

DESCRIPTIONS OF THE NYMPHS OF THE BRITISH SPECIES OF
CLOEON, *PROCLOEON* AND *CENTROPTILUM* (EPHEM., BAETIDAE)

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The descriptions are based primarily on cast nymphal skins, though a certain number of preserved nymphs from the same locality have been used, and refer therefore to full-grown specimens only.

In structure the nymphs of these genera resemble those of *Baëtis* closely (Macan, 1949a) and it is unnecessary to describe more than the parts which are of taxonomic significance. Reference may be made to Macan (1949b) for a discussion on the significance of length measurements based on material of this kind. The tails, to use a simple term which circumvents the cumbersome 'cerci and dorsal caudal appendage,' end in a fine hair-like lash in all five species. It is difficult to make out whether this is complete or not and measurements of the total length of the tails are, therefore, unreliable, though it is usually easy to see that in the present five species the middle tail is only a little shorter than the outer ones in contrast to the condition in *Baëtis* where it is distinctly shorter.

Every specimen available has been examined for pattern, shape of gills, and any other feature visible with a binocular microscope, and some have been dissected and mounted for examination under a monocular microscope. The numbers dissected are shown in brackets in the lists below.

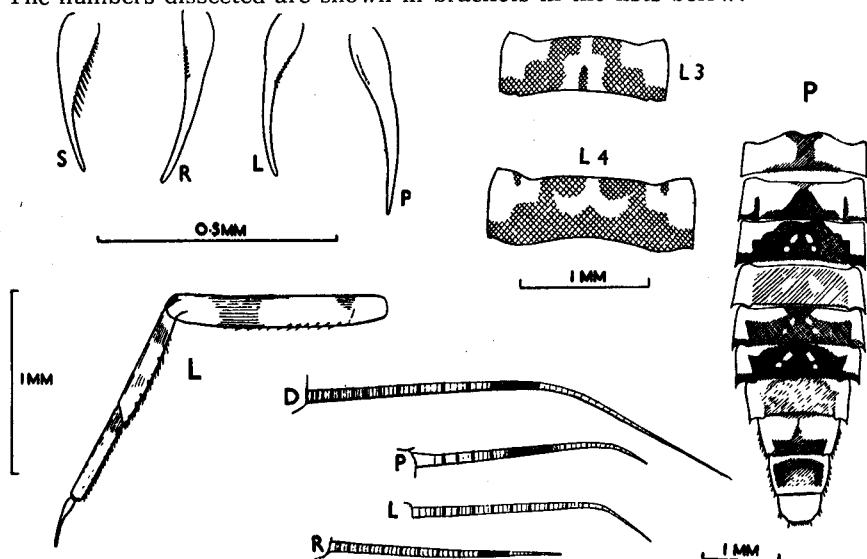


Fig. 1.—Claws of four species; pattern on abdominal tergum 3 and abdominal tergum 4 of two specimens of *Centroptilum luteolum*; pattern on abdominal terga of *C. penulatum*; cerci (outer tails) of 4 species; hind leg of *C. luteolum*. S=*Cloëon simile*, D=*C. dipterum*, R=*Procloëon rufulum*, L=*Centroptilum luteolum*, P=*C. penulatum*.

Cloëon dipterum (Linnaeus)

Material. Walker Dam, AS, 2 (1) cast skins and 3 nymphs; Clay Pond, Wray Castle, WL, 10 cast skins and 1 nymph; Blelham Beck, WL, 2 (1) cast skins; Brathay Quarries, WL, 5 (1) cast skins; Knittleton Lake WL, 6 (1) cast skins; Tarn Hawes, Silverdale, WL, 4 (1) cast skins; Wicken Lode, CB, 1 (1) nymph; Gerrards Cross, BX, 4 cast skins and 9 (3) nymphs; Bulstrode Park, BX, 2 cast skins; Headley Heath, SR, 3 (1) cast

skins; Basingstoke canal, Mytchett, SR, 2 cast skins and 6 (1) nymphs; Janesmoor, New Forest, SH, 4 (1) cast skins and 15 (1) nymphs; New Park Farm Pond, New Forest, SH, 1 cast skin; Latchmoor Brook, New Forest, SH, 1 cast skin; Newton Barrow Dewpond, SW, 1 cast skin.

