

## THE EPHEMEROPTERA OF EASTERN AUSTRALIA.

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With 90 Text-figures.

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### 1. INTRODUCTION.

THE Australian mayflies are a still practically undescribed fauna. In a previous paper (Harker, 1950) a few of the commoner species were described, but the region in which collections were made was limited, and it was difficult to time collections over the distances involved during the brief season in which subimagines emerged, so that the number of specimens available was small. Since the author avoided describing species when less than a series of twenty specimens had been examined, a number of new species was at that time recognised but not described. Now, owing to the generosity of Mr. D. E. Kimmins of the British Museum (Natural History), the Tillyard Collection has been made available, and these specimens, together with those previously collected, have enabled a number of new species to be distinguished.

My sincere thanks go to Mr. Kimmins for his assistance, and to Mr. B. McMillan who collected so many of the specimens in my original series.

### Methods.

*Measurements* : All measurements have been made from a series of a minimum of twenty specimens, unless otherwise stated. The measurement given

is the average of these figures, the range of the measurements appears in brackets. The body-length has been taken in the penultimate instar nymph from the anterior edge of the clypeus to the base of the caudal filaments. Unless otherwise stated, specimens examined have been collected by the author.

*Wings*: Where the cross venation varies throughout the series the text figure shows the maximum number. Text-figures have been drawn with the aid of a micro-projector, or, in the case of genitalia, with a camera lucida.

## 2. LEPTOPHLEBIIDAE.

### KEY TO GENERA.

#### *Imagines.*

- |    |                                                                                                                                                  |                                      |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| 1. | Tarsal claws of each pair similar . . . . .                                                                                                      | 2.                                   |
|    | Tarsal claws of each pair dissimilar . . . . .                                                                                                   | 4.                                   |
| 2. | In the hind wing Sc reaches wing margin at nine-tenths of wing length . . . . .                                                                  | 3.                                   |
|    | In the hind wing Sc reaches wing margin at three-quarters of wing length . . . . .                                                               | <b>Atalonella</b> Needham and Murphy |
| 3. | In the hind wing cross veins may be present in anal region. Basal segment of forceps in male narrows abruptly . . . . .                          | <b>Atalophlebia</b> Eaton            |
|    | No cross veins present in the anal region of hind wing. Basal segment of forceps narrows gradually . . . . .                                     | <b>Atalomicria</b> gen. n.           |
| 4. | Fore wing two or three times as long as broad . . . . .                                                                                          | 5.                                   |
|    | Fore wing five times as long as broad . . . . .                                                                                                  | <b>Jappa</b> gen. n.                 |
| 5. | Sc of the hind wing runs parallel to R <sub>1</sub> at wing tip. The intercalary of CuA in fore wing arises midway between CuA and CuP . . . . . | <b>Kirrara</b> gen. n.               |
|    | Sc of the hind wing turns down towards R <sub>1</sub> at wing tip. The intercalary of CuA arises from, or close to, CuA <sub>1</sub> . . . . .   | <b>Deleatidium</b> Eaton.            |

#### *Nymphs.*

- |    |                                                                                          |                                      |
|----|------------------------------------------------------------------------------------------|--------------------------------------|
| 1. | Gills lanceolate . . . . .                                                               | 2.                                   |
|    | Gills broad, undivided or divided . . . . .                                              | 4.                                   |
| 2. | Gills single . . . . .                                                                   | <b>Deleatidium</b>                   |
|    | Gills double . . . . .                                                                   | 3.                                   |
| 3. | First segment of maxillary palp very short . . . . .                                     | <b>Deleatidium (Atalophlebiodes)</b> |
|    | First segment of maxillary palp long, about equal to second and third together . . . . . | <b>Atalonella</b>                    |
| 4. | Two tusk-like projections arising from front of head . . . . .                           | <b>Jappa</b>                         |
|    | No such projections . . . . .                                                            | <b>Atalophlebia</b>                  |

### *Atalonella* Needham and Murphy, 1924.

#### KEY TO SPECIES.

- |    |                                                                                         |                              |
|----|-----------------------------------------------------------------------------------------|------------------------------|
| 1. | Two halves of penis distinctly separated forming a V shape . . . . .                    | 3.                           |
|    | Two halves of penis only slightly divided . . . . .                                     | 2.                           |
| 2. | Forceps base straight . . . . .                                                         | <b>A. parva</b> (Harker)     |
|    | Forceps base concave . . . . .                                                          | <b>A. simillima</b> (Ulmer)  |
| 3. | Penis with two small acute projections on adjacent surfaces of the two halves . . . . . | <b>A. fuscula</b> (Tillyard) |
|    | Not so . . . . .                                                                        | 4.                           |

4. Penis with three terminal rounded embossments . . . . . **A. delicatula** (Tillyard)  
 Penis with simple rounded tip . . . . . 5.  
 5. Lateral edges of penis bearing a rounded projection . . . . . **A. lucida** (Ulmer)  
 Lateral edges of penis concave . . . . . **A. brunnea** (Tillyard)

The genus *Atalonella* has been questioned by several authors (Lestage, 1931 ; Ulmer, 1938 ; Traver, 1946 ; Harker, 1950). No type-species was designated by Needham and Murphy, but the species described at the same time, *Atalonella ophis*, was probably considered as such.

Needham and Murphy distinguished *Atalonella* from *Atalophlebia* by a number of characteristics which they found separated *Atalonella ophis* from a species which they described as *Atalophlebia fulvipes*, which latter has since been transferred to *Atalophlebiodes* (Ulmer, 1938). That is, they did not compare the type species *Atalonella ophis* and *Atalophlebia australis*, and when these two are compared it is, in fact, found that the characters on which Needham and Murphy separated the two genera are not distinct in the majority of cases. However, although the distinction between the two genera is not valid for these characters, there is little doubt that *Atalonella ophis* does belong to a different genus from *Atalophlebia australis*, and can be distinguished from it by the following characters :

*Imago* : In the fore wing CuP is straight in its basal portion, and does not curve upwards acutely towards CuA, as it does in *Atalophlebia*. The veins in the basal half of the costal area are weak or absent. In the hind wing the costal border is angulated and bends down sharply to meet Sc before that vein reaches the wing tip. There is no intercalary present in the fork of MP, as is present in *Atalophlebia* ; there are no cross veins posterior to CuA.

*Nymph* : The gills are lanceolate, otherwise the nymphs are very similar to those of *Atalophlebia*.

It has been found that, once this distinction has been made between the two genera, several species previously described in *Atalophlebia* must be transferred to *Atalonella*. They are as follows :

*Atalonella parva* (Harker, 1950) **comb. nov.** It should be noted that the figure of the fore wing in this species in the original description should show CuA straight and not curved.

*Atalonella brunnea* (Tillyard, 1933) **comb. nov.**

*Atalonella fuscula* (Tillyard, 1933) **comb. nov.**

*Atalonella delicatula* (Tillyard, 1933) **comb. nov.**

Specimens of *Atalophlebia simillima* Ulmer, and *Atalophlebia lucida* Ulmer have not been seen, but from the figures accompanying their descriptions (Ulmer, 1919) they also seem to belong to *Atalonella*. *A. fusca* (Ulmer) has previously been moved to *Atalonella* by Needham and Murphy.

It is interesting to note that Tillyard (1935) remarked on the two quite distinct groups formed by the Tasmanian species he described in *Atalophlebia* ; it is one of these groups which, in this paper, is moved to *Atalonella*.

#### *Atalophlebia* Eaton, 1881.

##### KEY TO IMAGINES.

1. Rs arises in basal half of hind wing and is connected by a cross vein at its origin to  $R_1$  . . . . . 2.  
 Rs arises half-way between base and apex of hind wing, or in apical half of wing, not connected to  $R_1$  at its origin . . . . . 7.

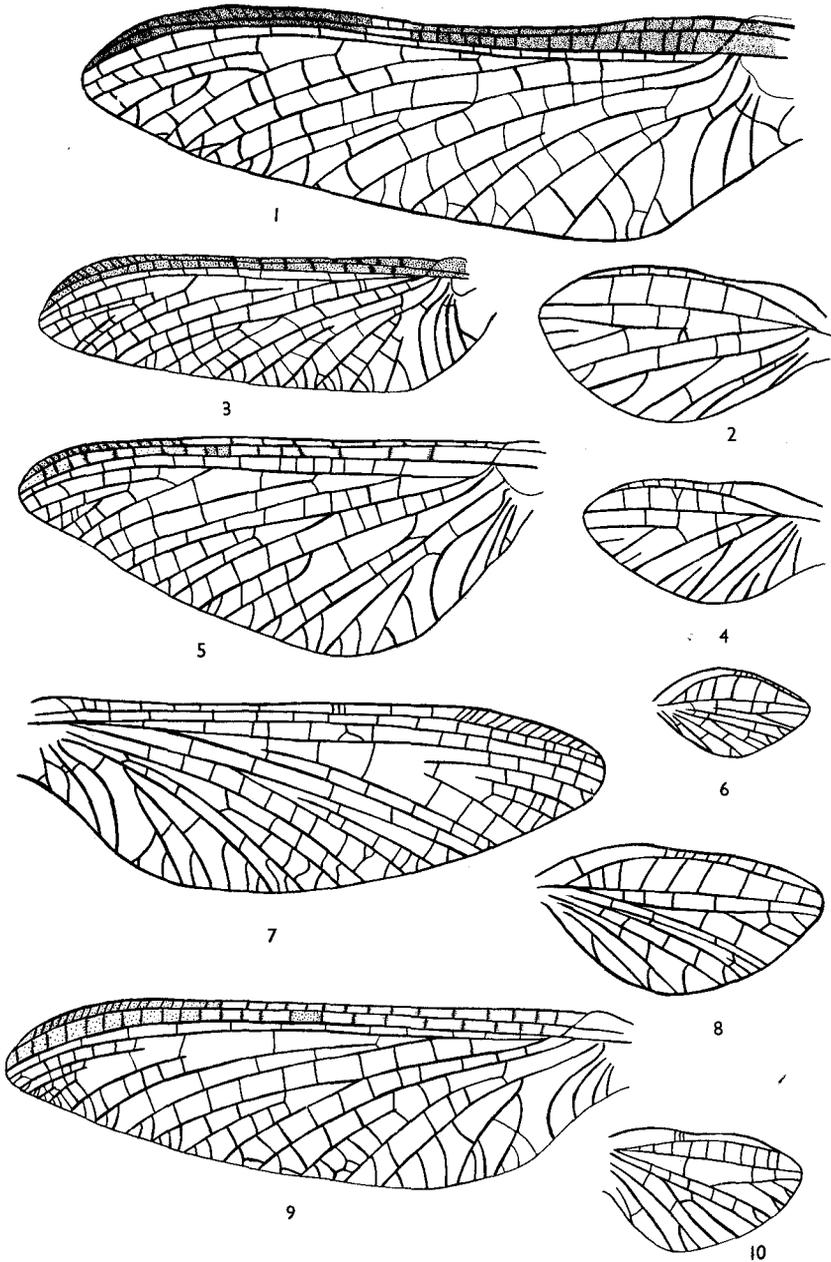
- |     |                                                                  |                                  |
|-----|------------------------------------------------------------------|----------------------------------|
| 2.  | Fore wing shaded in at least some region of C and Sc areas       | 3.                               |
|     | Fore wing not so shaded                                          | <i>A. kala</i> sp. n.            |
| 3.  | Forked cross veins present in pterostigmatic area of fore wing   | 4.                               |
|     | No such forked cross veins                                       | 5.                               |
| 4.  | Appendix dorsalis present                                        | <i>A. longicaudata</i> Harker.   |
|     | Appendix dorsalis absent                                         | <i>A. superba</i> Tillyard.      |
| 5.  | Cross veins absent in cubital and anal areas of hind wing        | <i>A. ida</i> Tillyard           |
|     | Cross veins present in cubital and anal areas of hind wing       | 6.                               |
| 6.  | No cross veins present in basal half of costal area of hind wing | <i>A. kokunia</i> sp. n.         |
|     | Cross veins present in basal half of costal area of hind wing    | <i>A. maculosa</i> Harker        |
| 7.  | Penis not reaching beyond narrowing of first segment of forceps  | 8.                               |
|     | Penis reaching beyond narrowing of first segment of forceps      | 11.                              |
| 8.  | Forceps base convex                                              | <i>A. hudsoni</i> Tillyard       |
|     | Forceps base not convex                                          | 9.                               |
| 9.  | Appendix dorsalis present                                        | 10.                              |
|     | Appendix dorsalis absent                                         | <i>A. albiterminata</i> Tillyard |
| 10. | The C and Sc areas of forewing shaded right to wing base         | <i>A. tuhla</i> sp. n.           |
|     | Fore wing not so shaded                                          | <i>A. australis</i> (Walker)     |
| 11. | Penis long and thin                                              | <i>A. pierda</i> sp. n.          |
|     | Penis about as wide as it is long                                | 12.                              |
| 12. | Penis with pointed tip                                           | <i>A. australasica</i> Pictet    |
|     | Not so                                                           | 13.                              |
| 13. | Tips of the two halves of penis directed away from each other    | 14.                              |
|     | Tips of the two halves of penis parallel                         | <i>A. incerta</i> Harker         |
| 14. | Penis with two spines at tip of each half                        | <i>A. marowana</i> Harker        |
|     | No such spines                                                   | <i>A. miunga</i> sp. n.          |

