

ART. XX.—*On New Zealand Ephemeridæ: Two Species.*

By C. O. LILLIE, M.A., B.Sc.

[*Read before the Otago Institute, 15th November, 1898.*]

Plates XIV.—XIX.

THE *Ephemeridæ* are insects with a long, soft, 10-jointed abdomen, furnished at its hinder end with either two or three many-jointed setaceous or filiform tails (caudal setæ). The body is smooth and glabrous. The head is free, with atrophied mouth-organs and carinated epistoma; short subulate antennæ, composed of 2 or 3 short stout joints, succeeded by a many-jointed setaceous awn, three ocelli, and large oculi (compound eyes). Thorax robust, mesothorax predominant, sternum well developed; fore wings ample, erect or spreading in repose, slightly plaited lengthwise; legs slender, femora strong, the fore coxæ somewhat distant from the others. The abdomen in the male armed with a pair of claspers (forceps) placed ventrally at the extremity of the penultimate segment; the vasa deferentia have each a separate intromittent organ, situated at the ventral joining of the ninth and tenth segments.

Peculiarities in structural detail are often noticeable in both or one of the sexes, and are chiefly presented by the ocelli, wings, legs, and caudal setæ; and in the male by the ocelli and forceps. The ocelli are always much larger in the male than in the female, and are divided into two parts transversely; the upper portion has larger facets than the lower, and is sometimes coloured differently.

The fore wings are usually trilateral, ample and rounded off at the extremities; they are relatively longer in the female. The hind wings in some of the genera are not developed; in others they are very minute; and generally they are not very large. Their usual form is triangular-ovate, or oblong-ovate, with a salient prominence in front, either close to the wing-roots or midway towards the apex, in which case the prominence is sometimes followed by a deep depression. Their neuration is fairly plentiful. The inner margin of the fore wing and the anterior margin of the hind wing hitch together automatically to a larger or smaller extent when the wings are spread open. The wing-membrane is usually glassy or iridescent in the adult. Wing-neuration in the *Ephemeridæ* is less complicated than it appears to be, and when difficulty is experienced in ascertaining the homologies

of the nervures it is likely to be occasioned by the suppression of some of them. Unstable in minutiae, so closely is the essential plan of neuration adhered to by nearly related mayflies that the general facies of the wing is an important aid to classification. The nervures are numbered in the diagrams as follows: 1, the costa, coincident with the anterior margin of the wing; 2, the subcosta; 3, the radius; 4, the sector; 5, the cubitus; 6, the præbrachial; 7, the pobrachial; 8, the anal; 9¹, 9², &c., axillary nervures; 10, the sutural, coincident with the inner margin.

The nervures of the fore wing arrange themselves in three groups. The first—consisting of the costa (1), the subcosta (2), and the radius (3)—communicates directly with the thorax; the second—containing the sector (4), the cubitus (5), the præbrachial (6), and the pobrachial (7)—is either annexed to the first group, or terminates in the wing-membrane adjacent to it, close to the base of the wing; the third group—consisting of the anal (8) and the axillary nervures (9¹, 9², &c.)—is associated with the prominent curved or angulated crease in the membrane which forms the boundary of a depression posterior to the great cross-vein and close to the wing-roots. By careful inspection of the third group of nervures, observing especially the disposition of the proximal extremities of the main nervures along the prominent curved fold of the membrane, the form of the area contained by the first axillary nervure and the inner margin of the wing, or of the area enclosed by the first and second axillary nervures, and lastly by the general aspect of the adventitious and other nervures, the approximate affinities of *Ephemeridæ* to one another can be ascertained very easily. Cross-veinlets are generally of small account in classification.

In the nervures of the hind wing the cubitus (6) is transferred from the second group, and is annexed to the radius (3), the sector and other adventitious nervures either remaining apart from both or forming a union with either of them. The anal nervure (8) is transferred to the second group. The axillary nervures forming the third group generally occupy a very limited space.

The legs present great differences, some sexual, some generic. The fore legs are always longer in the male than in the female, and are usually longer than either of the hinder pairs. The fore tarsus is often as long as the tibia; in the male frequently much longer. The number of tarsal joints is 5, or 4. The unguis of the fore tarsus are sometimes alike in size and form; often unlike.

