in segments 2-9 two tapering streaks are projected from the darker colouring into the paler space on each side of the segment; the lower streak extends along the lateral border of the dorsum to the base of the segment, and the upper streak, higher up on the side of the back, running nearly horizontally, also attains the base; the lighter ground-colour adjoining the dark streaks remains in the form either of a pair of unequal triangular spots or longitudinal streaks on each side of the base of the segment, of which the lower streak is the larger, or in the form of a single triangular spot corresponding with the lower of the two. Venter very light brown-ochraceous with piceous markings, viz. :—in segment 9 a pair of broad stripes, each tapering to a point behind, which meet in the middle of the base of the segment at an acute angle, so as to form a V; in segments 8-5 the corresponding stripes combine at the base so as to form U-shaped marks with oblique-pointed arms; in the more anterior segments their likeness to the letter U diminishes, owing to increased obliquity in the stripes and consequent increase of width in the curves resulting from their combination. The usual pairs of dark dots are recognizable, either immersed in the ventral stripes, or else in contiguity with the inner edges of the stripes. Forceps-basis and the proximal joints of the forceps-limbs usually pale, like the ground-colour of the venter; but the former is usually streaked with light brownish in the parts overlain by the penis-lobes. Setæ in opaque view either pitch-brown or raw-umber, paler towards the tips. Fore leg in opaque view light pitch-brown, inclining to rufo-piceous or burnt-umber. Hinder femora intense raw-umber, very slightly subopaque in

the place corresponding with that of the præterminal band in other species; tibiæ and some part of the tarsi basewards rather lighter than the femora, but the remainder of the tarsi about as dark as the femora. Wings vitreous; neuration in opaque view pitch-black, with the wing-roots and the bases of the longitudinal nervures very light bistre-brown in both wings, and also with the costa of the hind wing to a large extent pale.

♀. Very similar. The ventral stripes in segments 2-6 combine to form wider curves than in the ♂, and the innermost pairs of dark dots stand apart from the stripes; segment 7 has a pitch-black triangular stripe on each side from the base, an ochraceous depression in the midst, and a broad dark-coloured ovalvular border; segment 8 is bright yellow-ochreous in the midst, and is traversed by a blackish longitudinal stripe on each side, which is continued through the following segments to the base of the seta; segment 9 is edged very narrowly at the sides with yellowish, and traversed longitudinally by an abbreviated median yellowish cuneiform streak tapering forwards from the base of the lobe; the lobe itself is largely occupied by an ochraceous rhomboidal spot truncate anteriorly at the base of the lobe so as to be reduced to the form of an irregular pentagon, and its anterior lateral margins are narrowly ochraceous. Fore legs intense raw-umber. Setæ whitish sepia-grey, sometimes dark near the roots; the joinings for the most part blackish. Length of body, ♂ 11-12, ♀ 13; wing, ♂ 12-14, ♀ 16; setæ, ♂ im. 16-22, ♀ im. 22 mm.

*Hab.* Colorado and Washington Territory (M<sup>c</sup>Lach. Mus.); also (in Mus. Comp. Zool. Cambridge, Mass.) Truckee, Nev. (Crotch, June 10), between Elles and Humboldt, Nev. (S. Henshaw, June 10), Bridger Basin, Wy. (Garman), and Manitou, Col. (Morrison).

The description given above is based mainly upon specimens from Colorado in M<sup>c</sup>Lach. Mus. Those from Washington Ter. have the forceps-basis uniformly bistre-brown; and their hinder legs may be almost imperceptibly of a darker shade than those of the typical form. This last difference is slight enough to be attributable to fortuitous causes. In accordance with prevalent usage, the name *brunnea* is restricted to the ♂ imago described by Hagen in 1875, which is a *Rhithrogena*; but in that genus also it will rank as a synonym.

#### SIPHLURUS ALTERNATUS, Say.

‡ *Bætis alternata*, Say, Godman's West. Quart. Rep. ii. 304 (1824); Le Conte, Complete Writings of T. Say, i. 204 (1859); Hag., Smithson. Miscell. Coll. (1861), Synopt. Neuropt. N. Am. 49; Walsh, Proc. Acad. Nat. Sc. Philad. (1862), 369; Hag., Proc. Ent. Soc. Philad. ii. 169 (1863); Walsh, *op. cit.* 189 (1863).—‡ *B. || annulata*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 567 (1853); Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 48.—‡ *B. † femorata*, Provancher, Naturl. Canad. viii. 267 (1876); *id.*, Fn. Ent. d. Canad. ii. fasc. i. 83 (1877).

*Siphylurus annulatus*, ! Etn., Trans. Ent. Soc. London (1871), 127, pl. vi. 4, 4a [forceps and ventral markings].—*S. alternatus*, *id.*, *op. cit.* 129 (1871).—*S. alternans* [misprint in corrections for *alternatus*], Provancher, Fn. Ent. d. Canad. ii. fasc. i. 82<sup>2</sup> (1877).

*Subimago*.—Wings fumose, with coarser and more distinct neuration than those of the imago: neuration and membrane pale greenish at the tips of the hind wings (Walsh).