The most commonly occurring genus in Eastern Australia is *Atalophlebia*. This genus was first described by Eaton in 1881, with *A. australis* (Walk.) designated as the type-species. In his second monograph on the Ephemeroptera, Eaton placed fifteen species in this genus, six of them being from Australia. In 1916 and 1919 Ulmer described a further five species from Queensland. Tillyard described six species from Tasmania in 1935, three of which are transferred to the genus *Atalonella* in the present paper. In 1950 the author described five species from New South Wales, one of which is now moved to *Atalonella*.

The nymphs of some of these species have now been discovered, and their descriptions follow, together with those of five new species.

#### *Atalophlebia kokunia* sp. n.

*Male Imago*.—*Measurements*: Fore wing 9 mm. (7–10 mm.). Hind wing 3 mm. *General colour*: Yellowish brown with brown markings. *Wings*: Veins brown. In the fore wing (fig. 5) cross veins in costal and subcostal areas shaded with brown, and in pterostigmatal area membrane also shaded brown. Just below the bulla is one brown patch in subcostal area. Hind wing (fig. 6) with a very narrow costal area with a few cross veins. Rs arises close to wing base, and fork of MP at about half distance from base to apex. *Legs*: Yellowish with two dark bands on femur and one on tarsus. In the fore leg tarsus slightly longer than tibia, which is again longer than femur; tarsal segments in descending order of length are 2 = 3, 4, 5, 1 (fused with tibia). The hind



FIGS. 1-10.—Imaginal wings. *Atalophlebia tukla* sp. n. (1) Fore wing. (2) Hind wing. *Atalophlebia australasica* (Pict.). (3) Fore wing. (4) Hind wing. *Atalophlebia kokumia* sp. n. (5) Fore wing. (6) Hind wing. *Atalophlebia kala* sp. n. (7) Fore wing. (8) Hind wing. *Atalophlebia miunga* sp. n. (9) Fore wing. (10) Hind wing.

leg is missing in the holotype. Order of tarsal segments of middle leg is 5, 2, 3, 4, 1 (fused with tibia). Both tarsal claws of each pair alike and acute. *Genitalia*: Missing.

*Subimago*.—Cross veins irregularly shaded with brown, giving a distinctive pattern to wings (fig. 13).

*Female imago, nymph*.—Unknown.

Holotype male, QUEENSLAND: Eidswoold, 28.viii.1929. Morphotype subimago: QUEENSLAND: Eidswoold, 19.ix.1929 (*R. J. Tillyard*). In British Museum (Natural History). All types pinned and set. Only four specimens of this species have been examined.

#### *Atalophlebia miunga* sp. n. 9-13, 36

*Male imago*.—*Measurements*: Fore wing 9 mm. (8.0–10 mm.). Hind wing 2 mm. *General colour*: Light brown with darker head and thorax. *Wings*: Veins dark brown. In the fore wing (fig. 9) cross veins in basal half of subcostal area heavily shaded. Pterostigmatic area opaque and cross veins in the region are not shaded. Cross veins in costal area of pterostigmatic area forked. Costal space of hind wing (fig. 10) long and very narrow, with a number of cross veins. *Rs* arises in apical half of wing, and *MA* is forked basally to this. *Genitalia* (fig. 35): Light brown. Penis somewhat similar to that of *A. incerta*, but tips of the two halves point away from each other, whereas they are parallel in *A. incerta*. Appendix dorsalis well developed, no banding present on cerci.

*Female imago, subimago, nymph*.—Unknown.

Holotype male, NEW SOUTH WALES: Armidale, 3000 ft., xi.1948. In British Museum (Natural History). In alcohol, genitalia dissected, and mounted on a separate slide. Only five specimens of this species have been examined.

#### *Atalophlebia pierda* sp. n. 11-13, 37

*Male imago*.—*Measurements*: Fore wing 11 mm. (10.5–12 mm.). Hind wing 4 mm. *General colour*: Brown with dark brown markings. *Wings*: Veins brown. In the fore wing (fig. 11) costal and subcostal area yellowish-brown, and cross veins shaded dark brown. Pterostigmatal area slightly darker with one dark patch in subcostal area below bulla. Costal space in hind wing (fig. 12) long and narrow, with a number of cross veins. *Rs* arises in this wing at about two-thirds of distance from base to apex, and fork of *MP* is slightly basal to this. *Legs*: Reddish-brown with two dark bands on femur and one on tibia. Tarsus of fore leg longer than tibia, which is again longer than femur. Tarsal segments in descending order of length are 2, 3 = 4, 5, 1 (fused with tibia). In middle and hind legs order of tarsal segments is 5, 2 = 3, 4, 1 (fused with tibia). Tarsal claws all alike and acute. *Genitalia* (fig. 37): Forceps light brown, penis darker. Penis long and extending well beyond the narrowing of first segment of forceps. Cerci brown, with slightly darker brown bands. Appendix dorsalis well developed.

*Female imago*.—Subanal plate bears a deep semicircular incision.

*Subimago*.—Wings brown, with all cross veins very slightly shaded, the imaginal colouring showing through in costal and subcostal area of fore wing.

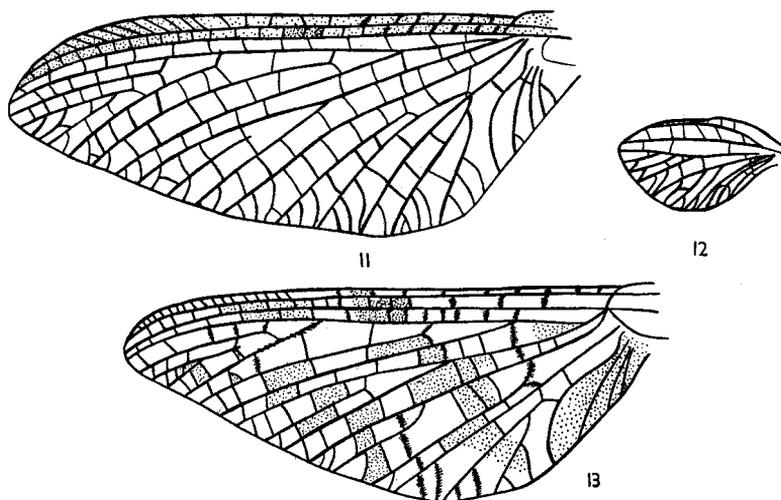
Holotype male, NEW SOUTH WALES: Hornsby, 21.ix.1917. Allotype female, N.S.W.: Hornsby, 22.ix.1917. Morphotype subimago and paratypes, N.S.W.: Hornsby, 24.ix.1917 (*R. J. Tillyard*). In British Museum (Natural History). All types pinned and set. Specimens examined from N.S.W.: Epping, xii.1948.

This species superficially resembles the New Zealand species, *A. dentata* (Eat.), but differs from it in the form of the genitalia.

*Atalophlebia tuhla* sp. n. 1-2, 30

*Male imago*.—*Measurements*: Fore wing 12 mm. (10–14 mm.). Hind wing 3 mm. *General colour*: Yellow brown with dark brown markings. *Wings*: Veins dark brown. In fore wing (fig. 1) costal and subcostal area uniformly dark brown except for one clear patch near the bulla. Base of wing clouded with brown. Length from base to tornus short. Hind wing (fig. 2) about two-thirds as wide as long. Costal space long and very narrow, and a number of cross veins present. MP forked at slightly less than half distance from base to apex. *Legs*: Yellow brown, with two black bands on femur. Tibia longer than femur in fore legs, and tarsus longer again. Tarsal segments in descending order of length are 2, 3, 4, 5, 1 (fused with tibia). Tarsal claws all acute. *Genitalia*: (fig. 34) Forceps very long, and first segment broad for about two-thirds of its length. Penis large, but does not protrude as far as the narrowing of first segment of forceps. Appendix dorsalis well developed.

*Female, subimago, nymph*.—Unknown.



Figs. 11–13.—*Atalophlebia pierda* sp. n. (11) Fore wing. (12) Hind wing. (13) Fore wing of subimago of *Atalophlebia kokunia* sp. n.

Holotype male, NEW SOUTH WALES: Kiandra, 15.i.1930 (*R. J. Tillyard*). In British Museum (Natural History). Pinned and set. Genitalia dissected off, and mounted on a separate slide. Paratypes. N.S.W.: Armidale, Commissioners Waters, 3000 ft., iv.1948.