The forceps of the male are 2-, 3-, or 4-jointed, with the basal joint, or the next, longest. In some genera they afford good distinctive characters of species.

Much diversity is exhibited in the number and relative proportions of the caudal setæ.

The term "nymph" is used to denote all the subaqueous stages in the development of the young after hatching. In general form they resemble the adult. The tracheal branchiæ are movable, membranaceous, or filamentose appendages to the integuments, enclosing branching tracheæ. The term "subimago" is used to denote the penultimate stage in the life of such of the *Ephemeridae* as moult once, after direct respiration through the stigmata has been established, and the wings have become fully expanded. The chief points by which this stage can be distinguished from the adult are—the dulness of the integuments, particularly of the wings; the ciliolate terminal margin of the wings in many genera; the shortness of the fore legs; the greater hairiness and shortness of the caudal setæ; the less protuberant and less highly coloured ocelli; and in the male the marked shortness and stoutness of the limbs of the forceps.

The above account is condensed from Eaton's Monograph.

In the "Revisional Monograph of Recent *Ephemeridae*, or Mayflies," by the Rev. A. E. Eaton, M.A., published in the "Transactions of the Linnæan Society," London, 1888, the following genera are given as represented in New Zealand:—

Ephemera (1 species).—Undescribed.

Atalophlebia (3 species).—*A. dentata*, *A. nodularis*,
A. scita.

Coloburus (1 species).—*C. humeralis*.

Siphlurus (1 species).—Doubtful.

Oniscigaster (1 species).—*O. wakefieldi*.

Chirotonetes (?) (1 species).—*C. ornatus*.

Thus it will be seen that six species are described, but of these the nymph stage of only one (*Oniscigaster wakefieldi*) is known.

During the present summer I succeeded in rearing a number of insects of two species of *Atalophlebia* from the nymph stage, and am consequently able to describe all three stages.

Genus ATALOPHLEBIA, Etn. (1881).

Adult.—Hind wing in front somewhat arched, the summit of the arch obtusely subangular, situated usually before the middle of the curve; subcosta (2) strongly arched, meeting the margin very obliquely; radius (3) nearly straight, constituting, as it were, the chord of the arch described jointly by the subcosta and the portion of the margin included between its extremity and the radius; hence, while the narrow marginal area is broadest at the base and acuminate at its termination, the submarginal area is broadest either in the

middle or a little way before the middle, and tapers gradually to its oblique apex. Cross-veinlets abundant in the fore wing. At the terminal margin the longitudinal nervures are provided with curved simple branchlets, and there are no isolated veinlets. The two intercalar nervures of the anal-axillar interspace of the fore wing have simple branchlets, and usually the hinder one close to its proximal extremity curves forward to unite with the other, which similarly curves forward to unite with the anal nervure. Guard at the orifice of the mesothoracic spiracle small and triangular. Forceps limb of male 3-jointed, the proximal joint much longer than the remainder, somewhat compressed, and in its basal half broadly dilated beneath; the deflexible basis, usually prominent in the middle of the distal border, is otherwise merely emarginate; the corresponding lobe in the female, usually bifid and sharply excised with acute triangular points, is seldom emarginate only. Segments 6–10 constitute about half of the abdomen; segment 8 (the longest) is nearly equalled by segment 7; the others are successively shorter. Median caudal seta about as long as the others, seldom thrown off by specimens; outer setæ, in both sexes, usually double the length of the body. Tarsal unguis all nearly alike, small, narrow, and hooked at the tip. In normal species the male fore tarsus is nearly as long as the tibia, or a little longer than it, and the latter is about one and a half times as long as the femur; the female fore tarsus is nearly half the length of the tibia, which is about one and one-third times as long as the femur.

Nymph. Hitherto unknown. Considering the marked differences in the two nymphs here described, it is hard to say what the generic characters might be.

Atalophlebia scita, Walker.

Nymph ♀ (living). Plate XIV., figs. 1a–p.