*Imago*.—♂. [Eyes in life pitch-brown, intersected by a black line at their lowest  $\frac{1}{4}$ : Walsh.]—(*Dried*). Notum light raw-umber brown, darker along the middle. Dorsum of the abdomen bistre-brown, varied with dull whitish yellow in segments 3–9; the lighter colour in segments 3–8 forms an acute triangle at the base of every segment on each side about half as long as the segment [two triangular yellowish spots, more or less confluent, sometimes extending to the dorsum, in segments 2– or 4–9 (Walsh)]. Venter extremely light ochraceous, with intense burnt-umber brown markings in segments 2–8, viz.:—in each segment two longitudinal stripes, a pair of dots, and a spot or streak; in segments 4–8 the longitudinal stripes extend from near the hinder lateral angles of the segment almost to the base, are gently curved outwards posteriorly, and are slightly convergent towards each other in front; in segments 2 and 3 the stripes are confluent at the base of the segment; in segments 2–8, between every pair of stripes, is a pair of dots placed transversely not quite in the middle of the segment, and these are followed at a short distance in the same segment by an abbreviated streak or lanceolate spot, half overlain at the joining by the margin of the segment, and half projected into the following segment. Setæ ochraceous, with piceous joinings. [Fore legs pale brown (Walsh).] Hinder legs, in opaque view, ochraceous; a broad band before the extremity of the femur, the extreme base of the femur, the knee, the joinings of the tarsal joints and tibia, and the ungues, intense burnt-umber brown. Wings vitreous, with pitch-brown neuration; the bistre-grey tint formerly attributed to the pterostigmatic region is now no longer visible.

♀. Anterior and lateral edges of the vertex, and sometimes the median line, as well as two abbreviated vittæ on each side of it, yellowish. Abdominal markings occasionally indistinct [*teste* Walsh]. Length of body 10–13; wing, ♂ 11–14, ♀ 12–15; setæ, ♂ im. 18–31, subim. 13, ♀ im. 18–19, subim. 14–15 mm.

*Hab.* Trenton Falls, N. Y. (Brit. Mus.); Rock Island, Ill. (Walsh); North-west Territory (Say); Quebec, Ca. (Provancher).

#### SIPHLURUS FEMORATUS, Say [not Etn., in Pl. 18].

† *Baëtis femorata*, Say, Godman's West. Quart. Rep. ii. 162 (1823); Le Conte, Complete Writings of T. Say, i. 171 (1859); Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 48; Walsh, Proc. Acad. Nat. Sc. Philad. (1862), 368?; Hag., Proc. Ent. Soc. Philad. ii. 169; Walsh, *op. cit.* ii. 188? (1863).—*B. interlineata*, *id.*, *op. cit.* 190?

*Siphlorus femoratus*, Etn., Trans. Ent. Soc. London (1871), 128.

*Subimago*.—Wings coloured exactly like those of *Hexagenia bilineata* [see p. 50, *ante*], the bordering of the cross veinlets along the anterior margin of the fore wing forming three dark clouds, of which the intermediate, situated about the bullæ, is the most distinct. Setæ pale brown, with brown joinings.

*Imago (living)*.—♂. Eyes pearly whitish above, with a movable black dot; their lower  $\frac{1}{4}$  (separated by a definite line from the whitish part) pale dusky. Notum piceous. Abdomen in segments 2–6 transparent whitish, each of them, above, bordered narrowly with piceous at the terminal margin, marked in the middle on each side with an obscure oblong spot, and slightly pulverulescent with piceous along the upper part; segments 7 and 8 of the dorsum piceous, each with a semi-oval whitish spot at the base on each side

extending to the middle; the last segment has the sides of the dorsum whitish throughout. Venter transparent whitish; forceps-limbs sometimes whitish only in their longest joint. Setæ whitish, with the joinings alternately broadly and narrowly fuscous. Wings vitreous; in the fore wing, the stronger of the longitudinal nervures, one discal sector with its cross veinlets, the subcostal cross veinlets, and a small more or less obvious spot at the bifurcation of the said sector, brown; a coarse medial black line about a millimetre long immediately behind the radius, and sometimes a slight brown cloud in the pterostigmatic region; in the hind wing one long and one short series of cross veinlets on the basal costa are strongly fuscous and enclose a brown cloud.

♀. Differs from ♂ in having segments 2-6 of the abdomen pitch-brown above, each paler towards the base; and there is no brown cloud at the base of the hind wing. Length of body 12-14; expanse of wing, ♂ 25-28, ♀ 28-29; length of setæ, ♂ im. 20-24, ♀ im. 13-16, subim. 10-14 mm.

*Hab.* Rock Island, Ill. (Walsh); Cincinnati, Ohio (Say). [After Walsh.]

#### SIPHLURUS BICOLOR, Walker.

*Palingenia bicolor*, ! Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 552 (1853); Hag., Smithson. Miscell. Coll. (1861), Synop. Neuropt. N. Am. 43.

*Siphurur bicolor*, ! Etn., Trans. Ent. Soc. London (1871), 128.

*Subimago (dried)*, ♀.—Wings light sepia-grey, the fore wing lighter and more transparent at the base and within the space bounded by the anal (8) nervure; neuration dark; cross veinlets of the pterostigmatic portion of the marginal area of the fore wing about 20 in number, sparingly forked and anastomosing; those of the disk margined with darker grey. Vertex of the head, and also the notum, brown-ochreous. Abdomen discoloured; setæ light yellowish brown. Fore femur dark reddish pitch-brown, the tibia rather less reddish and more piceous, the tarsus very light yellowish white. Hinder femora, in opaque view, extremely light yellow-ochre, changing in transmitted light to pale amber; the tibiæ and tarsi more nearly white; the ungues pitch-brown. Length of body 11, wing 13 mm.