I am indebted to Mr. D. Scott of Kirkcaldy for the specimens from Aberdeen.

Markings. On most specimens it is possible to make out a dark central area on each abdominal tergite, similar to that on the third tergite of *Centroptilum pennulatum* (fig. 1). There is usually a dot on either side of each segment, except the first and last, in the position of the upper dot of *C. pennulatum*. On some specimens these dots are tiny and the only light marks within the dark area, on others there is a progressive increase in size of these light areas, till finally little but the margins and a central line of the dark area remain. The unpigmented patches are usually largest on segments 4 and 7 and smallest on segments 5 and 6. In addition to the two light dots or patches there may be a triangular mark centrally at the distal end of the segment. There is considerable range and variety of pattern in the 82 specimens, though the basic pattern appears to be the same in all. Often the markings are difficult to detect and only a few specimens show a strong contrast between dark and light. Segment 4 tends to be lighter than the rest but there is no variegated effect such as that which makes *Centroptilum pennulatum* so distinctive (fig. 1).

On one specimen there are two dots on each side and the upper is elongated, so that the markings are those usually found on *C. simile*.

There is a small, but usually distinct, black band on the tails and, between it and the base, a series of dark rings (fig. 1). Some near the body are small and may be obscure. On one of the present series no more than 9 rings could be made out, 14 was the highest number recorded, but on most specimens there were 11 or 12.

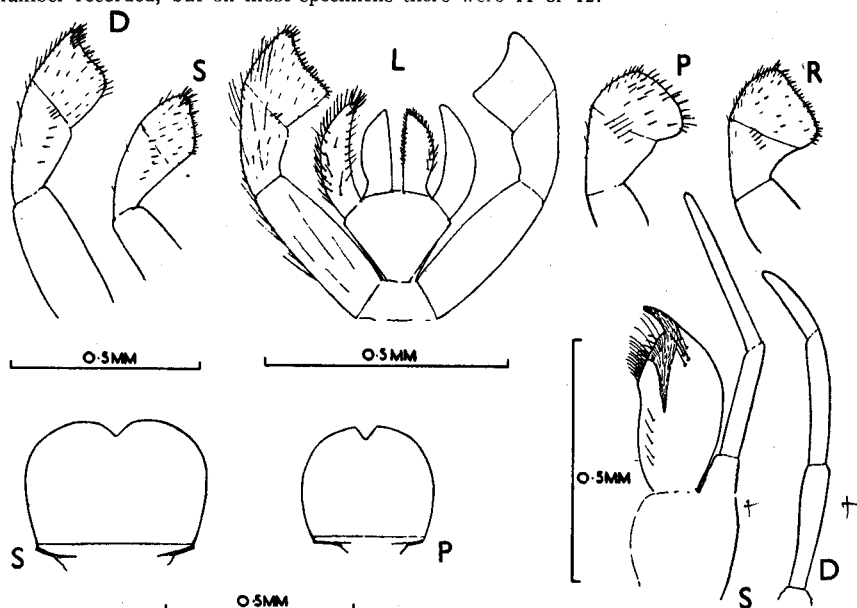


Fig. 2.—Labium and labial palps; maxillary palp and maxilla; outline of labrum. D = *Cloëon dipterum*, S = *C. simile*, L = *Centroptilum luteolum*, P = *C. pennulatum*, R = *Procloëon rufulum*.

Dimensions. The largest nymph measured 10.5 mm. from the front of the head to the tip of the last abdominal segment, the smallest 7.5 mm., and the cerci are about three-quarters of the length of the body.

Mouthparts. The labrum resembles that of *C. simile* in shape (fig. 2). Along the front margin there is a fringe of finely feathered hairs which are bifid at the extreme tip. Fine simple hairs are scattered over the upper surface and there are a few spines near the margin on the under surface. The canine area and the prosthema of the mandibles is shown in fig. 3. The maxilla is taller and narrower than that of *C. simile* (fig. 2) and lacks

the hairs at the apex near the base of the terminal tooth; the palp has three segments (fig. 2). The last segment of the labial palp has a characteristic shape (fig. 2).