General colour brownish-black or greyish-black; eyes black; wing-covers black or lighter grey; double median line along dorsal surface of the abdomen; terminal segment yellow; tracheal branchiæ yellowish-grey, veins pitch-black; legs dusky grey, a yellow spot at the proximal and distal ends of the femora; setæ dull grey, becoming lighter towards the extremities; middle seta slightly longer; angle between the setæ about 50°. Length of body, 9 mm.; length of setæ, 12 mm.

The colour differs according to the interval from moulting. Young nymphs and individuals just moulted are greenish-grey. The moults are many. The males in the later stages are distinguished by their bi-lobed eyes, the upper lobes being red.

Hab. Streams about Dunedin, &c. ; on stones. Extremely common. The eggs found in jelly-like patches on stones in the streams are probably those of this insect.

Subimago ♀ (in alcohol). Plate XV., figs. 2a-d.

Wings dark sepia-grey ; posterior margins ciliolate ; neuration black ; broad yellow median band on thorax, widening into an oblong patch posteriorly ; setæ warm sepia-grey, with dark joinings. The subimago stands on all three pairs of legs, with wings erect. The moult into the imago stage takes place twenty-four hours or more after emergence from the nymph.

Imago ♂ (in alcohol). Plate XVI., figs. 3a-m.

Thorax piceous ; eyes bi-lobed, upper lobes light-red ; abdomen dusky brown edged with black, lighter median line, and pairs of yellowish spots on segments 3-6; forceps luteous ; setæ warm grey, joinings black ; fore femur reddish-brown ; hinder legs fulvous ; tarsi greyish. Wings vitreous, neuration pitch-black. In the fore wing a yellow spot at the base of the costa ; subcosta and radius luteous. Marginal and submarginal areas slight luteous tinge. In the marginal area seven cross-veinlets before the bulla and fifteen after it. The insect stands on its two hinder pairs of legs.

Imago ♀ (in alcohol).

Similar. About seven cross-veinlets before the bulla in the marginal area of the fore wing, and about sixteen behind it. Length of body, ♂ 10 mm., ♀ 9 mm. ; length of wing, ♂ 11 mm., ♀ 10 mm. ; length of setæ, ♂ 16 mm., ♀ 13 mm.

Atalophlebia nodularis, Etn. Plate XVII., figs. 4a-l.

Nymph ♂ (living).

Dull brown, with legs and edges of abdominal segments luteous ; dark-brown spots at the extremities and middle of the femora ; wing-covers piceous. The abdominal segments have distinct lateral flanges, the posterior angles of which are, in segments 6, 7, and 8, produced into teeth ; the fifth segment is the widest. Length of body, 10 mm. ; length of setæ, 4 mm.

Hab. Streams near Dunedin, &c. ; generally found on soft mud at the bottom.

Not nearly so common as the last species.

Subimago ♀ (in alcohol).

Wings sepia-grey ; nervures pitch-black, the colour diffused round the cross-veinlets. The bulla surrounded by a dark spot, and another midway towards the tip. The subimago stands on all its legs. The moult to the imago takes place twenty-four hours or more after emergence from the nymph.

Imago ♂ (in alcohol). Plate XIX., figs. 6a—g.

Upper lobes of the eyes red, lower pitchy black; ocelli light-grey; epistome dark-red, four yellow spots on each side, under the ocelli. Thorax pitchy black. Abdomen dark-grey, with lighter median line. Two grey spots on segments 2—6. Fore leg very long and slender, light red-brown spot at each end and at the centre of the femur, the segments marked with blackish-brown; second and third legs similarly marked. Setæ light-grey, with broad black rings at alternate segments, the rings gradually spreading towards the extremity. Wings vitreous, base fulvous; veins brownish-black in marginal and submarginal areas, with cross-veinlets greatly thickened. Marginal and submarginal areas lightly tinged toward extremities. Brownish-grey spot behind the bulla. Length of body, ♂, 10 mm.; length of setæ, 15 mm.; length of wing, 10 mm.; length of fore leg, 15 mm.

Imago ♀. Plate XVIII., figs. 5a—g.

Very similar.

ART. XXI.—*A Revision of the Crustacea Anomura of New Zealand.*

By GEO. M. THOMSON, F.L.S.

[Read before the Otago Institute, 22nd November, 1897.]