*Hab.* St. Martin's Falls, Albany River, Hudson's Bay (Barnston, in Brit. Mus.).

#### SIPHLURUS MIRUS, sp. nov.

*Imago (dried)*, ♀.—Thorax dark pitch-brown above, varied at and near the peak of the mesonotum with dull light Mars-yellow. Abdomen fulvous or dull Mars-yellow above, varied with brownish, the hinder borders of the intermediate segments black, the bordering produced forwards along the lateral margins of the dorsum from the hinder angles of the segments so as to form acute triangular black spots in segments 2-8, and a black linear streak on each side in segment 9; the median basal dot and two diverging lines of the dorsal segments are visible in at least segments 9-8. Venter nearly of the same colours as the dorsum; segments 2-8 broadly margined with black behind; the black transverse bands, expanded just at their extremities, and narrowly conjoined along the lateral border, are each shortly extended into a projecting point midway between the side and the middle of the segment. Setæ whitish, with reddish joinings.

Fore wings vitreous, their neuration pitch-black somewhat brownish at the wing-roots. Hind wings transparent at the base, but largely occupied by a broad transverse transparent pitch-brown band (an hypertrophied bordering of the terminal margin) which extends from terminal margin to rather beyond the fork of the præbrachial nervure (6), and right across the wing from the costa, following the edge of the wing some distance further in along the inner margin; neuration pitch-black. Femora and tibiæ in opaque view light bistre-brown or bronze-brown, the tibiæ in some positions appearing light or pale dull brownish yellowish; tarsi brownish white, the ungues, terminal joint, and distal borders of the other joints, light burnt-umber or reddish brown. Length of body, ♀ 10, wing 12·5, setæ about 12 mm.

*Hab.* New Hampshire (Whitney, in Mus. Comp. Zool. Cambridge, Mass.). The conspicuous colouring of the hind wings enables this species to be distinguished at a glance.

#### SIPHLURUS TYPICUS, sp. nov.

*Subimago (dried).*—Wings uniformly light bistre-grey, with light bistre-brown longitudinal neuration; the nervures paler close to the wing-roots. Setæ in opaque view bistre-brown, with piceous joinings. Body pitch-brown.

*Imago (dried).*—♂. Notum almost intense brown-ochre, but browner. Dorsum of abdomen in opaque view bistre-brown, modified in segments 7–10 with light brown-ochre; in oblique view the predominant colour changes from bistre- to raw-umber brown, and segments 2–6 become more translucent than the others, especially at their bases; the darker colour in them occupies the middle of the back continuously as a broad longitudinal stripe, extends laterally therefrom along the joinings, and then is suddenly dilated midway towards the pleuræ so as to form a quadrangular spot bounded behind by the terminal margin and below by the hinder half of the lateral margin of the dorsal arc, thus filling the posterior lateral angle; from the upper anterior angle of this spot a dark streak is produced horizontally to the base of the segment, dividing the pale space thereabouts into a subquadrangular spot at the anterior lateral angle of the segment, and a longer portion beside the dark median stripe; in segment 7 the corresponding pale spaces are much more circumscribed in extent. Venter pale, in segments 8 and 9 modified with brown-ochre or ferruginous, and marked faintly sometimes in segments 2–7 with fine lines convergent towards the base of the segment, or U-shaped markings of the pattern common in this genus, which in other specimens are not traceable. Forceps-basis pale in the middle; its lateral borders and the forceps-limbs light brownish. Setæ whitish warm-sepia, with piceous joinings. Fore femur and tibia in opaque view light raw-umber brown, the latter opaque or redder at the tip; tarsus whitish, with narrowly piceous joinings, and with the terminal joint and ungues tinged very faintly with warm sepia-grey; in transmitted light the raw-umber changes to yellowish amber. Hinder femora and tibiæ very light raw-umber brown; the tarsi whitish, tinged (especially in the terminal joints) with warm sepia; their joinings and ungues light reddish. Wings vitreous, with a small brownish cloud along the axillar fold of the fore wing; neuration pitch-black, excepting the fore wing-roots and the bases of the main nervures, and also in

some lights the costa, subcosta, and radius, which are pitch-brown or light pitch-brown.

♀. Very similar. The ventral markings consist of a broad dark longitudinal stripe on each side at a little distance from the pleuræ in segments 2-5 or -6. The joinings of the setæ are more distinctly piceous than in the ♂, and this colour seems to be liable to run together into irregular bands, perhaps only in dead specimens. The terminal joints and the joinings of the other tarsal joints are warm sepia-brown. Length of body, ♂ 9, ♀ 10; wing, ♂ 10, ♀ 11; setæ, ♂ im. 18-25, subim. 11, ♀ im. 15 mm.

*Hab*: Denham, Mass. (M<sup>c</sup>Lach. Mus.); Worcester, Mass. (Mus. Comp. Zool. Cambridge, Mass.).