*Atalophlebia kala* sp. n. 7-8, 36

*Male imago*.—*Measurements*: Fore wing 12 mm. (11–13). Hind wing 3 mm. *General colour*: Light brown. *Wings*: Veins light brown. In fore wing (fig. 7) costal and subcostal areas unshaded. Cross veins in pterostigmatic area slanting and slightly forked. Costal space in hind wing (fig. 8) long and narrow with a number of cross veins. Rs arises at about one-third of distance from base to apex, and fork of MP is considerably basal to this. *Legs*: Darker than body, with a faint indication of two darker bands on femur. Tarsus of fore legs missing on specimens examined, tibia nearly twice as long as femur. In

hind legs tibia longer than femur, tarsus being very short. Tarsal segments in descending order of length are 5, 4 = 3 = 2, 1 (fused with tibia). Tarsal claws all acute. *Genitalia* (fig. 36): Forceps light brown, penis darker. Penis short, not reaching the narrowing of first segment of forceps. Cerci brown with slightly darker annulations. Appendix dorsalis well developed.

*Female imago*.—Subanal plate bears a deep V-shaped incision.

*Subimago*.—All cross veins very slightly shaded with brown, giving the wing a slightly darker appearance than that of imago.

Holotype male, NEW SOUTH WALES: Mt. Kosciusko, Lake Albina, 2.ii.1929 (*R. J. Tillyard*). Allotype female, morphotype subimago and paratypes, N.S.W.: Mt. Kosciusko, Lake Cootapatamba 6600 ft., 27.i.1930 (*R. J. Tillyard*). In British Museum (Natural History). All types pinned and set. *Genitalia* dissected and mounted on separate slide.

7-4, 33

*Atalophlebia australasica* (Pictet).

*A. australasica* has been placed previously in synonymy with *A. costalis* (Burmeister) by Ulmer (1919). In the British Museum there are specimens of *A. australasica* determined by Eaton which fit the original description given by Pictet, and which are very similar to the coloured plate given in his paper. Specimens of *A. costalis* determined by Tillyard, and also fitting the original description of Burmeister and Eaton's later brief description, show that these two are quite distinct species.

Mr. D. E. Kimmins has drawn my attention to the preoccupation of *A. costalis*, originally described in *Baetis*, by *Baetis costalis* Curtis, 1834 (now a synonym of *Heptagenia sulphurea*). In the British Museum there are specimens of *A. albiterminata* Tillyard, the type of which is missing, determined by Tillyard, and these are indistinguishable from those also determined by him as *A. costalis*. In the original description Tillyard refers to the close similarity of the two species, but does not differentiate between them, and since his two series are so very similar *A. albiterminata* is now thought to be in synonymy with *A. costalis*. As *A. costalis* is preoccupied, it should take the name of its first synonym and be known as *A. albiterminata*.

As no very full description of *A. australasica* is known to exist, the following features are thought to be worth recording.

*Male imago*.—*Measurements*: Fore wing 10 mm. (9–11 mm.). Hind wing 2 mm. *General colour*: Brown with light brown markings. *Wings*: Veins dark brown. In the fore wing (fig. 3) whole of costal and subcostal area dark yellow, and all cross veins in this area shaded with dark brown. Pterostigmatal region slightly darker than the more basal part. Base of wing slightly shaded with yellow. Wing narrow and long. Hind wing (fig. 4) half as wide as long. Costal space reaches nearly to apex of wing, and cross veins are present only in apical half. Rs arises about half-way along the wing, and MP is forked just basally to this. *Legs*: Femur light brown with two dark brown bands, tibia with one dark band. Fore legs are missing in holotype and paratypes. Tarsal segments of middle and hind legs in descending order of length are 5, 2, 3 = 4, 1 (fused with tibia). Tarsal claws all sharp. *Genitalia* (fig. 33): Light brown. Penis large and protrudes beyond the narrowing of first segment of forceps. Appendix dorsalis well developed.

*Female imago*.—Resembles male. Subanal plate bears a deep semicircular incision.

*Subimago*.—Wings grey with well-marked brown cross veins, which give a slightly mottled appearance. Imaginal colouring of C. and Sc areas shows beneath the grey colour.

*Nymph.*—*Measurements* : Body-length 11 mm. (10–12 mm.). *General colour* : Yellowish brown to dark brown. *Mouthparts* (fig. 27–31) : Labrum bears five denticular plates which are larger than those of other known Australian *Atalophlebia*. Mandibular teeth more pointed than those of other specimens of this genus. *Gills* (fig. 26) : Feathery in appearance, forming a thick mat on either side of abdomen, making nymph appear much broader than it really is. *Legs* : Two transverse dark bands present on femur and tibia. Tarsus generally darker than rest of leg.

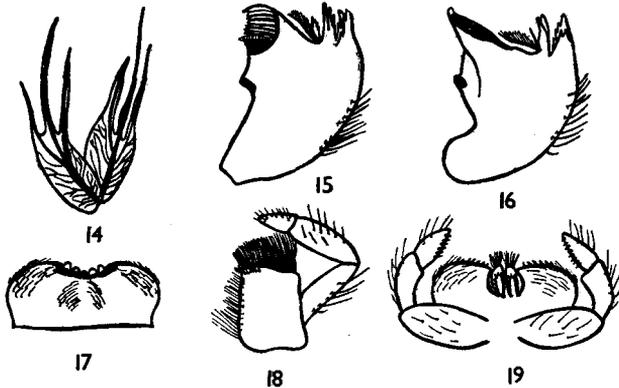
*Specimens examined, nymphs and imagines, NEW SOUTH WALES* : Newcastle, Kahibah, 100 ft., xii. 1948, from rock pools (B. McMillan). N.S.W. : Barrington Brush, 1350 ft., 8. viii. 1948, from stagnant pools (B. McMillan). N.S.W. : Coorombong, 50 ft., 9. xii. 1948 (B. McMillan). N.S.W. : Narrabeen, ix. 1948 (B. McMillan).

*Imagines.* N.S.W. : Hampton, i. 1948 (R. J. Tillyard). N.S.W. : Bolaro, 10. xi. 1936 (R. J. Tillyard). SOUTH AUSTRALIA : Mt. Gambier, 9. xi. 1934 (R. J. Tillyard). N.S.W. : Epping (R. J. Tillyard) and x. 1948 (J. Harker).

*Atalophlebia maculosa* Harker. 14-19

The nymphs and subimagines of this species were previously unknown.

*Nymph.*—*Measurements* : Body length 8.0 mm. (7.0–8.5 mm.) *General colour* : Black with some yellow. *Mouthparts* : See figs. 15–19. *Legs* : Two black bands on both femur and tibia, most of tarsus black. Tarsal claws yellow. *Gills* (fig. 14) : Trifurcate. Cerci banded with black.



FIGS. 14–19.—Nymph of *Atalophlebia maculosa* Hark. (14) Gill. (15) Left mandible. (16) Right mandible. (17) Labrum. (18) Maxilla. (19) Labium.

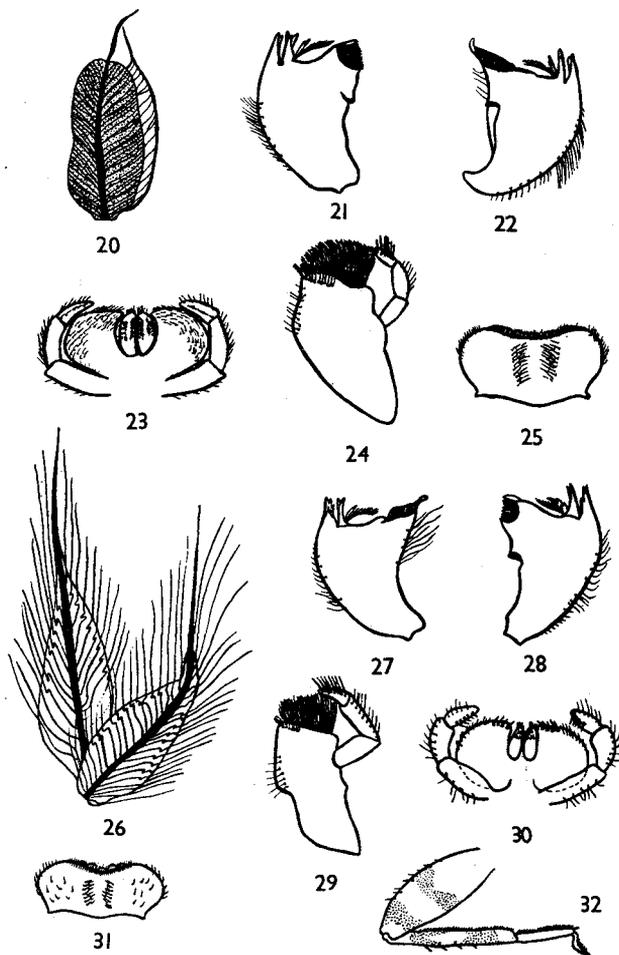
*Subimago.*—*Measurements* : Body-length 9 mm. (8.5–10 mm.). *Wings* : Dark brown. All cross veins heavily shaded so that wing appears dark brown, but the very small lighter areas between the cross veins give a speckled appearance on closer examination. Imaginal colouring appears beneath subimagonal cuticle.

*Atalophlebia longicaudata* Harker. 20-25

The nymph of this species was previously unknown.