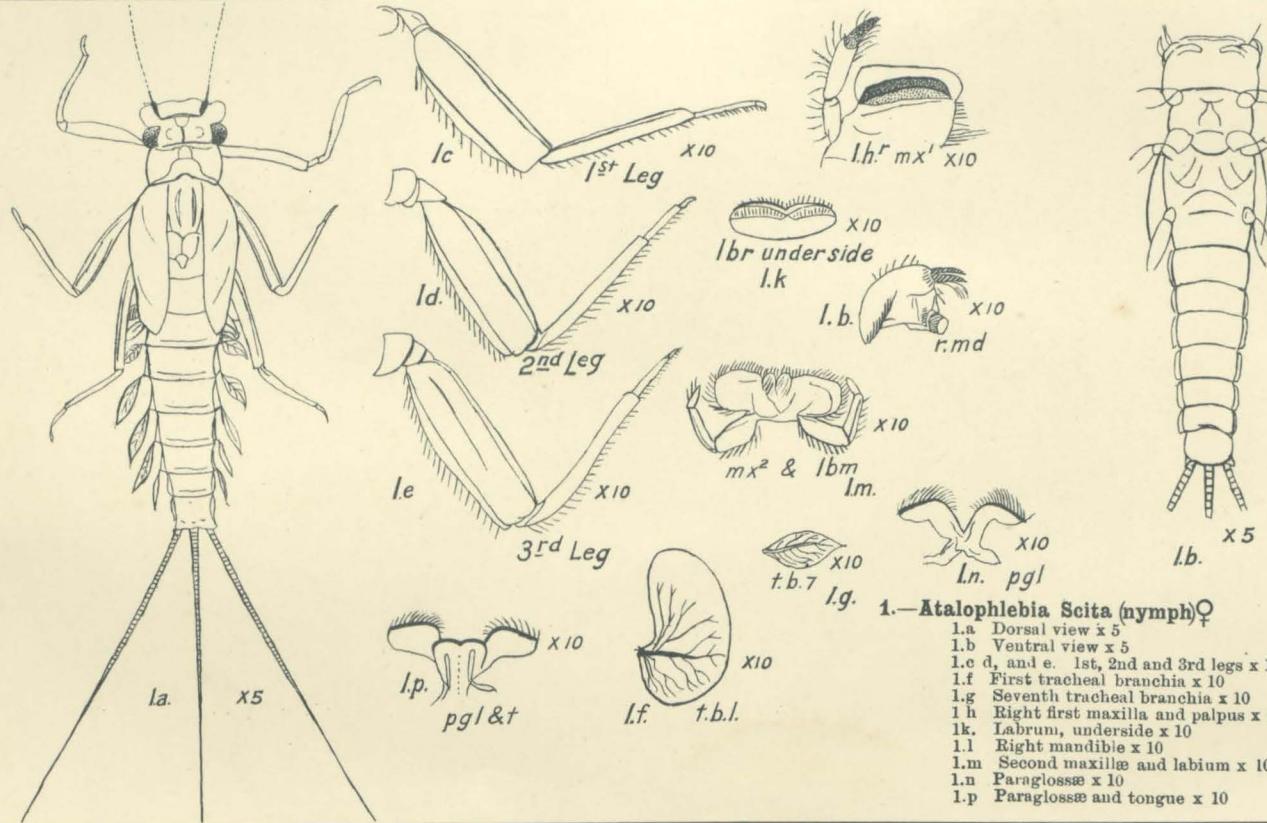
Plates XX., XXI.

In the "Catalogue of the Stalk- and Sessile-eyed Crustacea of New Zealand," published in 1876, Miers gives a list, with descriptions, of thirteen species of *Anomura*, belonging to nine genera. Of these, *Remipes marmoratus* and *Pagurus imbricatus* do not belong to New Zealand at all, having been collected by Hombron and Jacquinot at Raffles Bay, which is in Northern Australia. *Pagurus pilosus*, also of M.-Edwards, belongs to Dana's genus *Paguristes*. In regard to the remaining species, two of them—*Eupagurus cristatus*, Edw., and *E. spinulimanus*, Miers—have not again been identified, but I retain them here provisionally.

