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The New Zealand Mayflies

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THE NEW ZEALAND MAYFLIES.

By MARTIN E. MOSELY, F.E.S.

WITHIN the last two years a fine work on the New Zealand *Ephemeridæ*, or as they are now known to the entomologist, the *Ephemeroptera*, has been published in a New Zealand scientific journal by Captain J. S. Phillips. Captain Phillips is well known, not only in New Zealand but also over here, as the author of several admirable reports on some of the New Zealand trout fisheries. He has written this excellent monograph on the *Ephemeroptera*, of New Zealand from first-hand experience gained by the riverside, with a full knowledge of the life-histories of the insects of which he tells us. Many of these life-histories were worked out in the laboratory at Wellington, where an aquarium had been installed for the purpose of assisting his investigations.

We may therefore accept his work as authoritative, and it remains for us, as fishermen, to see what we may glean from it to add interest to our visits to the famous fishing waters where the flies occur.

It is, in one respect, unfortunate that the "entomology of artificial patterns," if I may be permitted to use the phrase, has been imposed upon the New Zealand trout fisherman in accordance with home notions. It would, perhaps, have been better had he been allowed to work out his patterns without the dominating influence of the traditions of home fishing.

If we ask at the tackle shop what flies are recommended for New Zealand waters, we are told that we cannot do better than to take out British patterns tied rather large. And this is what the fisherman generally does.

But try to imagine the confusion that will arise when the fisherman, according to his almost invariable practice, tries to identify the living fly by matching it against the artificial pattern in his fly box. I foresee numberless New Zealand flies described as March Browns, Blue-winged Olives, Iron Blues, Alders, Welshman's Buttons, etc., quite regardless of the fact that in the other hemisphere these flies have no part or being.

Captain Phillips will, I trust, forgive me if I express some regret

that, himself a fisherman, he has not given us the local popular names for the flies that he describes, even though they may have seemed out of place in a strictly scientific paper.

Some years ago, the New Zealand fishery boards became seriously concerned about a severe deterioration in the condition of their trout, more particularly in the North Island. In consequence they appointed a very competent and distinguished entomologist, Mr. R. J. Tillyard, to investigate and make a report on the existing conditions in that district. Mr. Tillyard found that in many waters the aquatic insect life was in serious danger of extermination due to the introduction and successful acclimatisation of the trout.

Here in this country, where the trout is indigenous, the fish and their food have evolved side by side. Protection has been acquired for the insects either by their form or by reason of their habits, and, generally speaking, the food supply has kept pace with the demands made upon it by the trout. But, according to Mr. Tillyard, in New Zealand, where the insect life has acquired no protective garb or habits, the delicate balance of nature has been upset, and in many districts the streams have been, to use his apt expression, "eaten out" and the aquatic fauna is in danger of extinction.

Captain Phillips does not altogether share this view, but he points to the danger of a serious diminution of insect life caused by the depredations of introduced birds, particularly as regards the larger and slower-flying mayflies (I use the term in the wider sense as applying to *all* the duns and spinners). He considers that this danger has been increased by indiscriminate bush clearance. He does not think that, so far, any species have become actually extinct, but it has been recorded of one fine large species, *Oniscigaster wakefieldi*, that "in 1874 this insect was common in the neighbourhood of Christchurch. I have lived there during the last nineteen years without seeing a single specimen. Whether they have been killed off by the trout or by the sparrows I cannot say." This statement, made many years ago by Captain Hutton, is suggestive, and in the interests of science it is a very good thing that Captain Phillips has placed on record the *Ephemeropterous* fauna as it at present exists.

Before passing on to an account of the New Zealand *Ephemeroptera*, I feel I must offer an apology on behalf of entomology for the almost impossible scientific names that have been inflicted upon the genera and species. In the absence of any recognised popular names, I have been compelled to use them here. Although, as a general rule,

I am in favour, in the interests of exactness, of the use of the scientific rather than the somewhat uncertain popular names, yet I must confess that the names of the New Zealand *Ephemeroptera* furnish a strong argument against my view.