*Nymph.*—*Measurements* : Body-length 10 mm. (9.5–11 mm.). *General colour* : Dark brown to black. *Mouthparts* : See figs. 21–25. *Legs* : Femur very broad, being about

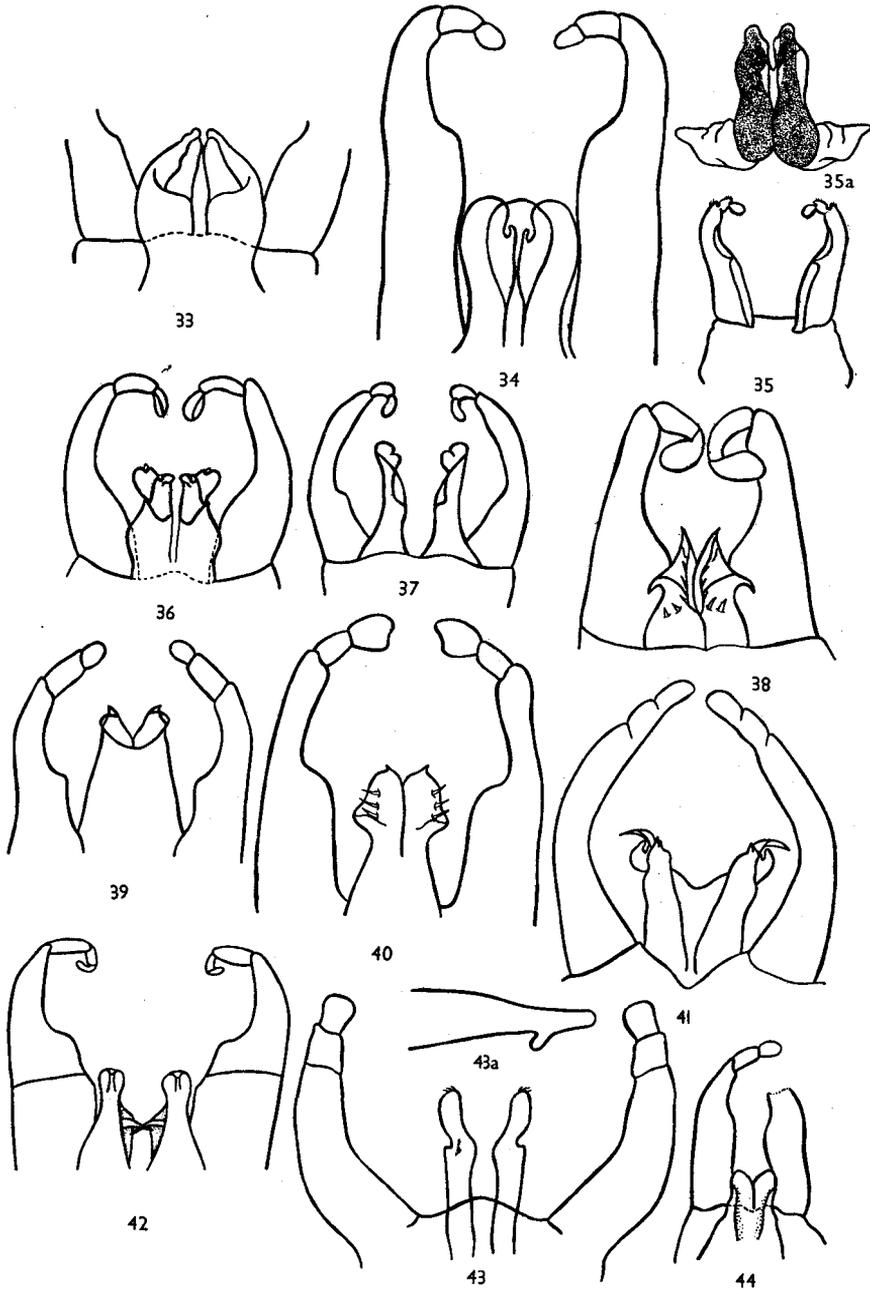
five times as broad as tibia and tarsus. Legs yellowish in colour with a broad black mark at distal end of femur, proximal end of tibia and central region of tarsus. In some specimens all these black markings are doubled. Tarsal claw with a black tip. Gills (fig. 20): Outer lamella broad, black with a long hair-like tip, inner lamella pale and transparent, and adheres closely to outer lamella.



FIGS. 20-32.—Nymph of *Atalophlebia longicaudata* Hark. (20) Gill. (21) Left mandible. (22) Right mandible. (23) Labium. (24) Maxilla. (25) Labrum. Nymph of *Atalophlebia australasica* (Pict.). (26) Gill. (27) Right mandible. (28) Left mandible. (29) Maxilla. (30) Labium. (31) Labrum. (32) Leg.

*Specimens examined*, NEW SOUTH WALES: Barrington, Tops R., 4700 ft., 27.iii.1948 (B. McMillan). N.S.W.: Armidale, Commissioners Waters, 3000 ft., 1.xii.1948.

The species of *Atalophlebia* found in Eastern Australia form a closely related group. When the nymphs are considered, however, one species, *A. longicaudata*, may appear to have less affinity with the genus than the others, due to the



FIGS. 33-44.—Male genitalia. (33) *Atalophlebia australasica* (Pict.). (34) *Atalophlebia tuhla* sp. n. (35) Forceps of *Atalophlebia miunga* sp. n. (35a) Penis of *Atalophlebia miunga* sp. n. (36) *Atalophlebia kala* sp. n. (37) *Atalophlebia pierda* sp. n. (38) *Deleatidium decipiens* sp. n. (39) *Deleatidium bundutum* sp. n. (40) *Deleatidium pusillum* sp. n. (41) *Atalomicria uncinata* (Ulm). (42) *Kirrara amenia* sp. n. (43) *Kirrara procera* sp. n. (43a) *Kirrara procera*. Lateral view of penis. (44) *Deleatidium nanatum* sp. n.

presence of a gill which is not furcated. Repeated observation has shown that the multifurcate gills of the rest of the genus have no fixed number of furca; those with large numbers vary greatly, those with three are more stable but are at times observed to have more than three. Since the furca themselves are merely divisions of a gill enclosing a tracheal branch, and the flat part of the lamella contains similar branches but does not divide around them, it is possible that more furca can be formed by the splitting back of the gill tissue. The plate-like gill of *A. longicaudata* is similar in appearance to the lamella of the multifurcate gills and can be seen to have similar branching trachea. Already the central trachea has been produced beyond the gill plate. It would seem that a series of gills appears in this genus with either the gradual production of many furca from the flat gill of *A. longicaudata*, through the trifurcate gill of *A. maculosa* to the much divided gill of *A. australasica*, or that the gills are gradually losing their division and becoming more plate-like. The former series is the more likely when compared with the general trends within the Ephemeroptera and also increases the respiratory surface, as the increasing division of the gill prevents to some extent the settling of silt on the surface, an important factor in streams which become very low in summer.

There is a close correlation between the increased division of the gills and the habitat, as can be seen from the following table:

<i>Nymph.</i>	<i>Gill.</i>	<i>Habitat.</i>
<i>A. longicaudata</i> . . .	Broad, single plate . . .	Wide streams, medium or fast flow.
<i>A. maculosa</i> . . .	Trifurcate . . .	Swifter parts of streams.
<i>A. incerta</i> . . .	„ . . .	Swifter parts of streams.
<i>A. australis</i> . . .	Multifurcate . . .	Under rocks or debris.
<i>A. costalis</i> . . .	„ . . .	Under rocks
<i>A. australasica</i> . . .	Feathery, much divided . . .	Stagnant pools.

#### ***Atalomicria* gen. n.**

*Male imago.*—*Wings*: Fore wing long and narrow like that of *Atalonella*, but cross veins are present and well developed in basal half of costal area. CuP of fore wing strongly curved. Hind wing has a distinct costal hump, but costal space is long and narrow. MP forked, and an intercalary present. MA arises at about half to two-thirds of distance from base to apex, and Rs arises at, or near, the same place. *Legs*: Tarsal claws of each pair similar and sharp. Tarsi appear to be four-segmented owing to fusion of first segment with tibia. *Genitalia*: Penis of male has an appendage near each orifice. Forceps three segmented with a long basal segment and two short distal segments. Basal segment narrows gradually, if at all, and not abruptly as in *Atalophlebia*.

*Nymph.*—Unknown.

*Type species.*—*Atalomicria uncinata* (Ulmer) 41

To this genus the following species is now referred.

#### *Atalomicria sexfasciata* (Ulmer) **comb. nov.**

This genus is close to both *Atalonella* and *Atalophlebia*, bearing a few characters of each, but the genitalia are quite distinctive.

It should be noted that in Ulmer's, 1917, figure of the hind wing of *A. uncinata* and *A. sexfasciata* there is no intercalary shown in the fork of MP. Of the

forty-three specimens examined by the author all had an intercalary in this fork.

A new text-figure (fig. 41) of the genitalia of *A. uncinata* is given. The penis of this species is curved slightly in the dorso-ventral plane, so that when the genitalia are mounted on a slide the cover slip presses the two halves of the penis on their sides. Ulmer's figure (1917) shows one angle only, and therefore this new figure is included, showing the further elaboration of the penis on the other side.

Ulmer's figure of the fore wing shows shading only in the pterostigmatal area, but in some of the specimens examined the whole of the costal and subcostal areas is yellow, and the pterostigmatal area is reddish.

#### Genus *Deleatidium* Eaton, 1899.

The nymphs of only three species have been determined, and all three have double gills. Phillips (1930), finding the same problem in New Zealand nymphs, placed species with double gills in the subgenus *Atalophlebiodes*. Ulmer (1938) and Traver (1946) both consider the subgenus to be worthy of generic rank; they distinguish certain features of venation which separate the imagines of two Brazilian species, *A. haruupi* and *A. sao-paulense*, from *Deleatidium*. These venational characters do not appear to be present in the Australian members of *Atalophlebiodes*, and marked differences are apparent in the hind wing of the Australian and Brazilian representatives. It is possible that the Brazilian species do not belong to this group at all. Since the imagines of the Australian *Atalophlebiodes* cannot be distinguished from those of *Deleatidium*, it is proposed that the latter should still be regarded as a subgenus.

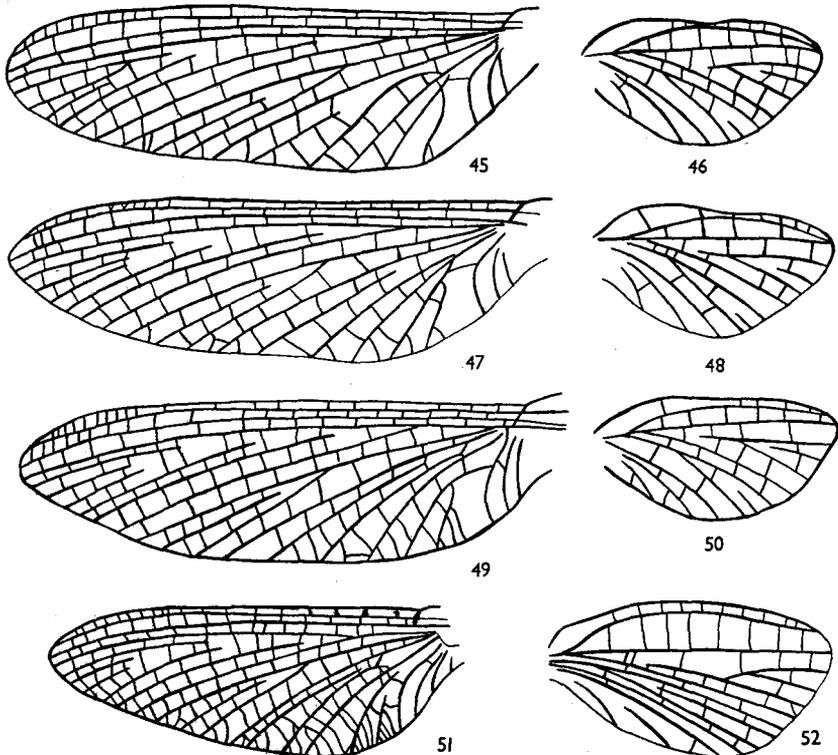
#### KEY TO IMAGINES.