The number of species included in the present list is thirty-five, belonging to sixteen genera.

The Crustacea of this group are not well represented in the seas of New Zealand—at any rate, in the littoral zone, which is the only one which has been investigated up to the present time. In individuals, such species as *Petrolisthes elongatus*

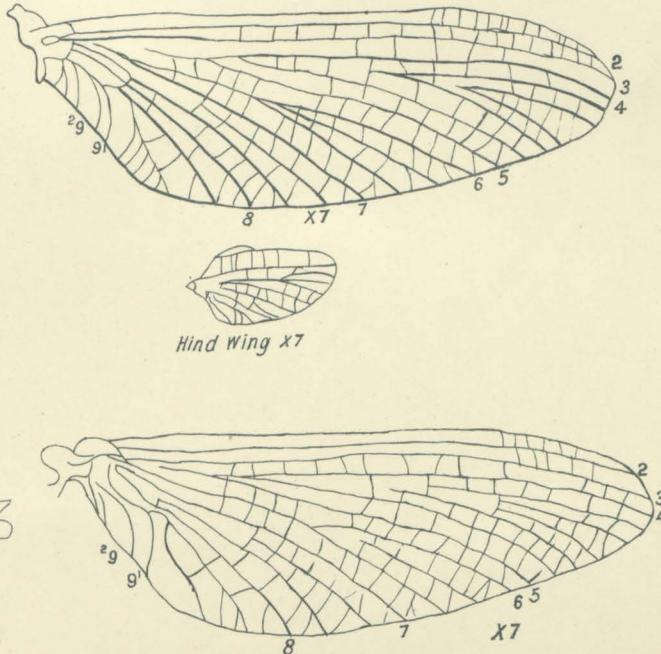
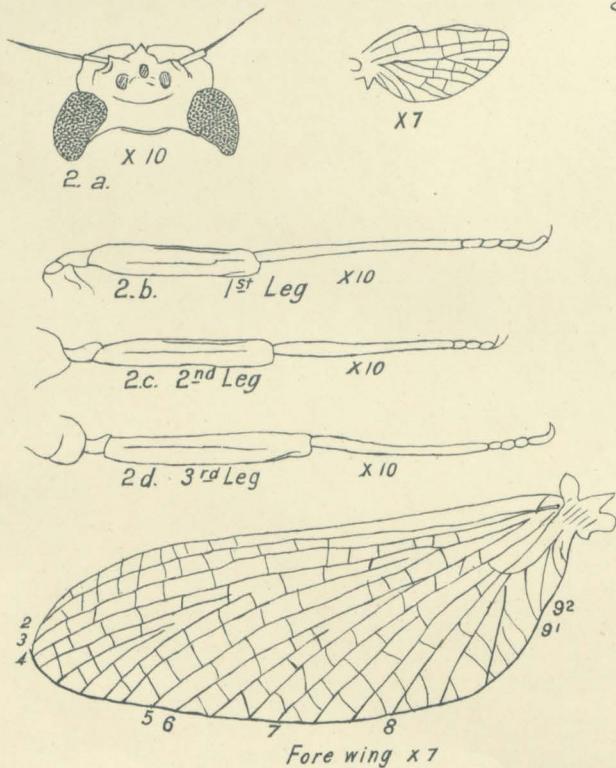
EPHEMERIDÆ.
(Lillei)



1.—*Atalophlebia Scita* (nymph)[†]

- 1.a Dorsal view $\times 5$
- 1.b Ventral view $\times 5$
- 1.c d, and e. 1st, 2nd and 3rd legs $\times 10$
- 1.f First tracheal branchia $\times 10$
- 1.g Seventh tracheal branchia $\times 10$
- 1.h Right first maxilla and palpus $\times 10$
- 1.k Labrum, underside $\times 10$
- 1.l Right mandible $\times 10$
- 1.m Second maxilla and labium $\times 10$
- 1.n Paraglossæ $\times 10$
- 1.p Paraglossæ and tongue $\times 10$

