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DESCRIPTIONS OF THE NYMPHS OF THE BRITISH SPECIES OF *HEPTAGENIA* AND *RHITHROGENA* (EPHEM.)

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The following species have been recorded (Kimmins, 1954) in Britain:

Heptagenia sulphurea (Müll.), 1776.

H. longicauda (Steph.), 1836 (*flavipennis* (Dufour), 1841).

H. fuscogrisea (Retz.), 1783.

H. lateralis (Curt.), 1834.

Rhithrogena semicolorata (Curt.), 1834.

R. haarupi Esb.-Pet., 1909.

H. longicauda was recorded at Reading in 1868, at Staines in 1904, and near Tilford on the R. Wey in May, 1933, when Mr. D. E. Kimmins took a single specimen. I have searched for it on four occasions in the R. Wey and have also visited the Reading neighbourhood without finding it, and have now decided not to delay any longer the description of the other species in the hope that it might turn up somewhere; in any case Schoenemund (1930) gives characters whereby it can be distinguished.

As in previous descriptions of nymphs, differences between species have been sought first on cast nymphal skins whose identity has been established from the imago and the final description has been made from both cast skins and whole nymphs. It is a pleasure to acknowledge the continuing and unfailing kindness of Mr. D. E. Kimmins, who has always been prompt to name adults and to supply data on distribution from the files of the Natural History Museum, and I also thank my assistant, Mr. T. Gledhill, who has made some of the drawings.

Heptagenia sulphurea

Material: In the list that follows the name of the place where the specimens were found comes first, and after it the vice county initials. The figures indicate respectively the number of cast skins and the number of whole nymphs examined. The number dissected is indicated in parentheses.

R. Rothay WL 2 (1) + 1; R. Brathay WL 4 (1) + 0; R. Nidd SY 1 + 1 (1); R. Wey SR 19 (1) + 1; R. Avon SH 0 + 2; L. Gartan ED 0 + 1; L. Sheelin CV 0 + 17 (2); L. Tait SL 0 + 1; L. Erne FE 1 + 0; not recorded 2 + 0.

Length: Most of the English specimens were 9 or 10 mm. long, the Irish generally 11-13 mm. long.

Markings: This is a dark nymph on which the light pattern stands out conspicuously. The dorsal markings of a large Irish specimen

are shown in Fig. 1S, and there is not a great deal of variation on this pattern in the other specimens. The transverse distal white bar shown on abdominal segment 4 in the figure may be absent or it may be fused with the two longitudinal lines to give a U-shaped mark as in Schoenemund's Fig. 135. Likewise the distal mark on segments 8 and 9 may be absent or joined to the paired dots. On all segments the two lines near the centre may be pear-shaped. The tails are conspicuously ringed in black and white, and generally, except at base and tip, two white segments alternate with two dark segments, but on a few specimens the white areas are a little smaller than this. The legs are marked as in Fig. 1, except that in some specimens the basal white area is split into three separate flecks.

Gills: The first, fourth and seventh gills are shown in Fig. 2S. It will be noted that there is a tuft of filaments on the seventh gill.

Legs: The upper margin of the femora (that is the margin shown uppermost in Fig. 1) is fringed with fine hairs and at intervals spines (Fig. 3S). The surface is beset with short spines which, under high magnification, are seen to be shaped rather like electric-light bulbs. The fore tibia bears a row of fine hairs down the middle, a few hairs along the upper margin, and scattered irregularly a small number of spines that can only just be made out under a magnification of x 25. Most are bulbous, but a few, especially those along the lower margin, are pointed. The mid and hind tibiae are similar except that they are fringed with hairs along the upper margin and the small spines are more numerous; there is a row of them just inside the upper margin of the hind tibia. On the tarsi there are a few hairs mostly towards the upper margin and a few small spines especially towards the lower margin. These are distinctly bigger and about twelve in number on the hind tarsus. At the distal end of each tibia there is a comb-like structure of hairs and fine spines. The claws have no teeth.

Mouthparts: Figs. 4 and 5 show labrum, maxilla, labium and hypopharynx.