- |                                                                                            |                               |
|--------------------------------------------------------------------------------------------|-------------------------------|
| 1. Penis not reaching as far as narrowing of first segment of forceps . . . . .            | 2.                            |
| Penis reaching up to, or beyond, narrowing of first segment of forceps . . . . .           | 4.                            |
| 2. Penis boot-shaped . . . . .                                                             | <i>D. mjobergi</i> (Ulm.)     |
| Not so . . . . .                                                                           | 3.                            |
| 3. Penis deeply divided. Forceps base with a central convex projection . . . . .           | <i>D. strigata</i> (Eat.)     |
| Penis only slightly divided. Forceps base slightly concave in the central region . . . . . | <i>D. nanatum</i> sp. n.      |
| 4. Penis only slightly divided . . . . .                                                   | 5.                            |
| Penis divided almost to base . . . . .                                                     | 6.                            |
| 5. Distal end of penis with two outwardly curved tips . . . . .                            | <i>D. bundutum</i> sp. n.     |
| Not so . . . . .                                                                           | <i>D. crassa</i> (Harker)     |
| 6. Penis rounded at tip . . . . .                                                          | <i>D. unguicularis</i> (Ulm.) |
| Penis not rounded at tip . . . . .                                                         | 7.                            |
| 7. Penis flattened at tip . . . . .                                                        | <i>D. annulatum</i> (Harker)  |
| Penis acute at tip . . . . .                                                               | 8.                            |
| 8. Lateral edges of penis curved to form a hook-like projection . . . . .                  | <i>D. decipiens</i> sp. n.    |
| Lateral edges of penis rounded . . . . .                                                   | <i>D. pusillum</i> sp. n.     |

#### *Deleatidium pusillum* sp. n. 51-52

*Male imago*.—*Measurements*: Fore wing 8 mm. Hind wing 2 mm. *General colour*: Yellow brown with light brown markings. *Wings*: Veins yellow. In the fore wing (fig.

51) cross veins in basal region of costal and subcostal area darker than elsewhere. In the hind wing (fig. 52) costal area relatively wide with a number of cross veins. Rs arises close to wing base and fork of MP is basal even to this. *Legs*: Brown without any distinct marking. In the fore leg tibia and tarsus about equal in length, being slightly longer than femur. Tarsal segments in descending order of length are 2, 3, 4, 5, 1 (fused with tibia). In middle and hind legs order of tarsal segments is 5, 4, 3, 2 = 1 (fused with tibia). Of each



FIGS. 45-52.—Imaginal wings. *Deleatidium nanatum* sp. n. (45) Fore wing. (46) Hind wing. *Deleatidium decipiens* sp. n. (47) Fore wing. (48) Hind wing. *Deleatidium bundutum* sp. n. (49) Fore wing. (50) Hind wing. *Deleatidium pusillum* sp. n. (51) Fore wing. (52) Hind wing.

pair of tarsal claws one is blunt and the other acute. *Genitalia* (fig. 40): Forceps light brown except for second segment, which is dark brown. Penis long, reaching beyond the narrowing of first segment of forceps. Cerci light brown with narrow dark bands on each segment.

*Female imago*.—Subanal plate V-shaped without an incision.

*Subimago*.—Wings grey to brown without any shading; cross veins dark brown.

Holotype male, allotype female, morphotype subimago, NEW SOUTH WALES: Bolaro, 10.ii.1936 (*R. J. Tillyard*). All types in British Museum (Natural History), pinned and set.

*Deleatidium decipiens* sp. n. 38, 47-48

*Male imago*.—*Measurements*: Fore wing 10 mm. Hind wing 3 mm. *General colour*: Light brown with dark brown markings. *Wings*: Veins yellow. In the fore wing (fig. 47) pterostigma slightly opaque. Cross veins in costal area, and in basal portion of wing, slightly darker than elsewhere. In the hind wing (fig. 48) costal area long with a deep concavity at about half its length from base to apex. Rs arises close to wing base, and fork of MP very close to wing base. *Legs*: Brown without any distinctive markings. In the fore legs tarsal segments in descending order of length are 2 = 3, 4, 5, 1 (fused with tibia). In the middle and hind legs order of tarsal segments is 5, 2 = 3, 4, 5, 1 (fused with tibia). Of each pair of tarsal claws one is sharp and the other blunt. *Genitalia* (fig. 38): Forceps yellow except for second segment, which is brown. Penis large, reaching past the narrowing of first segment of forceps. Cerci light brown; appendix dorsalis well developed.

*Female imago*.—Subanal plate large and oval with no incision.

*Subimago*.—Wings of a uniform grey colour without shading, but the well-marked cross veins give a slightly mottled appearance.

Holotype male, morphotype subimago, NEW SOUTH WALES: Upper Murrumbidgee, Adaminaby, 11.xii.1936 (*R. J. Tillyard*). Allotype female and paratypes, N.S.W.: Mount Kosciusko, Spencers Creek, 6000 ft., 2.i.1933 (*R. J. Tillyard*).

All types in British Museum (Natural History), pinned and set.

*Deleatidium nanatum* sp. n. 44-46

*Male imago*.—*Measurements*: Fore wing 8 mm. Hind wing 2 mm. *General colour*: Yellowish with brown markings. *Wings*: Veins yellow. In the fore wing (fig. 45) cross veins towards base of wing darker than those in any other part except the pterostigmatal area. Brace vein dark brown where it crosses Sc. Hind wing (fig. 46) has a long narrow costal region with few cross veins. Fork of MP arises close to base of wing, origin of Rs being apical to this fork. *Legs*: Brown without any distinctive markings. Tibia of fore legs distinctly longer than femur and tarsus. Tarsal segments in descending order of length in the fore leg are 2 = 3, 4, 5, 1. In the middle and hind legs order of tarsal segments is 5, 4 = 3 = 2, 1 (fused with tibia). One tarsal claw of each pair sharp, the other blunt. *Genitalia* (fig. 44): Forceps yellowish and large. Penis dark in colour and short, not reaching more than half-way up the broad part of first segment of forceps. Appendix dorsalis well developed and each of its segments, and those of the cerci, distinctively banded with dark brown.

*Subimago*.—Wings brown, with each cross vein shaded with darker brown, giving wing a slightly banded appearance.

*Female, imago, nymph*.—Unknown.

Holotype male, morphotype subimago, NEW SOUTH WALES: Upper Murrumbidgee, Adaminaby, 11.xii.1926 (*R. J. Tillyard*).

*Deleatidium (Atalophlebiodes) annulatum* Harker.

To the forms previously described the description of the nymph can now be added:

*Nymph*.—*Measurements*: Body-length 12 mm. (11–13.5 mm.). *General colour*: Dark brown. *Mouthparts*: Maxilla with three-segmented palp, distal segment of which is about the same size as middle segment; in this respect the nymph differs from the New Zealand species with their very small distal segments. Mandible with a broad molar region and very narrow incisors. *Gills*: Lanceolate, double.

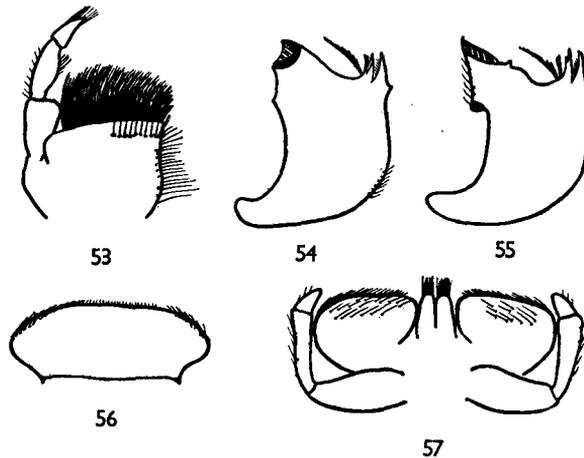
*Specimens examined*, NEW SOUTH WALES : Barrington R., 4600 ft., 27.iii. 1948 (*B. McMillan*). N.S.W. : Glen Innes, Beardy River, 3520 ft., iii. 1948.

*Deleatidium (Atalophlebiodes) crassa* (Harker) **comb. nov.**

Re-examination of this species shows that it belongs to *Deleatidium* and not *Leptophlebia*, the genus in which it was originally placed.

*Deleatidium (Atalophlebiodes) bundutum* sp. n. 204000 53-57

*Male imago*.—*Measurements* : Fore wing 10 mm. Hind wing 3 mm. *General colour* : Yellow with brown markings. *Wings* (figs. 49, 50) : Veins light brown without any shading of cross veins. Costal area of hind wing long and narrow. Rs arises about about half-way



FIGS. 53-57.—Nymphal mouthparts of *Deleatidium bundutum* sp. n. (53) Maxilla. (54) Left mandible. (55) Right mandible. (56) Labrum. (57) Labium.

between wing base and apex, and fork of MP slightly basal to this. *Legs* : Yellowish with two dark brown bands on femur. In fore legs tarsus slightly longer than tibia, which is longer than femur ; tarsal segments in descending order of length are 2 = 3 = 4, 5, 1 (fused with tibia). Order of the tarsal segments in mid and hind legs is 5, 2, 3 = 4, 1 (fused with tibia). Of each pair of tarsal claws one is sharp and the other obtuse. *Genitalia* (fig. 39) : Penis only partly bisected, and reaches beyond the narrowing of first segment of forceps. Cerci light brown.

*Subimago*.—Wings yellow-brown, very similar to imago.

*Nymph*.—*Measurements* : Body-length 14 mm. *General colour* : Yellow with dark brown markings. *Mouthparts* (figs. 53-57) : Free edge of labrum straight and not denticulate. Mandibular teeth very small and narrow relative to size of whole mandible. *Gills* : Lanceolate and double. *Legs* : Yellowish with darker regions on ventral half of femur. A very distinctive cream patch at apical end of femur.

Holotype male, morphotype subimago, NEW SOUTH WALES : Armidale, Dumaresque Cr., 3000 ft., 6.vii.1948. Morphotype nymph, N.S.W. : Barrington, Williams R., 1150 ft. 8.viii.1948 (*B. McMillan*).

The nymphs of *Deleatidium (Atalophlebiodes)* all live in the swifter parts of streams, and it is interesting to note in this connection the lanceolate gill and

rounded form of body. Attention has been drawn (p. 252) to the correlation between gill shape in *Atalophlebia* and the rate of water flow. Nymphs of *Deleatidium* exhibit the undivided gill in its simplest form.

### Jappa gen. n.

*Male imago*.—*Wings*: Fore wing has numerous cross veins, particularly in subcostal space, where they are upright and parallel, like those in the closely related genus *Deleatidium*.  $MP_2$  strongly bowed to rearward at its junction with  $MP_1$ . Proportions of fore wing markedly different from those of *Deleatidium*, the wing being about five times as long as wide, as compared to twice to three times as long as wide in *Deleatidium*. Hind wing has a long narrow costal region with numerous cross veins,  $MP$  forked, and intercalary may be absent or very small. *Thorax*: Pronotum much longer than that of any other Australian member of the Leptophlebiidae. *Genitalia*: Penis much longer than that of *Deleatidium* and deeply bilobed, the two halves appearing to be completely separated in most specimens. Forceps are three segmented, with the basal segment very long, and the other two very short.