Legs. The femora and tibiae are fairly uniformly covered with spines though these may be more numerous towards what, on fig. 1, is the under side; on the tarsi they are distinctly more numerous on the underside. The spines on the claws are relatively large (fig. 1).

Abdomen. The gills (fig. 4) are round and the second lamellae relatively large. Spines project from the sides of segments 5, 6, 7, 8 and 9. It is not easy to determine which spines are on the side and which are on the end at the corner, and any count is liable to an error of about ± 2 . On twelve specimens the range on successive segments starting at 5 was, 0-6, 5-8, 6-11, 8-14, 12-17.

Ecology. This species abounds in ponds but occurs also in slowly running water. Some of the ponds were without vegetation, but thick vegetation reaching the surface was characteristic of the other places.

Cloëon simile Eaton

Material. Knittleton Lake, WL, 6 (1) cast skins; Podnet Tarn, WL, 5 (1) cast skins; Yew Tree Tarn, WL, 2 (1) cast skins; Cunsey Beck, WL 1 (1) cast skin; Wicken Lode, CB, 4 (2) nymphs.

Markings. The markings show less variation than those of *C. dipterum*, perhaps because fewer specimens have been examined. On each segment there is a dark area with on either side two light dots where there is one in *C. dipterum*; the proximal is a curved line, the distal is round, and the two together resemble the 'umbrella and rain-drop' mark of *Baëtis niger* (Macan, 1949a). They are usually to be seen on segments 2-6 at least, and sometimes on segments 2-9. One specimen has only the proximal marks, which have the form of inverted commas with the tails pointing towards the centre. Segment 4 is sometimes lighter than the rest. Contrast between the light and dark areas is slight.

Mouthparts. The outer hairs of the marginal fringe of the labrum (fig. 2) are not feathered as in *C. dipterum*, and are bifid nearly down to the middle. The maxilla differs in being shorter and broader, in having 5-7 bristles at the apex, and in its two-segmented palp (fig. 2). There is a difference in the shape of the last joint of the labial palps (fig. 2).

Legs. Spines are less numerous than on the legs of *C. dipterum*, and aggregated more abundantly towards the lower margin of the tibia and tarsus, especially the latter, of which the upper half is almost free from spines.

Abdomen. The gills are pointed and the second lamellae smaller than those of *C. dipterum* (fig. 4), differences which probably afford the best distinction between the two species.

The numbers of spines on the sides of the abdominal segments are not greatly different from those of *C. dipterum*, but on two out of six specimens there are spines on segment 4.

Ecology. This species occurs in ponds (frequently with *C. dipterum*), and also in larger places where it is often found on submerged vegetation in fairly deep water.

Procloëon rufulum (Müller)

Material. Fordingbridge, R. Avon, SH, 4 (2) cast skins and 2 (2) nymphs; R. Mole above Leatherhead, SR, 6 (1) nymphs.

Markings. Even among the small number of specimens available great variation in pattern is found. There is a dark central area, as on segment 3 of *Centroptilum pennulatum* in fig. 1, and the contrast between this and the light area surrounding it is usually strong. A curved line and a dot on either side, as in *Cloëon simile*, can be detected on most specimens. On one the dark areas are all uniformly pigmented; on others the dark central area is complete on all segments, but segments 2, 3, and 6 are darker than the rest; and on a few the dark central area is only partly developed on some segments, as in *Centroptilum pennulatum* (fig. 1). Thus a specimen from the R. Mole has segment 2 with a dark central area and two light patches in it, segment 3 similar except that the curved line and dot take the place of patches, segments 4 and 5 almost completely light, segment 6 with a dark area, segment 7 all light, and segment 8 with a dark streak across the base.

The tails (fig. 1) are marked as in *Cloëon*, but there are fewer dark rings between the base and the dark band. 8 or 9 are usually distinct, and 7 to 11 is the extreme range observed.