The first of the groups dealt with by Captain Phillips is the *Ephemeridæ* proper, allied to our own British mayflies, *Ephemera danica* and *Ephemera vulgata*. In New Zealand these insects are also represented by two species, *Ichthybotus hudsoni* and *Ichthybotus bicolor*. The nymphs, in their habits, resemble those of our mayflies and live in burrows in the sand under the bed of the stream or in its banks. In the winged flies, both duns and spinners, there are, in the male, two well-developed outer *setæ* or whisks with only a partially developed central *seta*, but in the female all three are developed, though the middle is rather shorter than the two outer whisks.

ICHTHYBOTUS HUDSONI, *Eaton*.

The dun is described as having pearly wings in the male and lemon-yellow in the female with raw-umber margins, excepting at the wing bases, which are yellow. In both the forewings and hindwings there are generally two dusky zigzag bands running transversely across the wings, but sometimes these are absent.

In the spinners the wings, in the male, are transparent with burnt-umber margins, yellowish-green with similar margins in the females. The neuration is black shading to brown at the bases of the wings. The bodies are reddish-brown in the male and bright orange-brown in the female, both rather paler beneath.

The expanse of wings is 20 mm. in the male and 22 mm. in the female or about the size of our Turkey Brown.

The fly is seen on the water from December to February and is probably generally distributed throughout New Zealand, certainly throughout the North Island.

ICHTHYBOTUS BICOLOR, *Tillyard*.

This species is somewhat similar to *Ichthybotus hudsoni*, but, as its name implies, may be recognised by the wings of the duns, which are tinted in different colours.

In the dun the forewings have a ground colour of pale grey tinged with yellow and with a basal patch of pale orange and a band of dull purplish-brown along the upper margin; the hindwings are dull purplish-brown, paler towards the base and lower margin.

The body is coloured dull earthy greyish-brown.

The wings of the spinner are much darker than those of *Ichthybotus hudsoni* and the hindwings are brown; body deep chocolate-brown, faintly mottled with somewhat paler brown.

The expanse of wings is, in the male, 33 mm., and, in the female, 40 mm., so that it is a much larger fly than *Ichthybotus hudsoni*, of about the same size as our mayfly. It is found in the neighbourhood of Nelson towards the end of December.

The next group, the *Siphlonuridæ*, is allied to our own large flies, *Siphlurus armatus*, *Siphlurus lacustris*, and *Siphlurus linnæanus*, which have no popular names and are not very familiar to fishermen. Another British ally is also a very little-known insect which, so far, has only been found in Scotland and Westmorland, *Ameletus inopinatus*.

In New Zealand there are four genera against our two, *Coloburiscus*, *Oniscigaster*, *Ameletus*, and *Ameletopsis*. They all carry two well-developed outer and rudimentary inner *setæ*, and the nymphs are of the swimming type.

COLOBURISCUS HUMERALIS, *Walker*. Pl. I, fig. 3; Pl. II, fig. 7.

In the dun the wings are pearly with yellow upper margins and a vivid patch of yellow at their bases; the cross-veinlets are irregularly edged with grey; the bodies are blackish-brown.

The forewings of the spinner are glassy with yellow patches at their bases and with pale yellow upper margins deepening to bistre-brown towards the tips; body burnt-umber with dark bands round the segments, lighter beneath.

The expanse of wings in the male is 32 mm. and in the female 39 mm., about the size of our mayfly.

The fly is to be seen on the water from the middle of October to the beginning of February, and is widely distributed throughout New Zealand.

There is only the one species in *Coloburiscus*, but in the next genus, *Oniscigaster*, three have been described, *wakefieldi*, *intermedius*, and *distans*. They are all very much alike, and Captain Phillips is doubtful whether *intermedius* is really distinct from *distans*. According to Captain Hutton, as already stated, it is a question whether *wakefieldi* may not be verging on extinction owing to the depredations of trout and imported birds. Captain Phillips has never seen the insect alive, but is informed that it is occasionally found

in the vicinity of Mount Grey, Canterbury. The descriptions have been made from museum specimens.

ONISCIGASTER WAKEFIELDI, *McLachlan.* Pl. I, figs. 1 and 2.

In the dun the wings are light sepia grey with the cross-veinlets towards the outer margin strongly edged with dark brown. The body is greyish.

The wings of the spinner are faintly tinged with brown and the nervures are edged with dark brown. The body is dark brown, rather lighter in the male.