*Nymph*.—A burrowing type. Head large with lateral eyes, and with two tusk-like projections on either side of labrum. Labrum has a convex projection in middle of free border, not a concavity as in related genera. Maxillary palp two-segmented, with distal segment large and almost rectangular in outline.

Type species:—*Jappa kutera* sp. n.

### *Jappa kutera* sp. n. 64-65, 67-68

*Male imago*.—*Measurements*: Fore wing 12 mm. (11.5–12.5 mm.). Hind wing 2.5 mm. *General colour*: Red brown with dark red or black markings. *Wings*: Veins dark brown to red brown. In the fore wing (fig. 64) cross veins in costal and subcostal areas shaded with brown, and whole of this area is an opaque golden brown.  $MP_2$  is noticeably bowed, slanting towards  $CuA$ , to which it is joined by a cross vein. In the hind wing (fig. 65) costal area is long and narrow with cross veins along its length.  $Rs$  arises at about half length of wing, and fork of  $MP$  is slightly basal to this. A small intercalary present in fork of  $MP$ . *Legs*: Cream, or golden brown, without any markings. Tarsus of fore legs slightly longer than tibia, which is longer than femur. Tarsal segments in descending order of length are 3, 2 = 4, 5, 1 (fused with tibia). In the middle and hind legs order of tarsal segments is 5, 2 = 3 = 4, 1 (fused with tibia). Of each pair of tarsal claws one is blunt and the other sharp. *Genitalia* (figs. 67–68): Forceps and penis light brown. Penis very long, but not reaching beyond the narrowing of first segment of forceps. First segment of forceps narrows suddenly giving a right-angle edge. Cerci ringed with red brown. Appendix dorsalis well developed.

*Female, imago and nymph*.—These have been described in the appendix to a previous paper (Harker, 1950, p. 31).

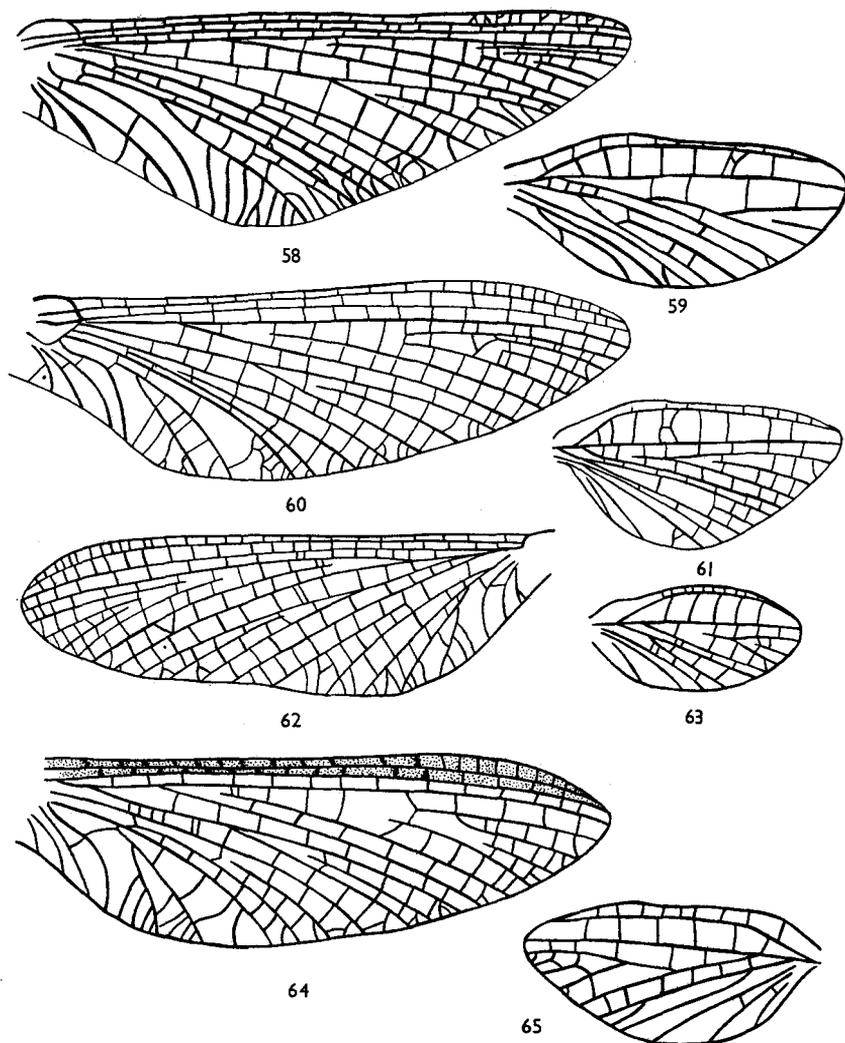
Holotype male, NEW SOUTH WALES: Armidale, 3000 ft., xi.1948. Allotype female, morphotype subimago and nymph, N.S.W.: Armidale, i.1948. In the Australian Museum Collection, in spirit. Other specimens examined, QUEENSLAND: Eidswold, 27.ix.1929, 20.ix.1929, 10.ix.1929 (*R. J. Tillyard*). In British Museum Collection, N.S.W.: Tarana, Fish R. (*B. McMillan*). N.S.W.: Tumut, 24.xii.1947 (*B. McMillan*).

### *Jappa tristis* sp. n. 62-63, 66

*Male imago*.—*Measurements*: Fore wing 10 mm. Hind wing 3 mm. *General colour*: Golden brown with dark brown markings. *Wings*: Veins golden brown. In the fore wing

(fig. 62) cross veins in basal part of costal and subcostal areas very faint, those in pterostigmatic area noticeably upright as compared with the more usual slanting veins in this region. In the hind wing (fig. 63) costal area relatively wide and long with a number of cross veins. Rs arises in apical third of wing, and fork of MP quite close to base of wing. *Legs*: Golden brown without markings. Fore legs are missing in all specimens. Tarsal segments in middle and hind legs in descending order of length are 5, 2 = 3, 4, 1 (fused with tibia). Of each pair of tarsal claws one is blunt and the other acute. *Genitalia* (fig. 66): Forceps and penis light brown. Penis long, reaching almost to the end of first segment of forceps. Cerci light brown. Appendix dorsalis well developed.

*Female Imago*.—Subanal plate large with an almost straight tip.



FIGS. 58-65.—Imaginal wings. *Kurrara procera* sp. n. (58) Fore wing. (59) Hind wing. *Kurrara amenia* sp. n. (60) Fore wing. (61) Hind wing. *Jappa tristis* sp. n. (62) Fore wing. (63) Hind wing. *Jappa kutera* sp. n. (64) Fore wing. (65) Hind wing.

Holotype male, allotype female, TASMANIA: Cradle Mt., 21.i.1917 (R. J. Tillyard). In the British Museum (Natural History), pinned and set.

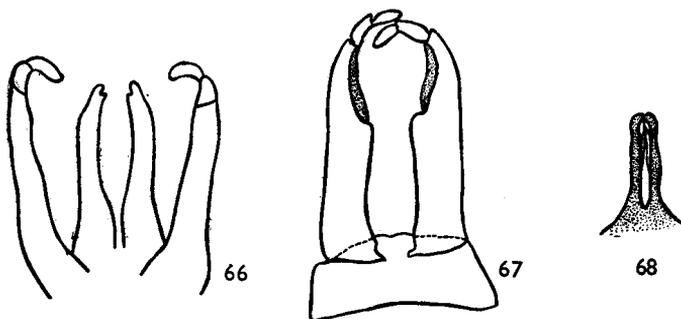
**Kirrara gen. n.**

*Imago.*—*Wings*: Intercalaries in posterior half of fore wing all arise further in towards base than in any other Australian genera. In particular the first intercalary of CuA arises midway between CuA<sub>1</sub> and CuP<sub>1</sub>, giving the appearance of another main vein. From the second intercalary of CuA a pectinate series of veins descends to the tornus, resembling the veins in members of the Siphonuridae, but, unlike that family, CuA does not end at the tornus. Costal area of hind wing narrow and elongate, with a shallow depression at half its length. No fork on MA, and a triad is formed on MP. *Legs*: Tarsi four-segmented, and tarsal claws of each pair are unlike. *Genitalia*: Forceps three-segmented with the narrowing of first segment occurring close to base. Appendix dorsalis well developed.

Type species:—*Kirrara procera* sp. n.

**Kirrara procera** sp. n. 43, 58 57

*Male imago.*—*Measurements*: Fore wing 18 mm. Hind wing 4 mm. *General colour*: Golden brown. In the fore wing (fig. 58) C and Sc spaces dark golden brown. First intercalary of CuA arises further in towards wing base than that of any other Australian Leptophlebiid, and a number of descending veins run from the second intercalary to the tornus, rather after the manner of those in the Siphonurids. Costal space of hind wing (fig. 59) long and narrow with a number of cross veins. Rs arises close in towards wing base, and fork of MP slightly basal to this. *Legs*: Yellow brown with darker markings except for a



FIGS. 66-68.—Male genitalia. (66) *Jappa tristis* sp. n. *Jappa kutera* sp. n. (67) Forceps. (68) Penis.

slightly darker region at each joint. In the fore legs, tibia and femur about equal in length. In the hind legs tibia slightly longer than femur. Tarsal segments in descending order of length are 5, 2, 3 = 4, 1 (fused with tibia). Tarsal claws of each pair unlike, one being sharp and the other blunt. *Genitalia* (fig. 43): Forceps three-segmented, first segment narrowing gradually from base to apex. The two halves of penis well separated, and reaching as far as beginning of second segment of forceps. Appendix dorsalis well developed.

*Female imago.*—Subanal plate V-shaped with a very small incision at the free end.

*Subimago.*—Wings grey with imaginal colouring showing through the subimagonal skin.

Holotype male, allotype female, NEW SOUTH WALES: Upper Murrumbidgee R., Adaminaby, 2.xii.1936 (R. J. Tillyard). Morphotype subimago,

N.S.W. : Bolaro, 10.ii.1936 (*R. J. Tillyard*). Other specimens examined.  
 N.S.W. : Tumut-Talbingo Road, 24.xii.1947, in heavy rain (*B. McMillan*).