Dimensions. The length is 7-8 mm.

Mouthparts. There are 2 or 3 hairs in the apical angle of the maxilla, the terminal joint of the labial palp bulges inwards as shown in fig. 2, and otherwise the mouthparts do not differ greatly from those of *Cloëon*. The maxillary palp has two segments.

Legs. There are fewer spines than on *Cloëon* and they are smaller. They occur along the top and the bottom of the femur; there are sometimes a few along the top of the tibia, but generally they are confined to irregular rows along the underside of the tibia and tarsus. The teeth on the claws are smaller than those of *Cloëon* (fig. 1).

Abdomen. The gills are simple, which character offers the greatest difference from *Cloëon*, and asymmetrical (fig. 4).

Spines occur on the sides of the distal segments but they are fewer than on *Cloëon*, the range on five specimens starting at segment 5 being 1-2, 2-4, 2-6, 4-7 and 6-8. One specimen had spines on segment 4, 1 on one side and 2 on the other.

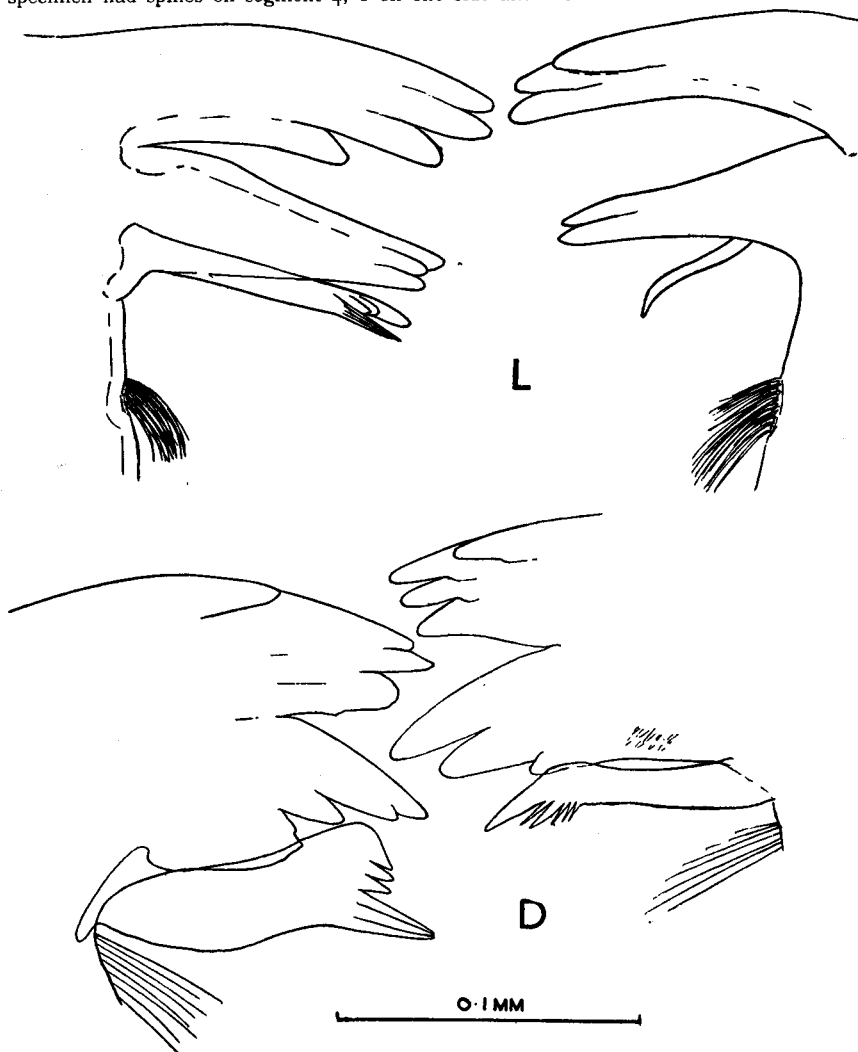


Fig. 3.—Canine area and prostheca of mandibles. L=*Centroptilum luteolum*, D=*Cloëon dipterum*.