The expanse of wings in the male is about 32 mm. and about 45 mm. in the female, which makes the fly rather bigger than the average size of our mayfly, *Ephemera danica.*

ONISCIGASTER INTERMEDIUS, *Eaton.*

The wings of the dun are blackish-grey with the neuration heavily and darkly edged both at the upper margin of the forewing and at the upper half of the hindwing; there is a light patch across the centre of the forewing and another towards the base.

In the spinner the wings are clear excepting towards the tips, which are of a light fawn colour; along the upper margin the nervures are heavily shaded with dark brown to give a dark pattern to this area. There are conspicuous brown blotches of colour on the upper margin towards the base of the forewings and towards the upper margins; body dark shining brown, lighter towards the tail.

The expanse of wings in the male is 35 mm. and 39.5 mm. in the female, so that the male is rather larger and the female rather smaller than the preceding species, say about the size of our mayfly. The species is on the water from November to January and has been found in Wellington, Hawke's Bay districts, North Island, and the table-land of Mount Arthur, South Island.

ONISCIGASTER DISTANS, *Eaton.*

This species so closely resembles *O. intermedius* that it is unnecessary, for the purposes of the trout fisherman, to give it a separate description.

We now come to the genus *Ameletus*, in which there are two species, *ornatus* and *flavitinctus*.

AMELETUS ORNATUS, *Eaton*. Pl. II, fig. 14.

In the dun the wings are clouded with whitish-grey, mottled with black in the male and green in the female; the base of the wings yellowish, veins brown, cross-veinlets bordered with brownish-grey and, in places, running into each other to make irregular blotches.

In the spinner the wings are yellowish with black or dark-brown neuration. The body is dark fawn, greenish towards the tail.

The expanse of wings is 28 mm. in the male and 34 mm. in the female, which is about the size of the March Brown. It is present on the water from November to February in various localities in the neighbourhood of Wellington.

AMELETUS FLAVITINCTUS, *Tillyard*. Pl. II, fig. 12.

The wings of the dun are greenish-brown with clear yellowish-green upper margins; veins yellow at the edges, black in the centre; the cross-veinlets are irregularly edged with greyish-brown, so that the effect is given of two dark zigzag bands extending across the wings together with dark areas towards the lower margins of the forewings and the tips of the hindwings; the body has a greenish tinge.

In the spinners the wings are clear, mostly of a pale, transparent yellow with blackish veins; body dark brown.

The wing expanse of the male is 36 mm. and of the female 41 mm., which is approximately the size of the mayfly.

The fly appears on the water in November near Lake Taupo, where, towards the southern end, there is a stream above a high waterfall. This is the first locality where it was discovered, but the insect has subsequently been found in the Wellington district and the Nelson district, and no doubt it occurs elsewhere as well.

The next genus in the group and the last, is *Ameletopsis*, represented by the one species *percitus*.