**Kirrara amenia** sp. n. *42, 60*

*Male imago*.—*Measurements* : Fore wing 13 mm. (12–14.5 mm.). Hind wing 3 mm.  
*General colour* : Brown with yellowish brown markings. *Wings* : Veins light yellowish brown with Sc, R<sub>1</sub>, and MA slightly darker in fore wing, and Sc darker in hind wing. Base of fore wing faintly clouded with yellow, costal and subcostal spaces being slightly opaque, and cross veins in this region being darker than elsewhere. Fore wing (fig. 60) has a relatively long region basal to tornus, giving a triangular appearance to the wing. Hind wing (fig. 61) about two-thirds as wide as long. Costal area long and relatively wide compared with the previous species, and has a number of cross veins along its length. Rs arises close to wing base; MP forked very close to wing base. *Legs* : Brown without any distinctive marking, femur being slightly darker than tibia and tarsus. In the fore leg femur and tibia about equal in length and tarsus slightly longer; tarsal segments in descending order of length 2 = 3, 4, 5, 1 (fused with tibia). In the middle and hind legs order of tarsal segments is 5, 2 = 3, 4, 1 (fused with tibia). Tarsal claws all sharp. *Genitalia* (fig. 42) : Brown with three segmented forceps, of which the last two segments are slightly lighter. Penis small and deeply bisected, reaching only to end of the wide region of first segment of forceps. Cerci brown with a slightly darker ring at end of each segment; appendix dorsalis well developed.

*Female imago*.—Generally resembling male, but with a slightly shorter, heavier body. Subanal plate large and oval with no incision.

*Subimago*.—General coloration dull brown. Wings a uniform grey without any shading.

*Nymph*.—Unknown.

Holotype male, allotype female, morphotype subimago and paratypes, NEW SOUTH WALES : Mt. Kosciusko, Spencers Cr., 6000 ft., 20.xii.1932 (*R. J. Tillyard*). In the British Museum (Natural History), all types pinned and set.

Notes on the Leptophlebiidae.

Leptophlebiidae is the dominant family of the Australian mayfly fauna. It appears to have invaded similar habitats to those occupied in Europe by other families. Together with this invasion of habitats unusual for the Leptophlebiids, the nymphs show morphological adaptations similar to those elsewhere recognised as peculiar to other families. The most striking example of this convergence of morphological adaptation appears in the new genus *Jappa*, which is closely similar in the nymphal stage to the genus *Ephemera*. Both nymphs are burrowing forms with curved tusk-like projections on the head, being formed on either side of the labrum in *Jappa*, and on the mandibles in *Ephemera*; the gills are feathery and lie above the abdomen in both genera, and the fore legs are modified for digging.

Another example of this convergence appears in an, as yet, undescribed genus, of which the nymph only has been found. This nymph (figs. 80–90) is so closely similar to nymphs of *Rithrogena* that it was at first thought to belong to this genus, but closer examination shows that the mouthparts are of the Leptophlebiid type, as are the veins showing through the wing pads. The gills in this nymph are, like those of *Rithrogena*, modified to form a sucker underneath the abdomen, and their individual form is closely related to that of the latter genus.

## 3. SIPHLONURIDAE.

**Mirawara** gen. n.

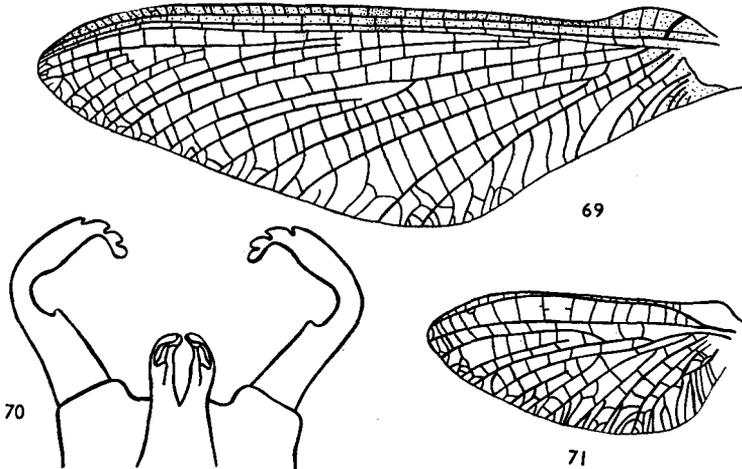
*Imago*.—*Wings*: Fore wing like that of genus *Coloburiscoides* Lestage, with  $MP_2$  normally attached to  $MP_1$ . Costal margin of hind wing slightly angulated near the base. MA and MP distinctly forked. *Legs*: Tarsi of all legs distinctly five-segmented. One of each pair of tarsal claws blunt, the other acute. *Genitalia*: Forceps four-segmented, with basal joint long and narrowing abruptly at about half its length. *Abdomen*: Last abdominal segment backwardly projected at its posterior lateral edge. Appendix dorsalis completely aborted.

Type species:—*Mirawara aapta* sp. n.

This genus is probably close to *Coloburiscoides*, but the four segmented forceps distinguish it clearly from this group.

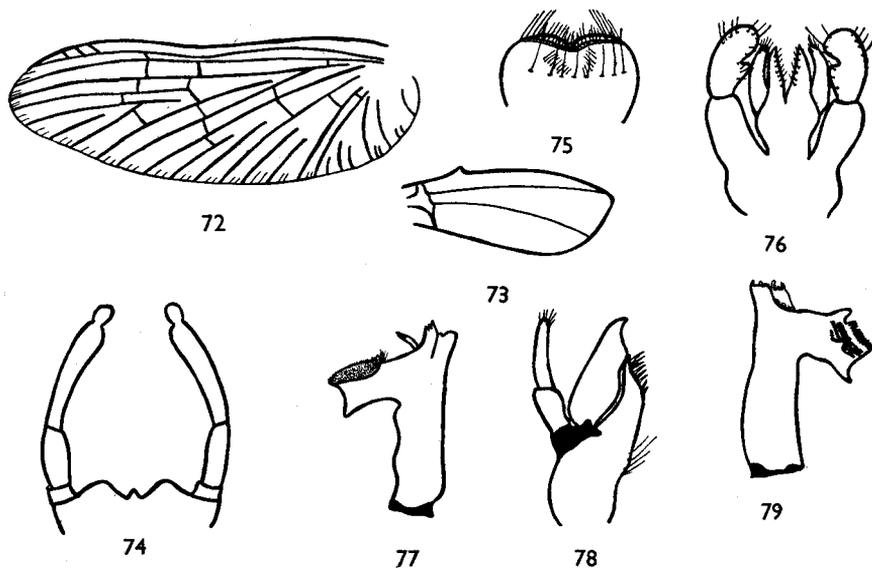
**Mirawara aapta** sp. n. 69-71

*Male imago*.—*Measurements*: Fore wing 19 mm. Hind wing 9 mm. *General colour*: Golden brown with dark brown markings. *Wings*: Veins dark brown. In the fore wing (fig. 69) C and Sc areas golden brown with two slightly darkened regions, one directly above the fork of Rs, and the other on a level with the forking of MA.  $MP_2$  is normally attached to  $MP_1$ . Costa of hind wing has a slight angulation near the base. MP forks on a level



FIGS. 69-71.—*Mirawara aapta* sp. n. (69) Imaginal fore wing. (70) Imaginal hind wing. (71) Male genitalia.

with the origin of Rs. *Legs*: Femur of fore legs longer than tibia, and together they are about equal to tarsi. Tarsal segments in descending order of length are 1 = 2 = 3, 4, 5. Femur of hind leg slightly shorter than tibia, and about equal to tarsi. Tarsal segments in descending order of length are 1 = 2, 3, 4, 5. Of each pair of tarsal claws one is acute and the other blunt. *Genitalia* (fig. 71): Forceps four-segmented; basal joint narrows abruptly at about half its length, and apical three small joints are divided by well-marked V-shaped concavities. Penis does not reach beyond the narrowing of first segment of forceps. *Abdomen*: Tenth abdominal segment bears a long backwardly directed projecting spine. Appendix dorsalis is aborted.



FIGS. 72-79.—*Baetis sogeriensis* sp. n. (72) Imaginal fore wing. (73) Imaginal hind wing. (74) Male genitalia. (75) Labrum. (76) Labium. (77) Right mandible. (78) Maxilla. (79) Left mandible.

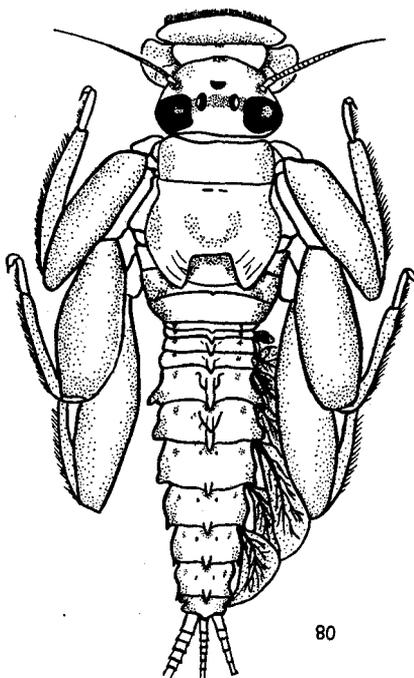


FIG. 80.—Nymph of Leptophlebiid, genus (?).

*Female imago*.—Posterior lateral edges of all abdominal segments slightly elongated, and abdomen more flattened than that of male. Subanal plate W-shaped.

*Subimago*.—Wings grey with all cellules slightly shaded. A lighter band apparent half-way between tornus and apex, running between costa and MP<sub>2</sub>.

Holotype male, allotype female, morphotype subimago, N.S.W.: Upper Murrumbidgee, Adaminaby, 11.xii.1936 (*R. J. Tillyard*).

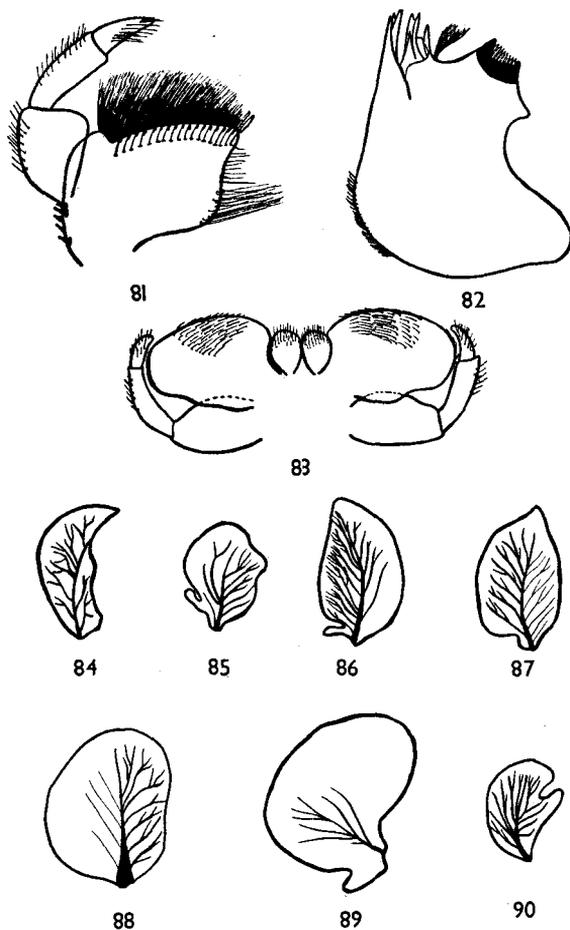
#### 4. BAETIDAE.