Ecology. A few specimens were found in moss on weir walls in the R. Avon, Hampshire, and in shallow water on stones and sand in the R. Mole above Leatherhead.

Centroptilum pennulatum Eaton

Material. R. Mole above Leatherhead, SR, 5 (3) nymphs and 1 (1) cast skin.

Markings. As fig. 1 shows there is a strong contrast between the light and dark areas on the abdominal terga and this gives the nymphs a characteristic variegated appearance to the naked eye. This contrast is typical of all the specimens though on the rest the light areas are more extensive than on the specimen illustrated, patches replacing the dots on segments 3, 5 and 6, and the dark areas on the other segments being smaller.

The tails resemble those of *Cloëon* and *Procloëon* but the dark rings between the base and the dark band are fewer, 5-6 in number (fig. 1).

Dimensions. The nymphs tend to be a little larger than those of *Procloëon* but not as big as most *Cloëon* nymphs. The lengths of the four specimens dissected were 7.5, 8.0, 8.0 and 9.7 mm.

Mouthparts. The labrum has a characteristic narrow shape (fig. 2), and the maxillary palp has three segments, but otherwise the mouthparts do not differ greatly from those of *Procloëon*; there are 3-5 hairs in the apical angle of the maxilla and the hairs in the row on the penultimate segment of the labial palp (fig. 2) are longer than in any other species.

Legs. There are more spines than on *Procloëon* but fewer than on *Cloëon*. The spines on the claws can scarcely be seen with a two-thirds objective (fig. 1).

Abdomen. The first six gills are bilamellate as in *Cloëon* (fig. 4). Spines occur on the sides of segments 8 and 9 only, and not on 4 or 5 to 9 as in *Cloëon* and *Procloëon*. There were 4-6 spines on the eighth and 5-8 on the ninth segments of the four specimens dissected.

Centroptilum luteolum (Müller)

Material. R. Brathay, WL, 1 cast skin; Windermere, WL, 1 (1) cast skin; Blelham Beck, WL, 13 (1) cast skins; Cunsey Beck, WL, 3 (3) cast skins; Hog House Beck, WL, 14 (1) cast skins; Yew Tree Tarn, WL, 2 (1) cast skins; Helton Lake, WL, 5 cast skins; R. Avon, Fordingbridge, SH, 14 (1) cast skins; R. Avon, Bisterne, SH, 1 cast skin; Daggons Brook, DT/SH, 5 (1) cast skins; Bottisham Lode, CB, 15 (1) whole nymphs and 17 (2) cast skins.

Markings. From the 91 specimens it is scarcely possible to pick two with identical patterns. There is usually a well-marked central area contrasting sharply with the lighter areas at the margin of the abdominal tergites. Within the dark area there is commonly a Y-shaped light mark basally. It may be as shown in fig. 1 L4 but sometimes the two arms of the Y are narrow where they join, and swell out terminally into a round or triangular head. On a few specimens, usually on the second segment, the arms and the base of the Y are separate as three distinct dots. Specimens with the least developed light areas have but two lateral dots and the base of the Y is missing. From them it is possible to trace a steady development; first there is the characteristic Y-mark; then there are light patches to be seen near the distal margin of the segments; next the two fuse to give a pattern similar to that shown on fig. 1 L3; the dark band between the now greatly elongated arms of the Y may disappear; and on some of the Cambridgeshire specimens tiny marks between and beside the arms of the Y are all that is left of the dark area.

A distinct pattern can usually be discerned on all the segments except the first and last, but sometimes it is present only on segments 2-6 inclusive. Segment 4 is lighter and segment 6 darker than the others on most of the Cambridgeshire specimens, but on few of those from Westmorland and Hampshire.

The tails have dark rings like the other species, but are immediately distinct because there is no black band (fig. 1), though the extreme tip of the tail is often darker.

The legs have faint dark markings as shown in fig. 1.

Dimensions. This is a small species between 6.0 and 8.0 mm. long.