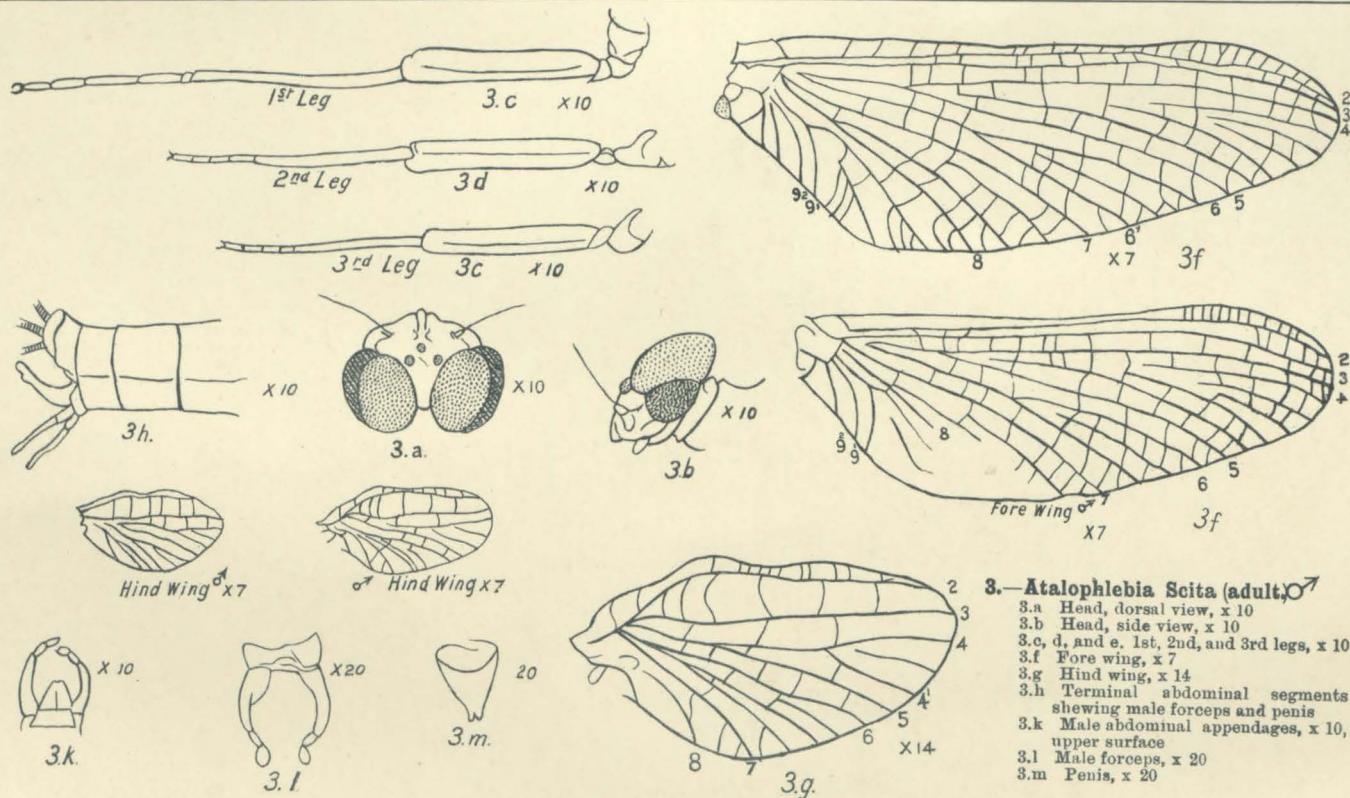
EPHEMERIDÆ.
(Liliis)