##### *Baetis* Leach.

##### *Baetis confluens* Harker.

To the previous description that of the nymph of this species can now be added:—

*Nymph*.—*Measurements*: Body-length 10 mm. (8–11 mm.). *General colour*: Light brown. *Mouthparts*: Labrum deeply notched in middle region of free margin, and bears



FIGS. 81-90.—Nymph of Leptophlebiid, genus (?). (81) Maxilla. (82) Left mandible. (83) Labium. (84-90) Gills 7-1.

more hairs than that of *B. baddamsae* Harker. Left mandible bears a strong blunt projection just below molar edge, which is absent in *B. baddamsae*. Labial palp notched on inner edge of distal segment, but not as deeply as that in *B. baddamsae*. *Legs*: Light yellowish brown with a dark patch on dorsal region of femur. Distal ends of tibia and tarsus marked with a dark line.

Morphotype, NEW SOUTH WALES: Barrington, Williams R., 1500 ft., 29.iii.1944 (*B. McMillan*). Paratype, N.S.W.: Armidale, Commissioners Waters, 3000 ft. 20.i.1945.

***Baetis sogeriensis* sp. n.** 72-77

*Male imago*.—*Measurements*: Fore wing 4 mm. Hind wing 0.5 mm. *General colour*: Creamy yellow with a darker head and tip of abdomen. *Wings*: Wings clear. In the pterostigmatic area of the fore wing (fig. 72) are a few scattered cross veins, no others occur in costal area. Hind wing (fig. 73) reduced, with only two very weak veins; a costal spur present. *Abdomen*: Segments one to six very pale and transparent with a brown band at posterior end of each. Segments seven to ten brown and opaque. *Genitalia*: (fig. 74) Basal segment of forceps slightly shorter than second, and with a very slight swelling on inner side. Third segment very small, globular and incompletely divided from second.

Holotype male and paratypes, NEW GUINEA: Sogeri, near Port Moresby, 1.vi.1947 (*R. Wharton*). Imagines and subimagines found on the walls of a latrine.

5. CHECK-LIST OF AUSTRALIAN SPECIES.

LEPTOPHLEBIIDAE.

*Atalomicria* gen. n. Type-species *A. uncinata* (Ulmer).

*sexfasciata* (Ulmer), 1917, in *Atalophlebia*. **Comb. nov.** Type: Stockholm Museum.

*uncinata* (Ulmer), 1917, in *Atalophlebia*. **Comb. nov.** Type: Stockholm Museum.

*Atalonella* Needham and Murphy, 1924. Type-species *A. ophis* (?). Needham and Murphy.

*brunnea* (Tillyard), 1935, in *Atalophlebia*. **Comb. nov.** Type: British Museum.

*delicatula* (Tillyard), 1935, in *Atalophlebia*. **Comb. nov.** Type: British Museum.

*fuscula* (Tillyard), 1935, in *Atalophlebia*. **Comb. nov.** Type: British Museum.

*lucida* (Ulmer), 1919, in *Atalophlebia*. **Comb. nov.** Type: Stockholm Museum.

*parva* (Harker), 1950, in *Atalophlebia*. **Comb. nov.** Type: Australian Museum.

*simillima* (Ulmer), 1919, in *Atalophlebia*. **Comb. nov.** Type: Stockholm Museum.

*Atalophlebia* Eaton, 1881. Type-species *A. australis* (Walker). Redescribed by Tillyard, 1933.

*albiterminata* Tillyard, 1935. Replaces *A. costalis*. Type: Unknown.

*australasica* (Pictet), 1843, in *Baetis*. To *Leptophlebia* Eaton, 1871, *Atalophlebia* Eaton, 1888. Type: Unknown.

- australis* (Walker), 1853, in *Ephemera*. To *Leptophlebia* Eaton, 1871, *Atalophlebia* Eaton, 1881. Redescribed Tillyard, 1933. Type: British Museum.
- \**brunnea* (Tillyard), 1935. To *Atalonella*. Type: British Museum.
- \**costalis* (Burmeister), 1839, in *Baetis*. To *Potomanthus* Pictet, 1853, *Leptophlebia* Eaton, 1871, *Atalophlebia* Eaton, 1888. Hononym *B. costalis* Curtis, 1834. Redescribed as *A. albi-terminata*.
- \**delicatula* (Tillyard), 1935. To *Atalonella*. Type: British Museum.
- \**furcifera* (Eaton), 1871, in *Leptophlebia*. To *Atalophlebia* Eaton, 1888, *Deleatidium* Ulmer, 1938. Type: National Museum of Victoria.
- \**fusca* (Ulmer), 1919. To *Atalonella* Needham and Murphy, 1924.
- \**fuscula* (Tillyard), 1935. To *Atalonella*. Type: British Museum.
- hudsoni* Tillyard, 1935. Type: Unknown.
- ida* Tillyard, 1935. Type: British Museum.
- incerta* Harker, 1950. Type: Australian Museum.
- inconspicua* (Eaton), 1871. In *Leptophlebia*. To *Atalophlebia* Eaton, 1888. Type: Hope Museum, Oxford.
- kala* sp. n. Type: British Museum.
- kokunia* sp. n. Type: British Museum.
- longicaudata* Harker, 1950. Type: Australian Museum.
- maculosa* Harker, 1950. Type: Australian Museum.
- \**lucida* (Ulmer), 1919. To *Atalonella*. Type: Stockholm Museum.
- marowana* Harker, 1950. Type: Australian Museum.
- miunga* sp. n. Type: British Museum.
- \**parva* (Harker), 1950. To *Atalonella*. Type: Australian Museum.
- pierda* sp. n. Type: British Museum.
- \**sexfasciata* (Ulmer), 1917. To *Atalomicria*. Type: Stockholm Museum.
- \**simillima* (Ulmer), 1919. To *Atalonella*. Type: Stockholm Museum.
- \**strigata* (Eaton), 1871, in *Leptophlebia*. To *Deleatidium* Ulmer, 1920 (referred to as *D. strigatum*). Type: McLachlan Museum (?).
- superba* Tillyard, 1935. Type: British Museum.
- tuhla* sp. n. Type: British Museum.
- \**uncinata* (Ulmer), 1917. To *Atalomicria*. Type: Stockholm Museum.
- Deleatidium* Eaton, 1899. Type-species *D. lilli* Eaton.
- decipiens** sp. n. Type: British Museum.
- furcifera* (Eaton), 1871, in *Leptophlebia*. To *Atalophlebia* Eaton, 1888, *Deleatidium* Ulmer, 1938. Type: National Museum of Victoria.
- mjobergi* (Ulmer), 1917, in *Euphyurus*. To *Deleatidium* Ulmer, 1920.
- nanatum** sp. n. Type: British Museum.
- pusillum** sp. n. Type: British Museum.
- strigata* (Eaton), 1871, in *Leptophlebia*. To *Deleatidium* Ulmer, 1920. Synonym: *Euphyurus bicornis* Ulmer.
- unguicularis* (Ulmer), 1916, in *Euphyurus*. To *Deleatidium* Ulmer, 1920. Type: Stockholm Museum.
- Deleatidium* (*Atalophlebiodes*) Phillips, 1930.
- annulatum* Harker, 1950. Type: Australian Museum.
- bundutum** sp. n. Type: British Museum.

*crassa* (Harker), 1950 in *Leptophlebia*. Type: Australian Museum.  
**Comb. nov.**

**Jappa** gen. n. Type-species *J. kutera*.  
*kutera* sp. n. Type: British Museum.  
*tristis* sp. n. Type: British Museum.

**Kirrara** gen. n. Type-species *K. procera*.  
*amenia* sp. n. Type: British Museum.  
*procera* sp. n. Type: British Museum.

#### BAETIDAE.

*Baetis* Leach, 1815, Type-species *B. bioculatis* Linn.  
 \**australasica* (Pictet), 1843. To *Atalophlebia*. Type: Unknown.  
*baddamsae* Harker, 1950. Type: Australian Museum.  
*confluens* Harker, 1950. Type: Australian Museum.  
 \**costalis* (Burmeister), 1839. Homonym. Removed to *Atalophlebia*  
*albiterminata*.  
*frater* Tillyard, 1935. Type: British Museum.  
*sogeriensis* sp. n. Type: British Museum.  
*soror* Ulmer, 1908. Type: Stockholm Museum.

*Cloeon* Leach, 1815. Type-species *C. dipterum* (Linn.).  
*fluviatile* Ulmer, 1919. Type: Stockholm Museum.  
*tasmaniae* Tillyard, 1935. Type: British Museum.  
*virens* Klap., 1905. Synonym: *C. viridis* Ulmer, 1916; Tillyard, 1935.

*Pseudocloeon* Klap., 1905. Type-species *P. kraepelini*.  
*kraepelini* Klap. Type: ?

#### CAENIDAE.

*Caenis* Stephen, 1835. Type-species *C. macrura* Steph.  
 \**scotti* Tillyard, 1936. Homonym: = *tillyardi*.  
*tillyardi* Lestage, 1938, for *scotti*.

*Tasmanocaenis* Lestage, 1930. Type-species *T. tonnoiri*, Lest.  
*tonnoiri* Lestage, 1930. Type: ?

#### SIPHONURIDAE.

*Ameletoides* Tillyard, 1933. Type-species *A. lacus-albinae* Till.  
*lacus-albinae* Tillyard, 1933. Type: ?

*Coloburiscoides* Lestage, 1935. Type-species *C. giganteus* (Tillyard).  
*giganteus* (Tillyard), 1933 in *Coloburiscus*. Type: C.S.R.I.O., Canberra.  
*munionga* (Tillyard), 1933 in *Coloburiscus*. Type: C.S.I.R.O., Canberra.

*Coloburiscus* Eaton, 1868, as *Coloburus*, preoccupied name, changed Eaton, 1888.  
 Type-species *C. humeralis* (Walker).  
*haleuticus* Eaton, 1871. Type: National Museum of Victoria.

**Mirawara** gen. n. Type-species *M. aapta*.

**aapta** sp. n. Type: British Museum.

*Tasmanophlebia* Tillyard, 1921. Type-species *T. lacustris* Till.

*lacustris* Tillyard, 1921. Type: British Museum.

*Tasmanophlebiodes* Lestage, 1935. No type-species designated.

*laeus-coerulei* (Tillyard), 1921, in *Tasmanophlebia*. Type: British Museum.

*nigrescens* (Tillyard), 1933. Type: British Museum.

#### HEPTAGENIIDAE.

*Atopopus* Eaton, 1881. Type-species *A. tarsalis* Eaton.

*spadix* Harker, 1950. Type: Australian Museum.

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