No Japanese *Siphururus* has yet been described; but in M<sup>c</sup>Lach. Mus. are 9 adult ♀ specimens (captured by Pryer) of a large species. The colours of the abdomen have been lost, and therefore it is inexpedient to describe the insect.

#### ONISCIGASTER, M<sup>c</sup>Lach. 1873.

*Illustrations.* *Adult* (details), Pl. XXI. 36; (whole figures) see citations under *O. Wakefieldi* of M<sup>c</sup>Lach. (1873 & 1874). *Nymph* Pl. LI.; see also citations of M<sup>c</sup>Lach. (1874) and Vayssière (1882).

*Adult.*—Fore leg of ♂ shorter than the body nearly in the proportion of 14 to 17; tarsus almost  $1\frac{1}{2}$  as long as the tibia, and this nearly  $\frac{7}{8}$  as long as the femur; gradation of the tarsal joints in the order of lessening length, 1, 2, 3, 4, 5, the first about  $1\frac{1}{2}$  as long as the second joint. Fore leg of ♀ little less than half [ $\frac{9}{20}$ ] as long as the body; tarsus about  $1\frac{3}{4}$  as long as the tibia, and this  $\frac{5}{8}$  as long as the femur; the rank of the tarsal joints in order of diminution is 1, 2 equal to 5, 3, 4, and the first is twice as long as the second joint. Hind tarsus of ♀ about  $1\frac{1}{2}$  as long as the tibia, and this little more than  $\frac{1}{2}$  as long as the femur; the joints in order of shortening rank 1, 5, 2, 3, 4, and the first is twice as long as the second. Ungues each unlike the other in every tarsus. Hind wing well developed, obtusely subovate; dilatation of the marginal area obtuse in front; axillar region well developed, largely occupied by numerous long anastomosing veinlets from the inner margin. In the ♀ abdomen the relative lengths of segments 2-10 may be formulated thus:—6, 8, 8, 8, 8, 10, 11, 10, 6; the first is thoracoid. Pleuræ of segments 2-5 in ♀ squarely truncate behind; those of segments 6-9 in ♀, or 5-9 in ♂, broadly and oniscoidally dilated, each narrowed and rounded off obtusely in front, and each produced behind into a short acute point separated by a small sinus from the hind border of the segment, so that this part of the abdomen is flanked by very conspicuous serratures; the pleural projections of segment 5 in the ♂ are narrower than the others. The 9th ventral segment is unprovided with a lobe in the ♀. Forceps-basis bipartite; the divisions, explanate, quadrangular, longer than broad, and remote from one another, might be reckoned as basal joints of the forceps-limbs. Forceps-limbs dactyloid, 4-jointed; the first joint short, tapering from the base; the second curved, longer than the others, and very slightly gibbous inside at the base. Penis small, perhaps retracted partially in dried examples. Median caudal setæ of ♂ about  $\frac{1}{4}$ , of ♀  $\frac{1}{3}$  as long as the body; outer setæ of ♂ about  $\frac{8}{9}$  as long as the body. In the ♀

*subimago* the median seta is about  $\frac{1}{3}$  and the outer setæ nearly  $\frac{3}{4}$  as long as the body. Oculi of  $\sigma$  remote above, oval and very prominent. Vertex of  $\text{♀}$  head about as long as broad, slightly wider in front than behind; the occipital border raised suddenly above the level of the posterior orbits of the oculi. Median ocellus of  $\text{♀}$  much smaller than the others, isolated in a broad descending groove in front of and below the anterior edge of the upper surface of the head. Pronotum of  $\text{♀}$  rather broadly reflexed upon the mesopleuræ; its posterior border (viewed from above) arched, with a very shallow median recess, which is not noticeable when viewed from in front.

*Nymph.*—Abdominal tracheal branchiæ recumbent upon the dorsum, borne by segments 1–6, diversiform and single, each inserted in a notch in the hind margin of the segment adjacent to the pleura; the foremost oblique, and somewhat resembling a truncate triangle with obtusely rounded angles, placed with the longest side inwards; the remaining five are formed each of a somewhat broadly obovate or oval pergamentose lamina with a large roundly expanded foliated lobe produced from its inner edge [defective in fig. 18], the margins of which are irregularly erose and incised. The tracheation of the lamina gives it a curiously marbled appearance. Antennæ shorter than the head, about 12-jointed in adolescence. Mandibular lobes strong and fang-like; the endopodite well developed; stipes well developed, circumscribed distally by a shallow constriction. Palpus of maxilla I. a little longer than the lacinia; the third joint gradually tapering, pungent, about as long as the second and little shorter than the first, but not quite as stout as either of them; lacinia somewhat lanceolate, with very few hairs on the oblique crown close to the point, and with short ciliæ mingled with a few slender curved spines on the inner edge preceded by a few very short hairs nearer the stipes. Lacinia of maxilla II. falcate, nearly of the same breadth as the narrowly ovate-lanceolate lobes of the labium; first joint of the palpus stout; second joint less stout and slightly curved, very little enlarged and almost squarely truncate distally, about as long as the first joint; third joint about half as long as the second, less stout, and somewhat elongate-oval. Median lobe of the tongue subquadrangular, with the distal corners rounded, longer than broad and slightly retuse, subequal in length to the paraglossæ, of which the terminal margins with that of the median lobe constitute together an arcuate curve; paraglossæ dilated distally very moderately. Hind leg a little longer than the fore leg; tarsus (claw excluded) nearly  $1\frac{1}{2}$  as long as the tibia. Abdomen carinate above longitudinally in the middle; the carination in segments 2–9 produced into short points, each projecting a little over the base of the next segment; pleuræ in segments 1–9 oniscoidally dilated, forming recurved acuminate serratures. Median seta plumose, the others ciliate inside, each in its distal  $\frac{2}{3}$ ; outer setæ about  $\frac{1}{2}$  as long as the body.