The smallest specimen examined, 4 mm. long, showed the characteristic features mentioned above.

Heptagenia lateralis

Material: Nor Moss Beck WL 3 (1) + 0; High Wray Beck WL 6 (1) + 0; Holbeck WL 3 (1) + 0; Belle Grange Beck WL 1 (1) + 0; Blelham Fishpond Beck 2 + 0; R. Winster WL 1 + 0; Windermere WL 14 (2) + 5 (1); R. Rawthey MY 10 + 0.

Length: Numbers in the different size groups were as follows:

	7.5	8	8.5	9	9.5	10	10.5	11	11.5	12 mm. long.
Becks in Westmorland		4	2	5	0	4				
Windermere	1	0	0	5	1	9	1	0	1	
R. Rawthey in Yorkshire				1	0	2	0	6	0	1

Markings: This is a drab uniformly pigmented species. On the abdominal tergites of over half the specimens there was no detectable pattern. On the rest there was a faint broad light U with its base resting on the distal margin of each segment and its arms running forward on either side of the mid-line. On one specimen the mark was V-shaped and on another there were gaps between the base and sides of the U. There was generally a faint light dot on each side. The leg pattern, though also faint, is distinctive (Fig. 1L), and was visible on all the specimens seen. A light cross runs along the two axes of each femur and separates four darker areas. Frequently these are darker in the centre and there are then four dark lines on the femur, each parallel with the margin.

The gills (Fig. 2L) are more pointed than those of *sulphurea* and the last one is devoid of filaments.

Legs: A fringe of hairs along the top of each femur more than twice as long as those on either of the other species is one of the most distinctive features of *lateralis* (Fig. 3L). High magnification shows that the little spines on the surface of the femora are pointed, not round as in *sulphurea* (Fig. 3L). Along the upper margin of the fore tibia of *lateralis*, hairs are few and so small that they are generally invisible under magnification x 25. 6-15 small pointed spines lie in an irregular row along the lower margin. On the mid tibia hairs are distinctly longer and more conspicuous and the small spines frequently more numerous than on the fore. On the hind tibia the small spines are still more numerous and there may be a regular row parallel with the upper margin; this, however, is not always apparent, in which case spines are scattered rather irregularly over the surface of the segment. On the fore tarsus there are about four very small spines and a few fine hairs. On the mid tarsus there are about 6 spines (Fig. 3L), and on the hind about 11 slightly larger ones. The claws bear 1 or sometimes 2 teeth just below the tip.

Mouthparts: The shapes of the labrum and hypopharynx (Fig. 4L) are unlike those of either of the other two species, and there are also differences in the shape of and arrangement of hairs on various parts of the maxilla (Fig. 4L) and labium (Fig. 5L).

Heptagemia fuscogrisea

Material: Kennet and Avon Canal near Reading BK 16 (2) + 9; L. Sheelin CV 14 (3) + 14 (1).

Length: 10-14 mm.

Markings: Though rarely as strongly contrasted as that of *sulphurea*, the pattern is clear on most specimens (Fig. 1F). On the abdominal terga there is commonly a light triangular mark projecting forwards from the centre of the apical margin and distal to it and sloping inwards a round and an elongate dot. These two dots may be joined together and connected to the triangle by a transverse mark.

On some specimens the elongate dot extends further forward and joins a light line parallel with the proximal margin of the tergum.

At every second junction between segments of the tails there is a dark ring. A slight darkening on either side of this is often noticeable and on three specimens it extends over the whole segment so that the pattern is like that of *sulphurea*; the contrast between light and dark is, however, never as strong as in that species.

The two dark transverse bands across the femora shown on Fig. 1F are of a characteristic reddish-brown colour which, however, fades somewhat in preservative. The gills have an unmistakable shape, and the seventh has no filaments (Fig. 2F).

