

NOTES ON *PROCLOËON PSEUDORUFULUM*  
 SP.N (= *PROCLOËON RUFULUM* (EATON))  
 AND ON *CLOËON SIMILE* EATON  
 (EPHEMEROPTERA)

By D. E. KIMMINS

At the time that I was preparing my keys to the British species of Ephemeroptera, war-time dispersal of the British Museum (Nat. Hist.) libraries prevented me from making as full a study of the literature on *Procloëon rufulum* as I could have wished. Consequently it was considered expedient to follow Eaton's conception of the species *Cloëon rufulum* (Müller, 1776), although it was found necessary to transfer it to the genus *Procloëon* Bengtsson. Subsequent investigation, whilst confirming my views on the generic position of *rufulum* Eaton, have caused me to modify my opinion on the interpretation of Müller's species and a further change in nomenclature appears inevitable.

Müller's collection appears to be lost; according to Hagen (1844, *Stett. ent. Zeit.* 5: 141) it was probably destroyed by fire or bombardment in Copenhagen. Müller describes the species as follows (1776, *Zool. Dan. Prodr.*, p. 142): 'Eph. *rufula* diptera, fusca, cauda biseta: setis annulatis; abdominis medio albo; marginibus rufus. *Diaphanum* refert, at alae minores nullae, nec squamulae.'

Bengtsson (1913, *Ark. f. Zool.* 7(36): 13) reviewed the status of *rufula* Müller, and on the basis of the above diagnosis, especially the character 'setis annulatis', came to the conclusion that Müller's *rufula* was not the same as Eaton's, and that the only Danish species to which Müller's diagnosis could refer was *Cloëon dipterum* (L.), ♂. He further points out that the *Cloëon rufulum* of Esben-Petersen represents yet a third species, which he had described under the name *bifidum* (later to become the type of the genus *Procloëon*). There is one point, however, in Müller's description to which Bengtsson does not specifically refer, that of the abdomen (abdominis medio albo). This is scarcely typical of *Cloëon dipterum* ♂, although Eaton has described a variety with the segments two to seven translucent white. Bengtsson subsequently described yet another species of this genus (*Cloëon inscriptum*), with the segments two to seven pellucid white, and it is possible that Müller's species would fit here better than in *C. dipterum*, in which case *rufulum* (Müller) would have precedence over *inscriptum*. This a matter for Scandinavian entomologists to settle.

Eaton (1871, *Trans. ent. Soc. Lond.*, 1871: 105-6) states that the normal form of *Cloëon rufulum* (his variation 2) has white setae, thus contradicting Müller's diagnosis. He further complicated the issue by describing a variation 1, which had different coloured eyes

in the ♂ and white setae 'with dull reddish joinings'. Since it had the abdomen dark fuscous with pale yellowish joinings, it cannot be the true *rufula* of Müller.

Müller is not likely to have particularized the annulate cerci unless they were a very noticeable feature, and thus one should accept Bengtsson's view that *rufula* Müller and *rufulum* Eaton are not the same. We are thus confronted with the question of the name to be applied to Eaton's *rufulum*. Although Bengtsson was certain that Eaton's *rufulum* was not the same as his *Procloeon bifidum*, he did not specify in what respects they differed, other than the relative separation of the bases of the forceps. On comparing the two descriptions one finds that in *bifidum* the bases of the forceps are described as close together, whereas Eaton says of these structures in *rufulum* that they 'are wider apart at the base than in our other native species' (of *Cloeon*). It is possible that this difference may be due to methods of preservation. I have seen examples (Fig. B) collected by Eaton and preserved in a glycerine mixture in which the forceps are widely separated at their bases. Others, preserved dry or in dilute formalin solution, have the forceps converging or crossing and the bases leaning inwards, the membrane between them crumpled, thus giving the appearance of being closer together. On the other hand, we may have Bengtsson's *bifidum* in this country in addition to *rufulum* Eaton. In other characters the males of the two species are rather alike (I am comparing *bifidum* with variation 2, which Eaton considered the normal form of *rufulum*). Bengtsson made no suggestion that *rufulum* of Eaton was other than a *Cloeon* and in this view he was followed by Lestage, Ulmer and Schoenemund. As I pointed out in my keys (1942), the relative proportions of the first and second tarsal segments of the hind leg of *rufulum* imago determined by Eaton are as three to one, a character of the genus *Procloeon*. Both species are therefore congeneric, and although Bengtsson was certain that they were distinct, there is the possibility that he may have been misled by the contraction of the forceps-base, and that his *bifidum* and Eaton's *rufulum* are one and the same. In the absence of authentic examples of *bifidum*, I am not prepared to state definitely that Eaton's *rufulum* is a synonym of *bifidum*, and I think it better, until more information is available, to describe *rufulum* Eaton as a new species. The nymphs of both species have two-segmented maxillary palpi and simple gills. The third gill of *rufulum* Eaton as figured by Macan from British material is slightly less pointed than the third gill of *bifidum* figured by Bengtsson.