*Type.* *O. Wakefieldi*, M<sup>c</sup>Lach.

*Distribution.* New Zealand.

*Etymology.* ὀνίσκος and γαστήρ, in reference to the lateral serratures of the abdomen.

ONISCIGASTER WAKEFIELDI, M<sup>c</sup>Lach. Plate XXI. 36 (wings, legs,  $\sigma$  head, and forceps). pl. 51—*Nymph.*

*Oniscigaster Wakefieldi*, M<sup>c</sup>Lach., Ent. Mo. Mag. x. 108–9, woodcut (1873, Oct.); *id.*, Rep. Brit. Ass.

1873, p. 118 (1874); *id.*, Proc. Ent. Soc. London (1874), p. vi; *id.* Journ. Linn. Soc. Zool. xii. 139-146, pl. v. 1-5 g (1874).

*Subimago (dried)*.—Wings, in opaque view, light sepia-grey; neuration generally piceous, but the principal nervures become pale basewards; the cross veinlets situated in the portions of the fore wing bounded posteriorly by the inner and terminal margins, and in front by the outer half of the sector (4) and the inner half of the pabrachial (7) nervures, and all of the cross veinlets in the hind wing are narrowly edged with faint nebulous dark bordering; those in the anterior portion of the fore wing (with the exception of those in the extremity of the pterostigmatic space) are edged more or less broadly with piceous—most broadly so in the marginal, submarginal, and the next adjoining areas,—and their bordering in the basal halves of the first two areas is confluent to a variable extent; between the great cross vein and the last-mentioned cross veinlets the membrane is pale, contrasting conspicuously with the adjacent parts; and in proximity to the wing-roots the base of the fore wing from the radius (3) to the inner margin is somewhat pale, both membrane and nervures; and so again to a small extent is the membrane in proximity to the bifurcation of the præbrachial (6) nervure. Setæ dull pale yellowish.

*Imago (dried)*.—♀. Notum dark pitch-brown. Abdomen of a duller colour than the notum on the dorsum, but nearly as dark, probably discoloured considerably in drying; in segments 2-6 the tracheæ appear to be pale and the joinings of the segments dark; the sides of every segment in proximity to the pleuræ are more or less dark; segments 6-9 are traversed lengthwise by a fine median black line, and are marked each by a pair of elongated dark spots or short streaks, one on each side of the line, at the base; the pleural expansions of these segments, and in 9 and 8 a forked longitudinal streak just above them on each side, are also dark. Venter light yellowish brown, with black or piceous markings: the markings comprise in each of segments 2-7 a large blotch on each side, gradually rounded off towards the base of the segment, intersected by the pale descending tracheæ near its anterior termination, and leaving only the joining pale; also a transverse streak at the joining, tapering to a point from the middle in both directions, whence is produced a short pointed streak or triangular cusp pointing forwards in the middle of the hind border of the segment; also a pair of small dots or oval spots, one on each side of the middle of the segment and in proximity to the point of the cusp; also the ventral ganglion nearer the base of the segment in the median line; and, lastly, another pair of larger oval spots set obliquely, and rather wider apart than the smaller spots, one on each side of the middle near the base of the segment; in segment 8 the smaller pair of dots is extremely small, and in 9 they appear to be totally absent, the larger pair alone remaining. Setæ whitish yellow, sometimes discoloured at the base. Wings vitreous, faintly tinted with light brownish [excepting sometimes towards the tips of the fore wings, perhaps in consequence of their having been seized between finger and thumb at the time of capture]; neuration piceous; cross veinlets dark-edged, nearly in correspondence with their edging in the *subimago*. Legs in opaque view dull light brown-ochreous, all with the base of the femur, a broad band before its extremity, one at the base of the tibia, one embracing the tip of the tibia and the basal half of the first

tarsal joint, and all with the extreme tips of the joints of the tarsus and with the ungues black; in transmitted light the ochre changes to dull amber.

♂. Very similar to the ♀, but perhaps rather lighter in colour. Setæ pale dull yellowish. Forceps pale yellowish brown. Length of body 16–21; wing, ♂ 16, ♀ 19–21; setæ, ♂ im. 17 & 5, ♀ subim. 13 & 7 mm.

*Hab.* New Zealand; Christchurch (Wakefield, in M<sup>o</sup>Lach. Mus. and Brit. Mus.).