Legs: The femora are much less hairy along the upper margin than those of the other two species and the hairs are confined to the distal half. The spines on the surface are pointed (Fig. 3F). The tibiae of all three legs are more similar than those of *sulphurea* and *lateralis*, though there is a tendency for the front pair to bear shorter hairs and fewer spines than the others. The distinguishing feature on the tibia of *fuscogrisea* is the greater number of spines along the lower margin. The tarsi also bear more spines, often many more than shown in Fig. 3F. There are generally 2 teeth on the claw.

Mouthparts: Labrum, hypopharynx (Fig. 4F) and labium (Fig. 5F) are distinctly different from those of the other two species. The maxilla is somewhat like that of *sulphurea*.

Heptagenia longicauda

Schoenemund (1930) divides six species of *Heptagenia* into two groups in his key. The first has large tufts of filaments longer than the lamellar part of the gills which is egg-shaped or pointed. In the second group the gill filaments are in tufts smaller and generally shorter than the lamellae. *H. longicauda*, referred to as *H. flavipennis*, falls into the first group. There are no figures of it, but the gill of *H. flava*, from which it is distinguished on colour, is illustrated. The lamella is oval and pointed and there is a great thick mass of filaments covering an area distinctly bigger than the lamella (Fig. 132). The species should be easily distinguishable from the three described above, all of which fall into Schoenemund's second group.

Genus Rhithrogena

I have compared specimens of *R. haarupi* taken in the R. Nith below Thornhill in Dumfries-shire with specimens of *R. semicolorata* from the Lake District, and have failed to find any difference between them. True, *R. haarupi* tends to be half as big again as *R. semicolorata*, lengths of nymphs ranging from 11-13 mm. compared with 7-10 mm. with a mode at 8 mm. but size is of doubtful value as a distinguishing feature, for there is evidence that it varies with temperature. Macan (1957a) measured a large number of nymphs of *R. semicolorata* during a stream survey and his findings agree with the above figures, most full-grown nymphs being 8-10 mm. long (see

Macan 1958 for a histogram). A few were larger and 15 fell into the 11-12 mm. size group. Of these 15, no less than 11 were found in tributaries, one of which was shown to have a more equable temperature than the main stream. Harker (1952) studied a stream which probably never got as warm as Macan's and in it found that *R. semicolorata* ranged up to 14 mm. in length. Thus the largest Lake District specimens of *R. semicolorata* are as large as the smallest specimens of *R. haarupi*, but those studied by Harker are of the same size.

Kimmins (1954) records that *R. haarupi* is 'common but local on large rapid rivers' and Harris (1952, p. 255) gives a distribution map to which the *R. Nith* record mentioned above must now be added. *R. semicolorata* occurs in rivers also but is particularly characteristic of small stony streams (Macan, 1957b).

KEY

1. First gill very large and meeting its fellow beneath the body. A dark dot in the centre of each femur
.....*Rhithrogena semicolorata* and *haarupi*
- First gill small and like the others in shape (Fig. 2). Markings on femora not like this 2
2. Filamentous part of the gill as large as the lamella
.....*Heptagenia longicauda*
- Filamentous part of the gill smaller than the lamella 3
3. Rather little or no pattern on body and tails; a light cross-shaped area on the femora separating four dark areas which are often darker in the middle so that four lines, each parallel with the margin, are apparent (Fig. 1L). Upper margin of femur fringed with hairs which, if folded back would extend more than half-way across the femur (Fig. 3L). Gills narrowing gradually to a rather blunt point (the seventh without a tuft of filaments) (Fig. 2L)
.....*H. lateralis*
- Black-and-white nymphs with conspicuous pattern (Fig. 1); femora with transverse bars (Fig. 1). Hairs along upper margin of femur much shorter (Fig. 3). Gills of other shape (Fig. 2) ... 4
4. Gills rather small and rounded at tip; last with a tuft of filaments (Fig. 2S). Femora with black transverse bands (Fig. 1S); fore margin closely beset with short hairs and spines (Fig. 3S)
.....*H. sulphurea*
- Gills large, produced into a point; last without a tuft of filaments (Fig. 2F). Femora with two reddish-brown bands (Fig. 1F); fore-margin with a few short hairs along the distal part (Fig. 3F)
.....*H. fuscogrisea*