Eaton (1871) placed *Cloeon dimidiatum* Curtis, 1834, in the synonymy of *rufulum* and this name has been used by Lestage for *rufulum* Eaton. Curtis' description is very brief and most of it would apply to *rufulum* Eaton, but of the cerci he says 'white, remotely dotted with black'. This black marking suggests *dipterum* (L.) rather than *rufulum* Eaton, and I propose therefore to transfer *dimidiatum*

Curtis to the synonymy of *C. dipterum* (L.). There appears to be no other available name for *Cloëon rufulum* Eaton, and in order to link it with the name under which it has long been known, I propose to describe it as *Procloëon pseudorufulum* sp. n.

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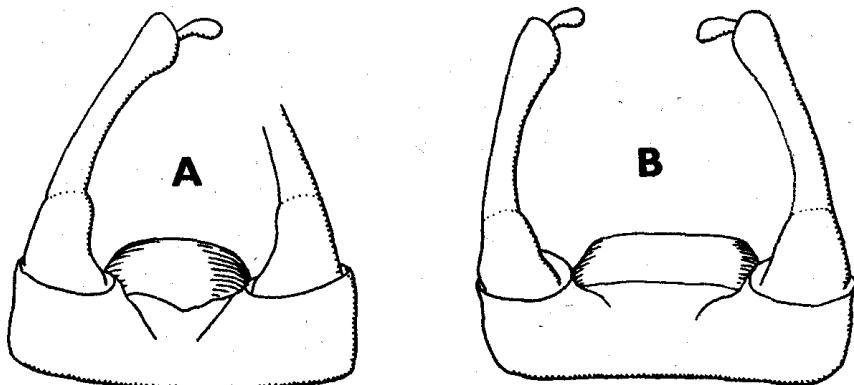
*Cloëon russulum* Eaton, 1871, Trans. ent. Soc. Lond. **1871**: 105, pl. v, Fig. 12 (misspelling of *rufula* Müller); Hagen and Eaton, 1873, op. cit. **1873**: 400.

*Cloëon rufulum* Eaton, 1885 (variation 2), Trans. Linn. Soc. (2), Zool. **3**: 188, pl. xvii, 31c, *nec* xlvi, 1.

*Procloëon rufulum* Kimmins, 1942, Freshw. Biol. Ass., Sci. Publ. **7**: 40, Figs. 20R, 21R, 34R; Macan, 1949, Ent. mon. Mag. **85**: 224, Figs. 1, 2, 4 (nymph); Harris, 1952, Angler's Entomology (Collins, London), pp. 224-6, pls. 17c, d; Kimmins, 1954, Freshw. Biol. Ass., Sci. Publ. **17**: 48, Fig. 20.

♂ (dried). Turbinate eyes dark orange (lemon-yellow in life), antennae fulvous. Thorax light brown, legs ochraceous. Wings hyaline, venation whitish. Abdomen with segments 2-6 translucent, pale ochraceous, apical margins faintly reddish, tracheal trunk blackish. Tergites 7-10 light chestnut, sternites 7-9 and the forceps-base creamy white. Forceps whitish, setae white, sometimes very faintly annulated with reddish.

♂ genitalia (from a fluid example). Forceps-base broad, the margin between the widely separated forceps somewhat membranous, and above it is a transverse, rather more sclerotized plate. Forceps with the two basal segments more or less fused, apex of the second somewhat clavate; terminal segment small, narrowly pear-shaped. As already pointed out, shrinkage of the centre of the forceps-base in preservation may cause the sockets of the forceps to approach one



*Procloëon pseudorufulum* sp.n. ♂ genitalia from beneath. Fig. A, paratype, Hereford, Kington; Fig. B, paratype, Berks., Reading, Eaton.

another more closely, as in the figure in my 1942 key, which was drawn from a microscope preparation. Even the sclerotized plate appears to become convex and less transverse (Fig. A).