*Section 11 of the Genera.*—Type of *Bætisca*. *Adult.*—In the fore wing the second axillary nervure (9<sup>2</sup>) meets the terminal margin close to the anal angle, simulating the usual appearance of the anal nervure and usurping its usual functions: the first axillary (9<sup>1</sup>) and anal (8) nervures simulate complete intercalar nervures of the anal-pobrachial interspace, and are immediately adjacent to each other; the third and fourth axillary nervures meet the inner margin before the middle, occupying the usual places of the first and second. Pronotum of minimum proportions; mesonotum excessively developed. *Nymph.*—Palpus of maxilla i. shorter than the lacinia. Pronotum and the mesonotal sutures undefined in adolescence, the wings being immersed in a large notal hood or shield, which obstructs the tracheal branchiæ and a large portion of the abdomen.

#### BÆTISCA, Walsh, 1862.

*Illustrations.* *Adult* (details), Pl. XXI. 37; (whole figure) *subim.* see unpublished drawing by Abbot, Brit. Mus. Cat. MSS. 460 c, vol. xii. pl. 42 bis, No. 662 (1792). *Nymph*, Pl. LII.; see also citations under *B. obesa* of Walsh [with circumspection] (1864) and Vayssière (1882).

*Adult.*—Fore leg of ♂ little longer than the body [as 8·5 is to 7 or 8]; tarsus scarcely  $2\frac{1}{2}$  as long as the tibia, and this little more than  $\frac{2}{3}$  as long as the femur; the tarsal joints in order of shortening rank 1, 2, 3, 4, 5, and the first is very nearly  $1\frac{3}{4}$  as long as the second joint. Fore leg of ♀ about  $\frac{5}{7}$  as long as the body: tarsus barely longer than the tibia, and this about  $\frac{2}{3}$  as long as the femur; the tarsal joints in decreasing length rank 1, 5, 2, 3, 4, and the first is nearly  $1\frac{1}{2}$  as long as the second joint. Hind tarsus of ♀ about  $1\frac{1}{7}$  as long as the tibia, and this  $\frac{3}{5}$  as long as the femur; the proportions of the tarsal joints approximate to those of the joints of the fore tarsus, but the first is scarcely  $1\frac{2}{3}$  as long as the second joint. Ungues each unlike the other in every tarsus. Hind wings ample, subrotund; dilatation of the marginal area obtusely rounded off in front; axillar region of moderate dimensions, but with plentiful neuration; intercalar neuration unusually long and plentiful; cross veinlets remote from the terminal margin. In both wings cross veinlets are very numerous, and many of them are delicate; in the fore wing they are not restricted from the vicinage of the terminal margin, where many of the longitudinal nervures are provided with short branchlets. Prosternal projection bifid; mesothorax remarkably stout; abdomen relatively short. In the ♀ abdomen the proportional lengths of the 3rd–10th segments may be formulated thus:—6, 6, 7, 14, 7, 7, 7, 6; of the remaining two segments, the first is thoracoid, and the second was not sufficiently traceable for measurement in the dried specimen examined; the pleuræ of segments 7 and 8 are obtuse, those of segment 9 acutely truncate behind; the ventral

lobe of segment 9 is subtriangular, with the apex shortly and acutely excised. Forceps-basis of ♂ entire, slightly retuse in the middle; forceps-limbs 3-jointed, with the first joint nearly thrice as long as broad, the second (the longest joint) somewhat gibbous at its inner base and slightly incurved, and the third joint short. Penis-lobes unarmed, apparently combined into a single acute ovate lamellar intromittent organ, concave above and terminating with a single seminal pore. Median caudal seta atrophied; outer setæ in both sexes  $\frac{9}{7}$  to  $\frac{7}{8}$  as long as the body; those of the ♀ *subimago*, from  $\frac{2}{3}$  to  $\frac{5}{8}$  as long as the body. Oculi of ♂ undivided, nearly contiguous above. Vertex of ♀ head somewhat transverse; the occipital margin raised slightly above the level of the posterior orbits of the oculi. Median ocellus of ♀ isolated, a little smaller than the others. Pronotum of ♀ of minimum proportions, reflexed only in the least degree upon the mesopleuræ.

*Nymph*.—[Pl. LIII. was prepared from a cast slough, and consequently a small but appreciable amount of distortion must be allowed for in some of the figures.] Body stout, tapering in its posterior half; integument extensively but very minutely granulated or scabrid. Abdominal tracheal branchiæ, in specimens of advanced grade, completely obtected by the convex mesonotal shield (referred to above in the Sectional description) and [*fide* Walsh] decumbent upon the dorsum in the cavity enclosed thereby; their insertions in segments 2–6 are successively approximated to one another by small degrees. The said shield (in which the fore wings are immersed) differs merely in its larger development from those of the nymphs of *Oligoneuria* and *Ephemerella* (already described), occupying, as it does, not only the interspace between the terminal margins of the wings, but also surrounding their extremities and extending laterally beyond their costal margins to the borders of the dorsum, in which respects it is doubtless in agreement with that of *Prosopistoma*. The lateral margins of the shield are flanged, in continuity with the narrowly dilated pleural margin of the mesothorax, to fit closely those of the subjacent segments; its posterior edge, somewhat cordately sinuate, is received into a slot or furrow in the front of a correspondingly undulated ridge traversing the anterior part of the dorsum of the sixth segment, which is the longest by far of the segments. [In figure 1, owing to displacement in the moulted integument, this is overlapped by the shield, which nearly attains the posterior border of that segment.] In moulting the shield splits longitudinally in the middle; on each side of it two large slightly compressed straight prickles arise, one in the midst and the other at the lateral border a little anterior to it, sloped in front but steep behind, their bases being prolonged forwards; of these the intermediate are the smaller. Above each of the fore wing-roots is a small triangular tubercle. Head shortly bicornute in front; the spikes, horizontally prorect, slightly divergent, and either smooth or (one or both of them) unidentate on the inside near the point, arise from above the anterior border of the upper part of the head, which, viewed from below, forms a prominent transverse ledge emarginate in the middle and receding at the sides. Genæ acutely prominent below the orbits. Antennæ 7-jointed; the last three joints and the second joint are longer than the others. During life (*fide* Walsh) the antennæ are deflexed and lie back in grooves below the oculi. Lobes of the mandibles strong and fang-like; endopodite well developed; outer edge of the stipes minutely eroded. Palpus of maxilla 1. shorter