Mouthparts. The hairs along the front margin of the labrum, which is like that of *Cloëon* (fig. 2) in shape, are not bifid, and those on the upper surface are longer than in any other species. The mandibles differ from the rest in the deep incision which separates the teeth of the canine area into two groups (fig. 3). The maxillae differ little from those of *Cloëon simile* (fig. 1) except that the palp is three-segmented, and the number of hairs in the apical angle ranges from 4 to 8. The labial palp bears, in addition to the usual spines and hairs, very fine long hairs which are difficult to see on some specimens, and the shape of the last segment is characteristic (fig. 2).

Legs. On the femora there are only a few spines and they are confined to the lower surface. On the tibiae and tarsi spines are more numerous and longer, but they too are confined to irregular rows along the under surface (fig. 1).

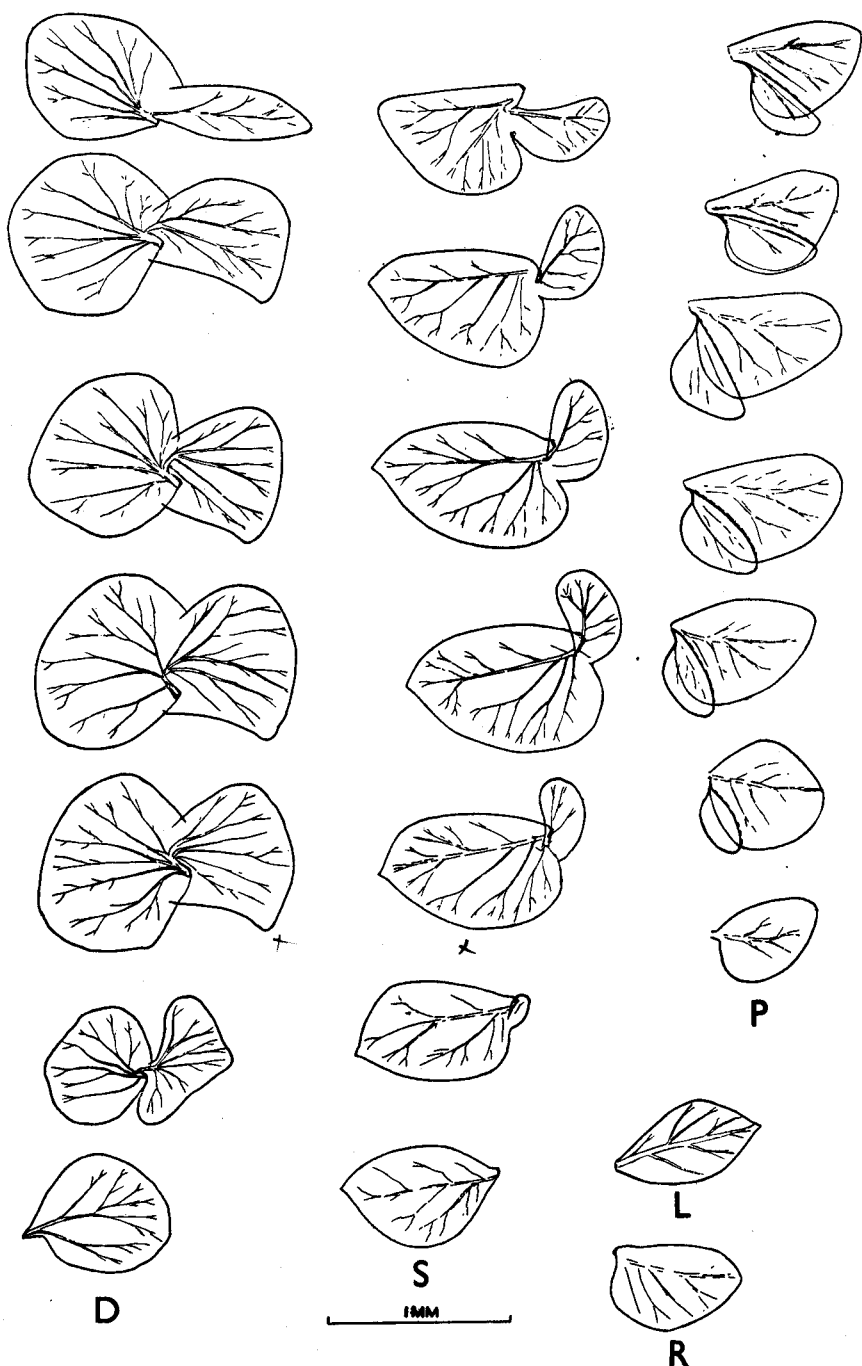


Fig. 4.—Gills of *Cloëon dipterum* (D), *C. simile* (S) and *Centroptilum pennulatum* (P); and third gill of *C. luteolum* (L) and *Procloëon rufulum* (R).

Abdomen. The gills are simple, pointed, and roughly symmetrical (fig. 4). The sides of the abdomen are without spines except for some very small ones towards the distal corners of segments 8 and 9.

Ecology. This very common species is associated particularly with dense weed-beds in slow streams and rivers, and it is found on exposed shores in Windermere.

KEY

- 1.—All gills monolamellate, round, slightly asymmetrical, and with a pigmented margin; middle tails distinctly shorter than the outer tails; tails with or without a dark band, but never with dark rings; abdominal tergites with triangular denticles along the distal margins and no other armature; penultimate joint of labial palp produced inwards to form a lobe *Baëtis*
- Gills bilamellate or monolamellate, if latter either pointed and symmetrical (fig. 4 L) or bluntly pointed and asymmetrical (fig. 4 R), and without a pigmented margin; middle tails slightly shorter than the outer tails; tails with or without a dark band, but always with dark rings; abdominal tergites with triangular denticles along the distal margin, these becoming elongate towards the margin in *Centroptilum luteolum* and encroaching onto the sides of segments 8 and 9, on which there are large spines in the remaining species; penultimate joint of palp not produced into a lobe 2