2.—*Atalophlebia scita* Subimago ♀

2.a Head dorsal view x 10.
2.b, c, d. 1st, 2nd, and 3rd legs x 10

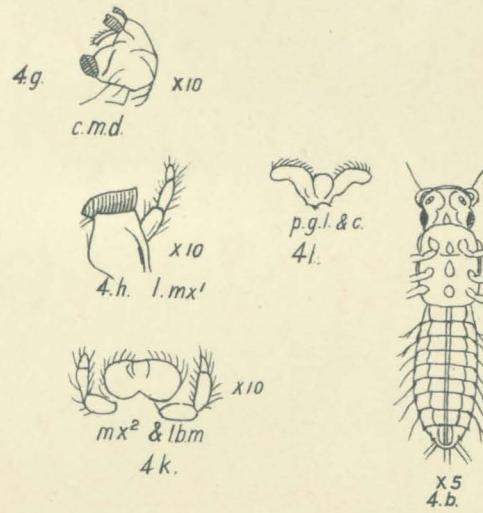
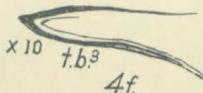
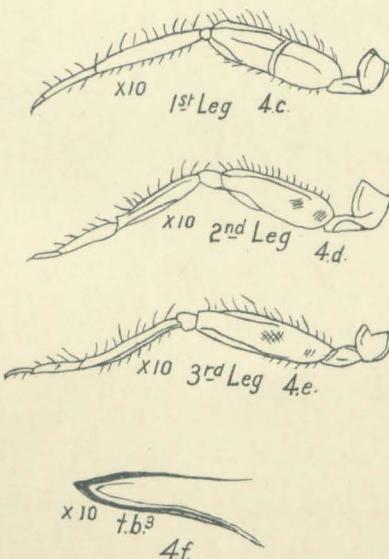
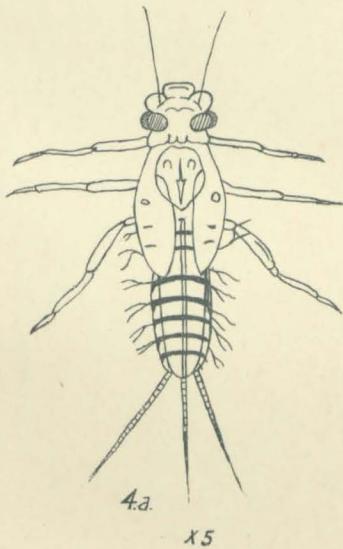
EPHEMERIDÆ.
(Lille)



3.—*Atalophlebia Scita* (adult) ♂

- 3.a Head, dorsal view, x 10
- 3.b Head, side view, x 10
- 3.c, d, and e. 1st, 2nd, and 3rd legs, x 10
- 3.f Fore wing, x 7
- 3.g Hind wing, x 14
- 3.h Terminal abdominal segments showing male forceps and penis
- 3.k Male abdominal appendages, x 10, upper surface
- 3.l Male forceps, x 20
- 3.m Penis, x 20

EPHEMERIDÆ.
(Linnæi)