than the lacinia; the third joint subulate, as long as the second and longer than the first; lacinia nude on the crown, its terminal border beset with numerous curved spines, its inner edge with a small isolated tuft of short hair in the middle. Laciniaæ of maxillæ II. narrower than the lobes of the labium, which nearly resemble quadrants of the longer segments of a short ellipse; palpus chelate, the second joint being produced distally on the inner side into a slender conical projection shorter than the terminal joint. Median lobe of the tongue subquadrate, with the terminal corners rounded off, and with the margin slightly mucronate in the middle between them; paraglossæ narrow, distally dilated and rounded off. Hind leg longer than the fore leg; tarsus (claw excluded) about  $1\frac{1}{2}$  as long as the tibia. Pleuræ of segments 6-9 of the abdomen narrowly dilated oniscoidally; their outer edges for some distance from the points straight and oblique, and then rounded off. Setæ all of one length, about  $\frac{1}{3}$  as long as the body and plumosely pilose. Resident in swiftly flowing rivers on the underside of stones, creeping slowly, but swimming with celerity.

*Type.* *B. obesa* (in ‡ *Baëtis*), Say.

*Distribution.* N. America.

*Etymology.* Diminutive of *Baëtis*, the classical name of the Guadalquivir, grecised.

*BÆTISCA OBESA*, Say. Plate XXI. 37 (wings, legs, genitalia).

*Baëtis obesa*, Say, Journ. Acad. Nat. Sc. Philad. viii. 43 (1839); Pict., Hist. Nat. Névropt. ii. Ephém. 195 (1843-5); Walk., List of Neuropt. Ins. in Brit. Mus. part iii. 563 (1853); Le Conte, Reprint of Say's Works, ii. 412 (1859); Hag., Smithson. Miscell. Coll. (1861) 45.

*Bætisca obesa*, !Walsh, Proc. Acad. Nat. Sc. Philad. (1862) 378; !*id.*, Proc. Ent. Soc. Philad. ii. 187 (1863); !*id.*, ditto, iii. 200-6, fig. [nymph] (1864); !Etn., Ent. Mo. Mag. v. 89 (1868); Packard, Guide to Study of Ins. ed. i. 595, fig. 576 [after Walsh] (1870); Etn., Trans. Ent. Soc. London (1871), 101, pls. ii. 6 [wing; misdrawn] & v. 9 [details]; Joly [translation of Walsh 1864], Bull. Soc. d'Etud. Sc. Angers 1878-1879, pp. 157-173, figs. 1-3 [after Walsh] (1880); Vayssière, Ann. d. Sc. Nat. (6) Zool. xi. 4, 5, pl. i. 2 (1881) & xiii. 72-77, pls. vi. 56, ix. 98-99 bis, & x. 99-103 (1882).

*Subimago (dried).*—Wings dark sepia-grey with a narrow transparent colourless space on each side of every cross veinlet in the greater part of the disk, and with broader colourless spaces elsewhere in the parts deficient in cross veinlets, viz. :—in the fore wing a large clear band, broadest in the hinder half of the wing, describing a curve from the anal angle outwards to nearly the middle of the costa, and almost interrupted at the fork of the præbrachial (6) nervure; also a large irregular blotch extending transversely from the costa half across the sectorial intercalary nervures: in the hind wing the base is pale, and the dark ground-colour, very sparsely varied with pellucid spots, extends to some depth along the terminal margin. Setæ light warm sepia-brown.—A specimen from Detroit, Mich., has light yellowish-grey wings varied with dusky; and in the fore wing the lighter colour occupies almost the whole of the space posterior to the anal (8) nervure; also a broad patch, in continuity with that space, extending in proximity to the wing-roots, and near the conjunction of the sector (4) and cubitus (5), to the radius (3); also a band, likewise in continuity with the first-mentioned space, passing straight across to the costa by the fork constituted by the union of the sector (4) with the

second intercalary in advance of the cubitus (5). Setæ, forceps, and legs dull light yellowish; the unguis burnt-umber brown.