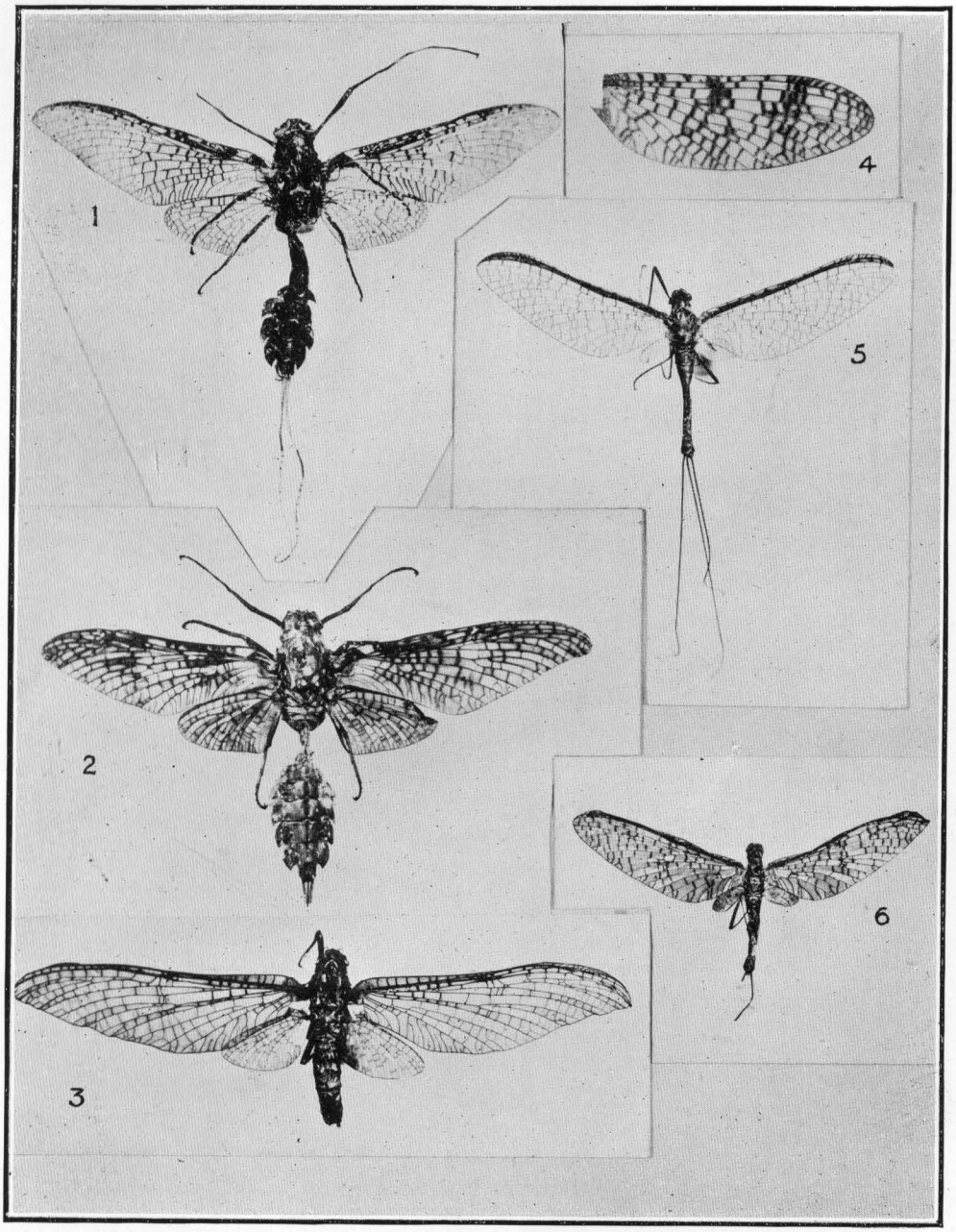
AMELETOPSIS PERCITUS, *Eaton*.

In the dun the wings are semi-opaque, brilliant yellow with three greyish patches in a line along the upper edge of the forewing towards the tip.

The wings of the spinner are also of a brilliant yellow with mostly black veins; body, ground-colour fawn with burnt-umber markings.

The wing expanse of the male is 33 mm., that of the female 40 mm., which is about the size of our mayfly.