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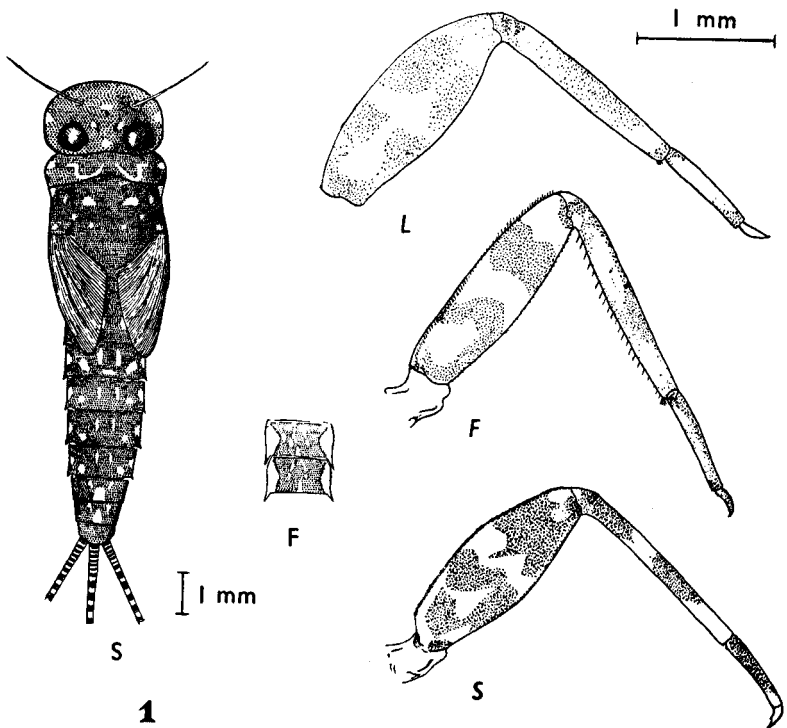


Fig. 1. Markings on upper surface of body and of legs of *sulphurea* (S), *fuscogrisea* (F) and *lateralis* (L).