*Imago (dried)*, ♀.—Notum rather dark burnt-umber-, or intense warm sepia-brown. Abdomen above dark burnt-umber, varied with lighter, and modified at the sides near the base with blue-purplish grey; venter reddish white, with a longitudinal fuscous line in the middle of the penultimate segment. Setæ pubescent, yellowish white, with rufescent joinings. "Intermediate setæ ferruginous" [Walsh]. Forceps yellowish white. Fore femur light amber-yellow, modified with brown-ochre towards the tip; tibia and tarsus brown-ochreous, with pitch-brown unguis; in transmitted light the light amber predominates. Hinder legs lighter than the fore legs; the tibia and tarsi yellowish white. Wings vitreous; longitudinal neuration of the fore wing translucent light brownish, excepting the bases of the costa, radius, and axillary nervures, which are pitch-brown; the marginal area of this wing contains about 10 very faint cross veinlets before the bulla, and 17 beyond it.

♀. Very similar. Length of body 6–8; wing 9–12; setæ, ♂ ♀ im. 6–7, subim. ♂ 3·5, ♀ 4–5 mm.

*Hab.* North America; Illinois (Walsh); Indiana (Say); Detroit, Mich. (Mus. Comp. Zool. Cambridge, Mass.); California (M<sup>c</sup>Lach. Mus.).

The Michigan subimago above described probably agrees with the precocious ♂ referred to by Walsh at the end of his description in 1862.

*Provisional Second Series of Group III. of the Genera of the Ephemeridæ.*

*Adult* unknown. *Nymph*.—Palpi of both pairs of the maxillæ multiarticulate; that of maxilla I. far shorter than the lacinia; that of maxilla II. much longer than the lacinia, flagelliform and geniculated. Abdominal tracheal branchiæ diversiform, borne by segments 1–7; the foremost formed each of a narrow membranous lamina with long fringes; those of the second segment are composed of a rounded pergamentose lamina with a fascicle of fibrils annexed to its base; those of the remaining segments have been lost in the unique specimen.

*Section 12 of the Genera*.—Type *nameless*. Separated provisionally from Section 13 [see page 22].

GENUS and SPECIES *undetermined*.

*Illustrations*. *Nymph*, Pl. LIII. (slough and details).

*Nymph-slough*.—Antennæ shorter than the head, multiarticulate and subulate, with the first two joints longer and much stouter than the remainder. Labrum transverse and emarginate. Mandibles virtually symmetrical, each with two fang-like lobes projecting inwards nearly at right angles with it almost in the middle; of these the lowest, representing the molar portion of the crown, ends in a short sharp tooth dominating a small excision; the intermediate fang is bifid, with acute unequal points; the extremity of the mandible, narrowed cuneately from the lobes to the points, is slightly incurved and trifid, with the median tooth the longest. Maxilla I. broad; lacinia short, termi-

nating in several (about 5) curved subulate teeth; palpus minute, setaceous, 11-jointed, with the second joint the longest, and the third, nearly equalled in length by the penultimate, longer than any of the remaining joints. Laciniaë of maxillæ II. broadly falcate, almost as broad as the subquadrangular lobes of the labium; palpus 13-14-jointed; the first joint much the stoutest and longest, about half as long as the flagellum; the second joint (the first of the flagellum) longer than any of the others. Terminal margins of the fore wings free. Hind leg little longer than the fore leg; tarsus about  $\frac{1}{2}$  as long as the tibia, and this about  $\frac{2}{3}$  as long as the femur; all the legs are fringed with hair along their upper edges, and have strongly incurved ungues. Setæ defective; the median plumose, the others ciliated within. Length of body 21 mm.

*Hab.* Chili (Reed, in M<sup>c</sup>Lach. Mus.).

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Part IV. Read December 17th, 1885.

*Third Series of Group III. of the Genera of the Ephemeridæ.*

*Adult.*—Anal-axillar interspace of the fore wing curvilinear-trilateral, subtended by the anal angle and a part of the terminal margin. Forceps-basis of ♂ well developed—its form and that of the penis (especially the latter) facilitate distinctions of genera; forceps-limbs either 4-jointed, with the second joint proportionally very long, or 3-jointed (through coalescence of the first with the second joint), with an enlargement at the base of the proximal joint. *Nymph* [those of section 13 unknown]: palpi of maxillæ I. and II. 2-jointed and geniculated; terminal joint of the palpus of maxilla II. peculiarly pouched. Abdominal tracheal branchiæ [excepting the hindermost in some genera] foliaceous and fringeless, furnished at the base each with a fascicle of fibrils or an annexed lamella filiformly dissected at the edges.

*Section 13 of the Genera.*—Type of *Atopopus*. *Adult.*—In the fore wing the first axillary-nervure (9<sup>1</sup>) meets the inner margin at or near the very obtusely rounded anal angle; the second axillary (9<sup>2</sup>), subparallel with and adjacent to the first, receives several branchlets [or curved cross veinlets] from the distal portion of the inner margin which comes between its own termination and that of the third axillary nervure (9<sup>3</sup>); the almost straight anal nervure (8) meets the terminal margin rather far in advance of the anal angle; the trilateral, somewhat leg-of-mutton-shaped space [the “anal-axillar interspace”], bounded by the anal and first axillary nervures together with the terminal margin, and attenuated towards the wing-roots, contains a variable number of intercalary nervures, incurvate from the terminal margin and commonly grouped together in two couples of unequal length, of which the longer [usually the nearest to the first axillar (9<sup>1</sup>)] extends about halfway to the wing-roots. Tarsi of the hinder legs as long as the tibiæ or longer. *Nymph* unknown: perhaps that ranked in section 12.

Absence of requisite materials precludes description of the genera of this section in full detail.