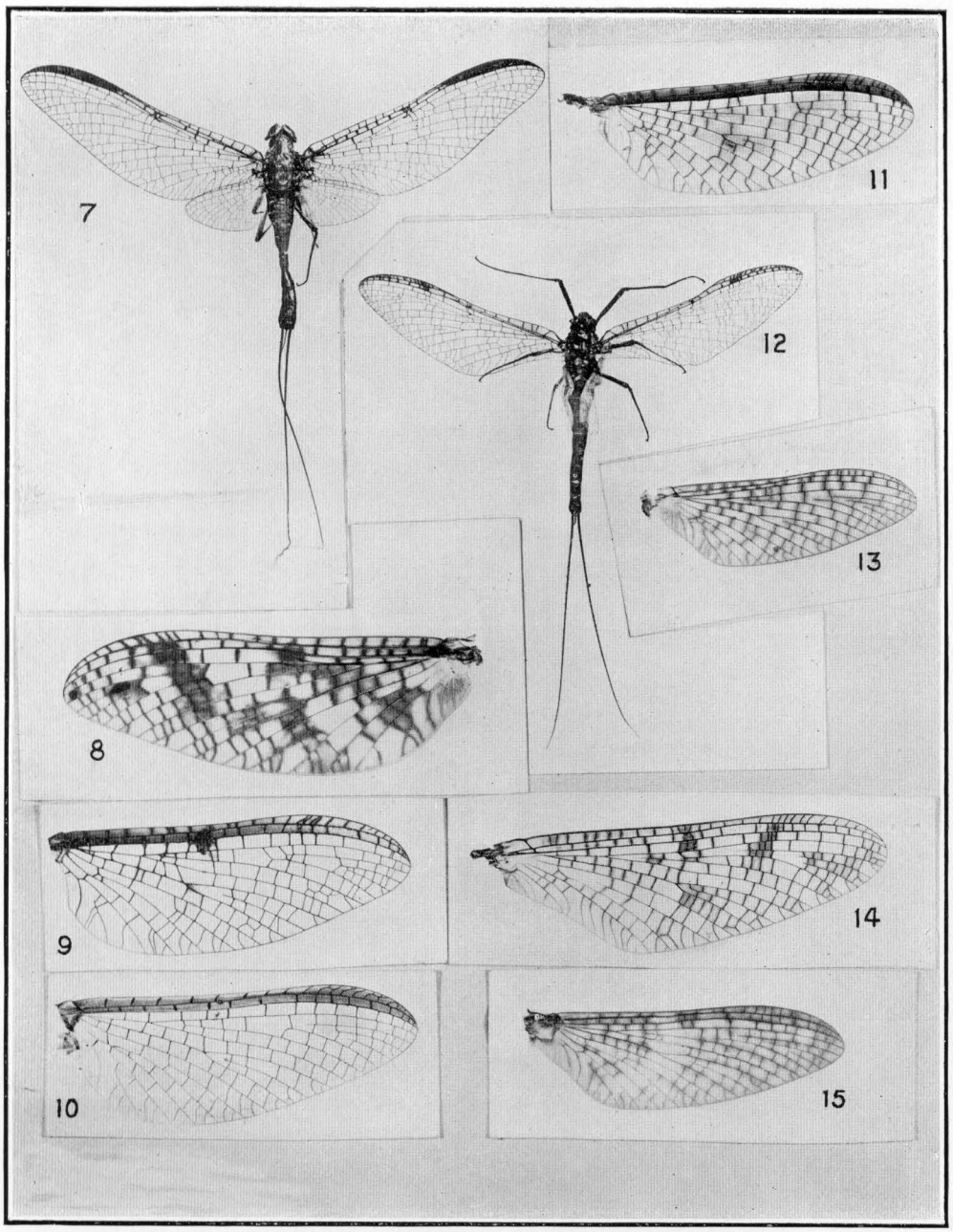
PLATE I.



Phot. M. E. M.

New Zealand Ephemeroptera or May-Flies.

PLATE II.



Phot. M. E. M.

New Zealand Ephemeroptera or May-Flies.

The fly appears on the water from the end of December up to March, and has been found throughout the Wellington district, in Hawke's Bay, and near Canterbury.

This completes the description of the family of the *Siphlonuridæ* and we can pass on to a group of much smaller flies related to our Turkey Brown and placed by the entomologist in the family *Leptophlebiidæ*. All the remaining known New Zealand species belong here; they all have three fully developed *setæ* and the nymphs come under the category of "crawling nymphs."

There are only two genera in the family, *Atalophlebia* and *Deleatidium*, but the species are numerous, thirteen in all, and some very much alike.

In the first of these genera, *Atalophlebia*, there are five species, of which one has not yet been fully described and remains unnamed.

ATALOPHLEBIA VERSICOLOR, *Eaton*. Pl. II, figs. 8 and 9.

The wings of the dun are dull and colourless excepting round the margins, where they are light brown (according to Eaton, a dull reddish-purple). There are two conspicuous dark grey zigzag bands extending across the forewing.

In the spinner the wings are clear, the upper margins tinted with transparent raw-umber. There are some very black cross-veinlets in this area, two groups of which are suffused with small greyish clouds; body burnt-umber or bistre-brown.

The wing expanse of the male is 24 mm. and that of the female 29 mm., that is, about the size of our Little Yellow May Dun.

The fly is found on slow or moderately flowing streams in the neighbourhood of Auckland, Hawke's Bay, Wellington, Nelson, and Canterbury.