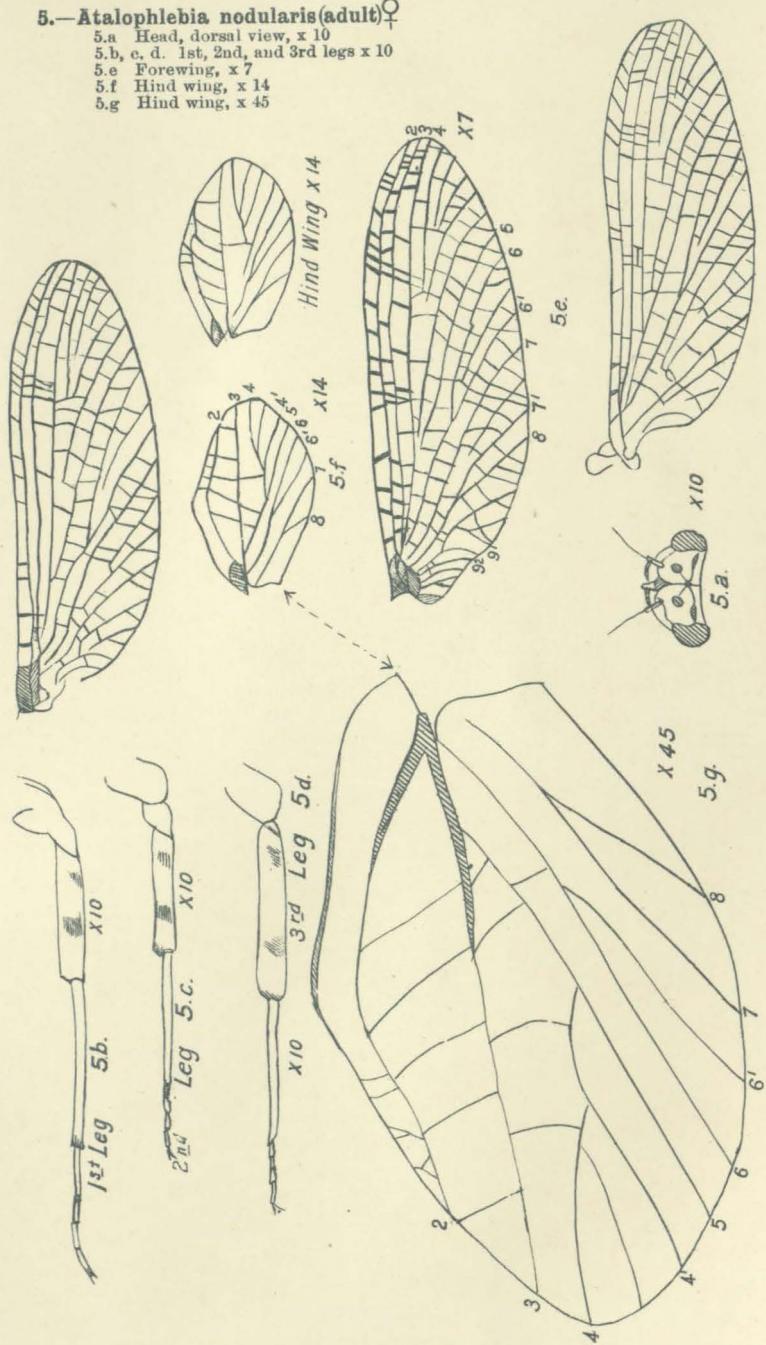


4.—*Atalophlebia nodularis* (nymph) ♂

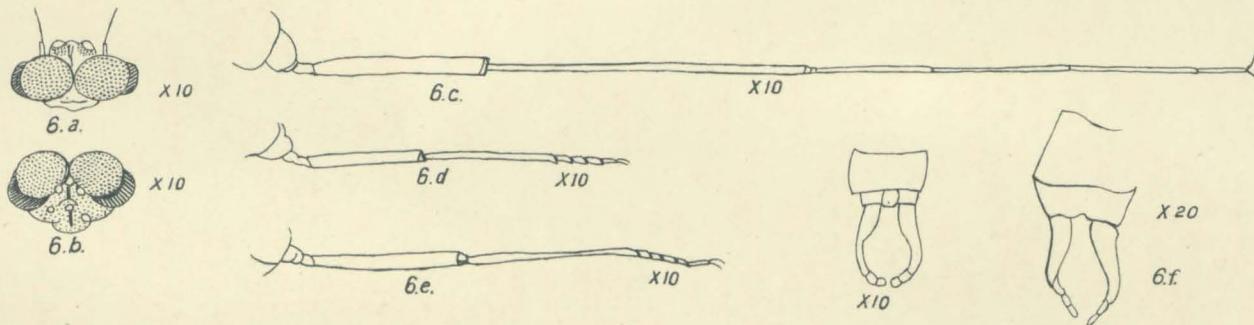
- 4.a Nymph dorsal view x 5
- 4.b Nymph ventral view x 5 (not the same individual)
- 4.c, d, e, f, g, h, i, j, k, l 1st, 2nd, and 3rd legs x 10
- 4.f Third tracheal branchia x 10
- 4.g Left mandible x 10
- 4.h Left first maxilla and palpus x 10
- 4.k Second maxilla and labium x 10
- 4.l Paraglossæ and tongue x 10

5.—*Atalophlebia nodularis* (adult) ♀

- 5.a Head, dorsal view, x 10
- 5.b, c, d. 1st, 2nd, and 3rd legs x 10
- 5.e Forewing, x 7
- 5.f Hind wing, x 14
- 5.g Hind wing, x 45



EPHEMERIDÆ.
(Lillo)



6.—*Atalophlebia nodularis* (adult) ♂

- 6.a Head dorsal view x 10
- 6.b Head front view x 10
- 6.c, d, and e. 1st, 2nd, and 3rd legs x 10
- 6.f Male forceps x 20
- 6.g Penis x 20