♀ (dried). Thorax light brown, legs ochraceous. Wings hyaline, venation whitish. Abdomen with tergites light yellowish brown, tinged with light red, tracheal trunk black. Sternites 1-6 translucent ochraceous, 7-9 opaque ochraceous. Cerci whitish, with faint reddish annulations.

Wings of subimago light greyish or greyish white.

Length of fore wing, ♂, 7 mm.; , 8 mm.

I have selected as type and allotype a ♂ and ♀ (in 2% formaldehyde solution) from HEREFORD (Kington, R. Arrow, 17-20. vi. 1947, D. E. Kimmins); also in the British Museum (Nat. Hist.) are paratypes from the following localities:—DEVON (Newton Abbot, canal and R. Teign, Sheepwash, R. Torridge); DORSET; HANTS (Ringwood and Fordingbridge, R. Avon); SURREY (Weybridge, R. Thames); HERTS (Waltham Cross); MIDDLESEX (Laleham); BERKS (Reading); HEREFORD (Kington, R. Arrow); DENBIGH (Llangollen, canal); YORKS (R. Wharfe) and LANCS (Hawkshead). The flight time ranges from late May to September.

This species differs from *Procloeon bifidum* (Bengtsson) in having the bases of the forceps wide apart and the third gill of the nymph slightly less pointed.

#### *Cloeon simile* Eaton

This species has also been the subject of some confusion both in this country and in Europe. The adult was described by Eaton in 1870 (*Trans. ent. Soc. Lond.*, p. 2) from British examples. He stated that it was abundant at Clumber Park, near Retford, Notts., and that it also occurred at Quy Fen, near Cambridge. He gave as dates and habitat, September and October, still water. In 1885 (*Trans. Linn. Soc. (2) Zool.* 3: 186, pls. xvii, 31b, xlvii, 2) Eaton redescribed the adult, gave the continental distribution (Portugal, France, Switzerland) and figured details of the nymph. He did not describe the nymph of *simile* as such, but gave a general description of a *Cloeon* nymph.

In 1914, Bengtsson (*Ent. Tidskr.* 37: 217-8) described *Cloeon praetextum* from Scandinavia, a species closely resembling *C. simile* Eaton in the adult but differing in the number of segments of the nymphal maxillary palpus and in the structure of the gills from the details of the nymph figured by Eaton as *simile*. Lestage (1917, *Ann. Biol. lacustre*, 8: 175-186) discussed the nymphs of the European species of *Cloeon* and gave a key to them, separating *dipterum* and *simile* on the relative proportions of the last and penultimate segments of the maxillary palpus, and the relative widths of the 7th gill. He gave figures of the maxilla, mandible, labium and labrum of *simile* nymph (taken from Eaton) and the 1st, 2nd and 7th gills, also attri-

buted to *simile* but taken from Vayssiére. Now Vayssiére's figures are however said to be of *dipterum* and Lestage himself (1921, *Larves nymphes aquat. ins. Eur.* pp. 251, 253), whilst still using Vayssiére's figures to illustrate the gills of *simile*, quotes the originals in his references under *dipterum*. It is not clear whether Lestage had actually seen nymphs which he considered to be *simile* or whether his account of the species is based on Eaton's general account of a *Cloëon* nymph and his figures of *simile*. Schoenemund (1930, *Tierw. Deutschl.* 19: 47-8) listed adults of *C. simile* from a number of localities but gives no localities for the nymph, nor did he give any illustrations of the latter in his key, his characters being taken from Lestage. Thus up to this time, the adult of *simile* was recognized, but the nymph was apparently known only from Eaton's figures, while Bengtsson had described a species very similar in the adult stage to *simile* but differing considerably in the nymph.

In 1949 Macan (*Ent. mon. Mag.* 85: 224, figs. 1, 2, 4) figured and described as *simile* (from British material) nymphs which differed noticeably in various respects from the nymph figured by Eaton. Adults bred from these nymphs were similar in all respects to *simile*. The maxillary palpus had only 2 (not 3) segments, the apical margin of the terminal segment of the labial palpus was more obliquely truncate and less sinuous, the upper lamella of the gills was smaller and the apices of the lower lamellae more pointed. Macan did not comment on these discrepancies from Eaton's figures in his paper (although we had discussed them in correspondence), merely acknowledging that I had identified some of his adult material and had drawn his attention to the fact that certain species had two-segmented maxillary palpi. Macan's figures much more closely resemble the nymph of Bengtsson's *C. praetextum* than Eaton's *simile*.