ATALOPHLEBIA DENTATA, *Eaton*. Pl. I, figs. 5 and 6; Pl. II, fig. 11.

In the dun the wings are cloudy white, occasionally tinted with dull brown or orange, upper margins dark amber-yellow, veins black with the cross-veinlets irregularly bordered with grey.

The spinner has clear wings very faintly tinged with yellow, upper margins coloured dark amber-yellow, neuration pitch-black; the body is light bistre-brown.

Expanse of wings in the male about 26 mm., in the female about 28 mm., that is, slightly larger than the Little Yellow May Dun.

The fly appears on the water throughout the summer in the neighbourhood of Auckland and also Hawke's Bay, Wellington, and Nelson.

ATALOPHLEBIA CRUENTATA, *Hudson*. Pl. II, fig. 10.

The forewings of the dun are of a light pearly-brown excepting the upper margins, which are orange-red shading to brick-red at the bases. There is also an orange bar running from the base through the centre of the wings. The cross-veinlets are black, bordered irregularly with grey; the hindwings are pale pinkish pearl with the upper margins orange at the tips.

The spinner has colourless wings excepting at the upper margins, where they are orange; cross-veinlets pitch-black; body dull red.

The expanse of wings of the male is 28 mm. to 30 mm., about the size or slightly larger than the Little Yellow May Dun.

This species can be distinguished from *dentata* by the orange tips to the wings and the presence of a dark bar on the front femur. It has been found at Auckland, Hawke's Bay, Wellington, Nelson, and Canterbury.

ATALOPHLEBIA NODULARIS, *Eaton*. Pl. I, fig. 4.

In the dun the wings are mainly grey with irregular pearly spaces. Some of the cross-veinlets towards the upper margins are narrowly edged with heavy black. These occur in groups arranged to make two very distinct dark blotches; elsewhere the cross-veinlets are edged with light grey, so that the wings appear somewhat mottled.

The spinner has clear wings with dark neuration, the cross-veinlets being heavily shaded towards the upper margins; the bases of the wings are brown; body sepia-brown.

This is a small fly with an expanse of wings of only about 20 mm. in the male and 23 mm. in the female, that is, about the size of the Blue-winged Olive.

It is found in large numbers in the Nelson district near Lake Rotoroa, in the moderately swift streams in the Wellington and Nelson districts and also at Christchurch and Dunedin.

The last of the known species of *Atalophlebia* has not been fully worked out as regards its life-history, and, although Captain Phillips is well acquainted with the nymphs, his visit to the district in which they are found was too short to enable him to breed out the winged forms. Consequently, to avoid future confusion, he has very wisely left the species unnamed.

We now come to the last genus of the New Zealand *Ephemeroptera*, *Deleatidium*. There are eight species in the genus, most of which are small, about the size of our Olive Duns, and one species as small as our Pale Watery Dun. In this genus all the species have three whisks, of which the central is the longest. Four of them are so much alike that I find it scarcely possible to make an intelligible distinction between them without giving very technical details which would be out of place here. Accordingly I will group them together at the end, giving merely their expanse of wing and the localities in which they have been recorded. The nymphs in this genus are of the "crawling" type.

DELEATIDIUM MYOBRANCHIA, *Phillips*. Pl. II, fig. 15.

In the dun the wings are faintly tinged with pale yellow with faint rose-madder pink along the upper margins and towards their bases. There is a light-coloured blotch in the centre of each wing due to the absence there of cross-veinlets. The body is chestnut or light red shaded with black.

In the spinner the colour of the wings is very similar to that of the dun, but the wings are clear instead of opaque. The body is brick-red with black markings.

The expanse of the wings of the male is 22 mm. and of the female 25 mm., rather larger than the Blue-winged Olive.

It is found at Hawke's Bay, Wellington, Nelson, and Canterbury.

DELEATIDIUM CERINUM, *Phillips*.

The wings of the dun are dead white with a waxy appearance. In the spinner they are clear and very iridescent. The body is whitish at the base, shading to brown-ochre towards the tail in the male and burnt-umber in the female.

It is the smallest of the described New Zealand *Ephemeroptera*, with a wing expanse of about 14 mm. to 16 mm., which is about the size of our Pale Watery Dun, *Centroptilum luteolum*.