- 2.—Spines on the sides of abdominal segments 4 or 5 to 9; usually 8-12 dark rings between the base and the dark band of the tails (fig. 1) 3
- Spines on the sides of abdominal segments 8 and 9 only; usually 5-6 dark rings between the base and the dark band of the tails, or no dark band 5
- 3.—Gills bilamellate; larger species; legs with numerous relatively long spines on all parts, though most thickly toward the lower surface; terminal joint of the labial palp not bulging inwards (fig. 2); spines on sides of abdominal segments more numerous (see text); usually 11 or 12 dark rings between the base and the dark band of the tails (fig. 1) *Cloëon* 4
- Gills with single lamellae; smaller species; legs with fewer and smaller spines usually confined to the lower part of the tibiae and tarsi; terminal joint of labial palp bulging inwards (fig. 2); spines on sides of abdominal segments fewer; usually 8 or 9 dark rings between the base and the dark band of the tails (fig. 1) *Procloëon rufulum*
- 4.—Gills round, the second lamellae relatively large (fig. 4); outer corner of last joint of labial palp produced into a point (fig. 2); no hairs in the apical angle of the maxilla; maxillary palp with three segments *Cloëon dipterum*
- Gills pointed, the second lamellae relatively small (fig. 4); outer corner of last joint of labial palp not produced into a point (fig. 2); 5-7 hairs in the apical angle of the maxilla (fig. 2); maxillary palp with two segments *Cloëon simile*
- 5.—Gills bilamellate (fig. 4); relatively large spines on the sides of abdominal segments 8 and 9 (fig. 1); spines on the upper surface of the femora; cleft dividing the teeth of the canine area of the mandibles into two groups not deep; labial palp as in fig. 2; a dark band on the tails (fig. 1) *Centroptilum pennulatum*
- Gills simple (fig. 4); small spines near the distal corners of the sides of abdominal segments 8 and 9; no spines on the upper surface of the femora (fig. 1); a deep cleft dividing the teeth of the canine area of the mandibles into two groups (fig. 3); labial palp as in fig. 2; no dark band on the tails *Centroptilum luteolum*

I wish to thank Mr. D. E. Kimmins who named a number of the adult specimens for me and who drew my attention to the fact that some species have three segments to the maxillary palps and others two.

REFERENCES

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