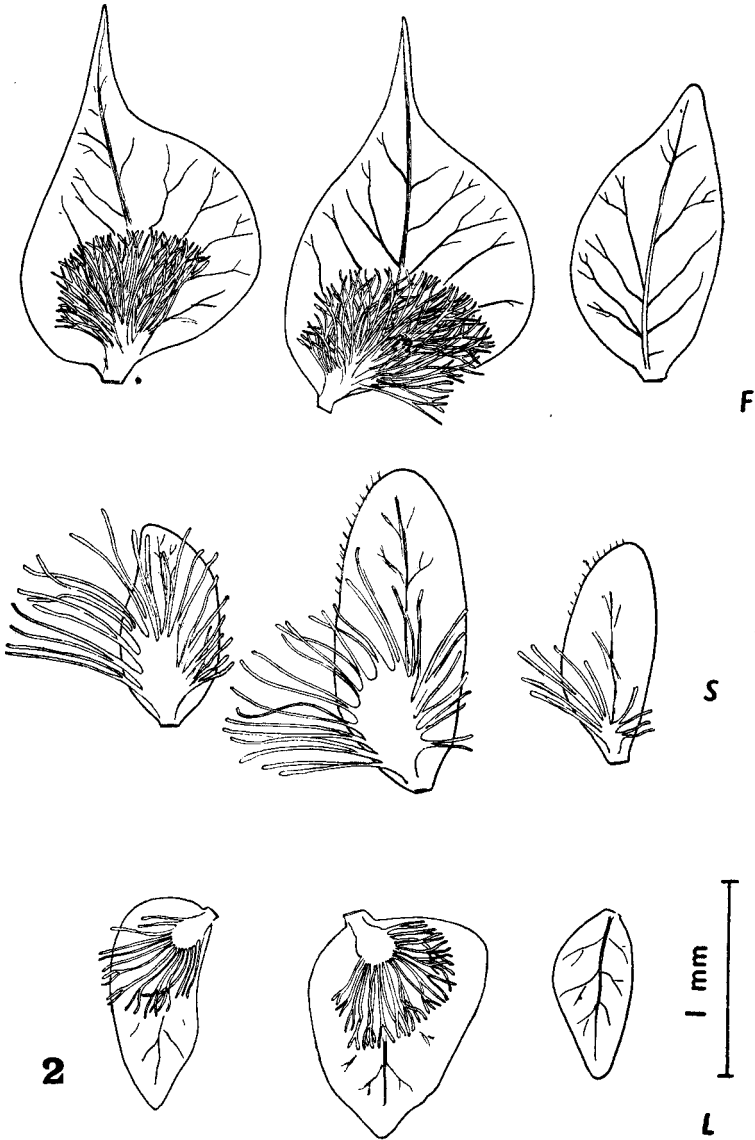


Fig. 2. First, fourth and seventh gills of *lateralis* (L), *sulphurea* (S), *fuscogrisea* (F).

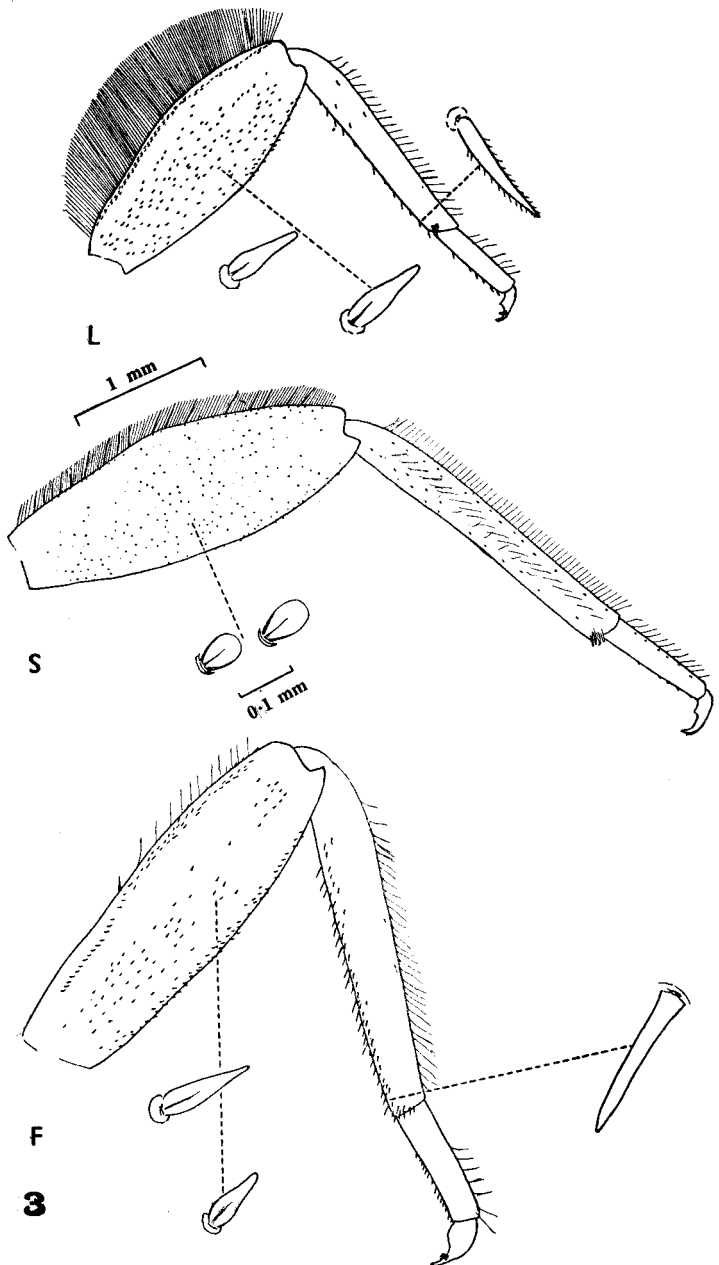


Fig. 3. Middle legs of *lateralis* (L), *sulphurea* (S), *fuscogrisea* (F).