It is found towards the end of the summer and throughout the autumn on the Hutt River in the Wellington district.

DELEATIDIUM SEPIA, *Phillips*.

As the name implies, the wings of the dun are dark sepia-grey, sometimes with a brown tinge.

In the spinner the wings are clear, faintly tinged with brown and the bases distinctly brown. The body is dingy chestnut-brown, somewhat lighter beneath.

The expanse of the wings is about 20 mm. to 22 mm., about the size of the Blue-winged Olive.

It is found during the later part of the summer in the streams round Wellington.

DELEATIDIUM AUTUMNALE, *Phillips*. Pl. II, fig. 13.

In the dun the wings are irregularly shaded with grey with brown wing bases. In the spinner the wings are clear, the veins being coloured with burnt-umber. The body is light brown with dark-grey markings. It is more heavily shaded with grey in the male, and in this sex the last three segments sometimes have a reddish tinge.

The expanse of wing is 16 mm. to 17 mm., about the size or a little bigger than our Olive Dun.

It is very common during March and April, often appearing in large numbers about sunset on the Hutt River in the Wellington district.

We have now to consider the last four species which, as stated above, resemble one another too closely to warrant separate descriptions. They are all small flies, resembling our Olive Duns in appearance, the spinners having clear wings. Of the four, *vernale* is noteworthy for the unusual feature that the male is larger than the female.

DELEATIDIUM VERNALE, *Phillips*.

Expanse of wings about 19 mm. Found at Ngaio and at Khandallah near Wellington in the spring and early summer.

DELEATIDIUM LILII, *Walker*.

Expanse of wings about 20 mm. Found in considerable numbers in most districts from October to January towards dusk.

DELEATIDIUM FUMOSUM, *Phillips*.

Expanse of wings about 17 mm. Found in March and April in the streams round Wellington. As the wings are smoky grey, Captain Phillips suggests that it might be called the Little Blue Dun.

DELEATIDIUM CROMWELLI, *Phillips.*

Expanse of wings 17 mm. to 18 mm. Found towards the end of summer in the streams round Wellington.

With these last four descriptions my task is completed, and the reader has now been introduced to all the described species of the New Zealand *Ephemeroptera*. It may be considered as certain that there are far more species in New Zealand than have been mentioned above, as few fishermen can exercise sufficient self-denial to devote an hour or so, whilst the rise is on, to the catching of flies in place of trout, and it is mainly to the fisherman that any knowledge of this order is due. In the past, entomology has been far more indebted to the fisherman than has the fisherman been to the entomologist, but as regards this account, which I have merely transcribed from Captain Phillips's highly technical paper, we must all acknowledge our great indebtedness to this particular entomologist, who has gone a long way to redress the balance. I will add, in conclusion, that the enthusiastic angler-entomologist who wishes to study Captain Phillips's paper at first hand, will find it published in the "Transactions of the New Zealand Institute," 1930, Vol. LXI, pp. 271—390, with numerous plates and text figures and with full descriptions of the nymphs, which, for reasons of space, I have entirely omitted here.

To illustrate this article I have photographed examples of the insects in the collections of the British Museum (Natural History).

EXPLANATION OF PLATES.

		Pl. I.	
FIG. 1.	*Oniscigaster wakefieldi*	× 2	spinner, male
,, 2.	,, ,,	× 2	dun, male
,, 3.	*Coloburiscus humeralis*	× 2	dun, female
,, 4.	*Atalophlebia nodularis*	× 4	dun (sex unknown)
,, 5.	,, *dentata*	× 2	spinner, male
,, 6.	,, ,,	× 2	dun, male
		Pl. II.	
FIG. 7.	*Coloburiscus humeralis*	× 2	spinner, male
,, 8.	*Atalophlebia versicolor*	× 4	dun, female
,, 9.	,, ,,	× 4	spinner, female
,, 10.	,, *cruentata*	× 4	spinner, male
,, 11.	,, *dentata*	× 4	dun, female
,, 12.	*Amelctus flavitinctus*	× 2	spinner, female
,, 13.	*Deleatidium autumnale*	× 4	dun, female
,, 14.	*Amelctus ornatus*	× 4	dun, male
,, 15.	*Deleatidium myzobranchia*	× 4	dun, female