We are thus faced with the confused situation in which, from British material (the type-country of *simile*), two quite different nymphs have been described as *simile*. Have we possibly two species in Britain, closely resembling each other as adults but differing widely as nymphs, or has an error in identification occurred? When Dr. Macan was preparing his paper on the nymphs of *Cloëon*, I searched our collections for nymphal material of *C. simile* determined by Eaton and found two sets of small tubes, each set containing individual, dissected mouth-parts of nymphs and labelled by Eaton '*C. simile*', and a tube containing a complete nymph, also labelled *simile*. These dissections have now been mounted as microscope preparations, and were presumably dissected by Eaton as models for the illustrations to his big monograph. One of these sets of dissected mouth-parts has a *three-segmented* maxillary palpus and the other a *two-segmented* palpus! The complete nymph also had a two-segmented palpus and the gills were of the pattern figured by Macan as a *simile*. I have recently compared Eaton's figures of the details of *simile* with dissections of *dipterum* and could find no appreciable difference, even the terminal

segment of the maxillary palpus being clearly shorter than the penultimate segment.

It is obvious from these facts that there has been some confusion in the labelling of Eaton's collection and that he either gave his artist dissections of *dipterum* which had been wrongly labelled as *simile*, or that he intended that most of the details of the *Cloëon* nymph should represent the common species *dipterum*, but by an oversight they were attributed to *simile*. A third possibility is that he did not fully appreciate the distinctions between the nymphs of the various species of *Cloëon*. I incline to the view that there were errors in the labelling of his collection, a view which gains support from the fact that the whole nymph figured as *C. rufulum* on the same plate, clearly shows the gills to be bilamellate, with the upper lamella smaller than the lower, a character of *Cloëon simile* as figured by Macan. Until this view be disproved by breeding an adult of *simile* from a nymph of the *dipterum* pattern (three-segmented maxillary palpi, bilamellate gills with large upper lamella), I propose to continue to accept Macan's diagnosis of *simile* nymphs as correct. I do not however consider the situation as finally clarified and one purpose of these notes is to draw attention to the confusion existing on the plate dealing with *Cloëon* nymphs in Eaton's monograph, in the hope that further field work will be stimulated.

If my hypothesis of an error in labelling proves correct, Bengtsson's *C. praetextum* may possibly prove to be a synonym of *C. simile* Eaton. There are however slight differences in the shape of the gills of *simile* as figured by Macan and of *praetextum* as figured by Lestage (1917) under the name of *Procloëon* sp., which according to Bengtsson (1936, *Opusc. Ent.* 1:5) is his *C. praetextum*.

This paper affords an opportunity to comment on one other case of synonymy affecting British species of *Cloëon*.

#### *Cloëon dimidiatum* Lubbock

1863, *Trans. Linn. Soc. Lond.* 24: 61-67, pls. 17-18; id., 1865, op. cit. 25: 277-492, pls. 58-59.

Eaton (1870) identifies this with his interpretation of *C. rufulum* (Müller), which is now placed in the genus *Procloëon*. The species dealt with by Lubbock in his work on the development of the nymph (identified for him by F. Walker) cannot be Eaton's *C. rufulum*, since the figure of the ♂ hind leg shows the basal segment of the tarsus to be only about twice as long as the second segment, a character of *Cloëon*. In the figures of the nymph, the apex of the terminal segment of the labial palp is obliquely and sinuously truncate, the maxillary palpi are stated to have three segments and the gills are bilamellate. Furthermore, Lubbock says the nymphs are very common 'in our Kentish ponds', which would certainly not be true of Eaton's *Cloëon rufulum*, which is neither common in N.W. Kent nor an inhabitant

of ponds. I consider that Lubbock's insect was certainly *C. dipterum* (L.). It is interesting to note that in the British Museum (Nat. Hist.) copy of Walker's List of the Specimens of Neuropteroous Insects in the Collection of the British Museum, 1853, there are manuscript annotations by Eaton (undated) and against *Cloeon dimidiatum* (p. 580) he has written '=*dipterum*'.

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