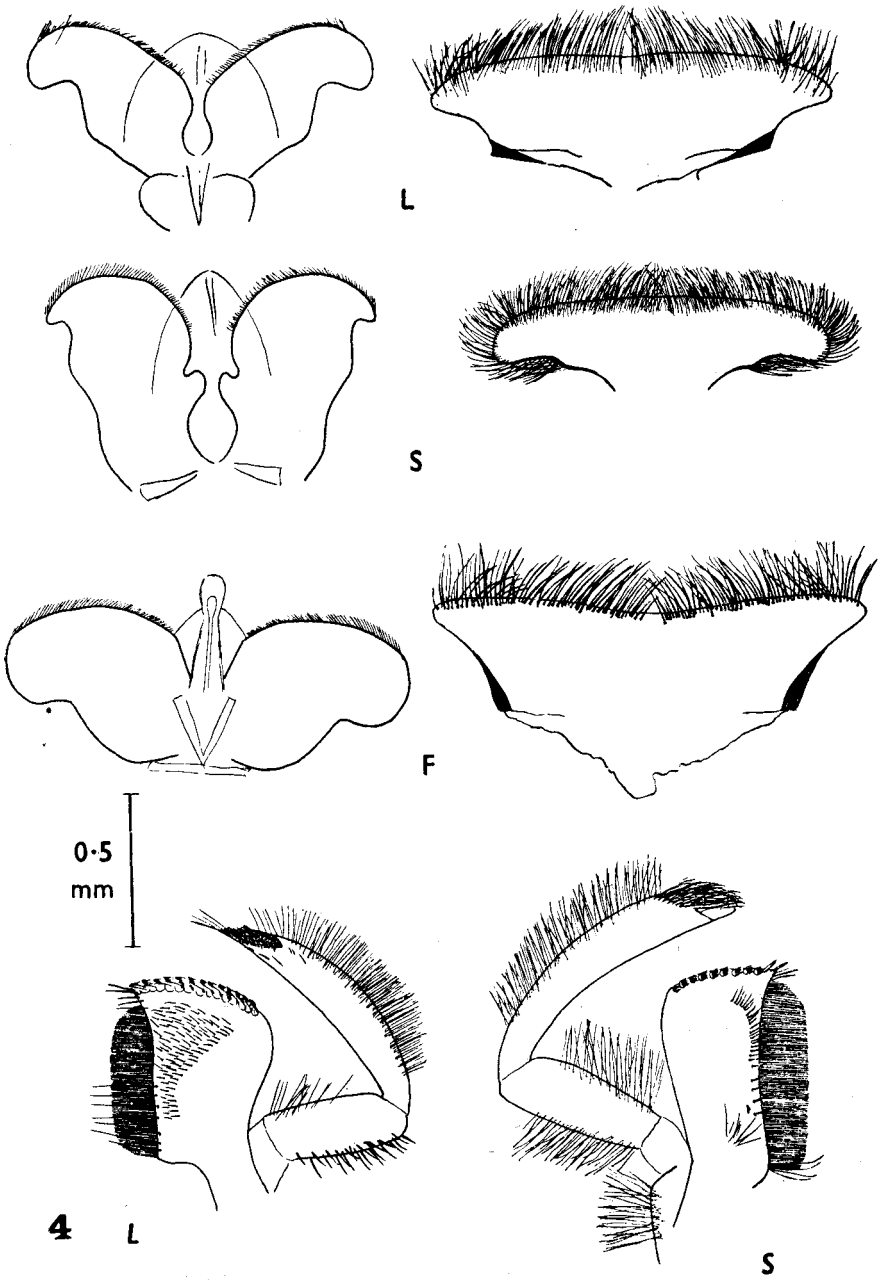


Fig. 4. Hypopharynx, labrum and maxilla of *lateralis* (L), *sulphurea* (S), *fuscogrisea* (F).

Fig. 5. Labium of *lateralis* (L.), *sulphurea* (S.), *fuscogrisea* (F).

