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Taxonomy and ecology of European species of the *Cloeon simile* Eaton group (Ephemeroptera: Baetidae)

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The nomenclatural analysis of *Cloeon simile* Eaton and *C. praetextum* Bengtsson stat.nov. and the discussion of morphological differences between these species for all development stages were carried out on the basis of material from Middle and Western Europe. A neotype of *C. praetextum* was designated from Bengtsson's original collection. The description of nymphs and imagines of *C. schoenemundi* Bengtsson and imago male of *C. degrangei* n.sp. are given on the basis of material from France. The taxonomic validity and systematic position of the species *C. hovassei* (Verrier), *C. rabaudi* (Verrier) and *C. languidum* Grandi are discussed. Remarks on the distribution and ecology of some of the more abundant species are included.

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European species of the genus *Cloeon* Leach may be classified into what seems to be two natural groups: the *C. dipterum* (Linnaeus) group and the *C. simile* Eaton group. In an earlier note (Sowa 1975) I gave the taxonomic characteristics of the former which in Europe includes at least 3 closely related species. As compared with this, the *simile* group is characterized by the following systematic features:

Imagines: second segment of the hind leg from 1.5–2.0× shorter than first segment. Costal and subcostal field of wing colourless. Abdomen without bright maculation. Turbinate eyes of males low, basal segments of forceps meet or almost meet on the ventral surface of the body. Penis in the form of a broad lamella.

Nymphs: maxillary palp 2-segmented. Tails slightly shorter than abdomen. Terminal part of tail devoid of long hairs short not longer than 1/4 of tail length. Gills pointed, tracheation "semipalmatic", the dorsal flap relatively small, in some species it also appears as a rudiment on the seventh gill. Chorion of the eggs sculptured. An oviparous species.

The present note is an attempt at determining the species content of the *simile* group in Europe. The analysis was based on a moderately rich material, a large number of which was reared, from several European countries.

Cloeon simile Eaton, 1870, and **C. praetextum** Bengtsson, 1914 stat. nov.

Figs. 1–6, 30, 31; 7–18, 22.

Designation of neotype of *C. praetextum*

The taxonomic relation between these two nominal species is still very uncertain. *Cloeon simile* was described on the basis of English material, and the lectotype designated by Kimmins (1960) is preserved in the British Museum (Nat. Hist.), London. Nymphs of this species had not been recognized until Macan's (1949) description also on the material from England. Data about the eggs were given by Degrange (1960) on the basis of material from France; these data are in agreement with the English material.

C. praetextum was described by Bengtsson (1914) from Swedish material (imagines and nymphs; the type locality not quoted) which were previously determined by this author as *C. simile* (Bengtsson 1913). In analysing Eaton's species Kimmins (1957) suggests their possible

identity with *C. praetextum*. Also Landa (1969) and Dahlby (1973) claim that the two species are synonymous, while Grimeland (1966) and Ulfstrand (1969) report only *C. simile* from different parts of Scandinavia. Puthz (1978) gives a joint distribution of the two species in Europe.

In my opinion these taxons are separate, true species, though they undoubtedly are very closely related and often mistaken for each other by European investigators. Those who favour their synonymization do not take into consideration the distinct differences in the sculpturing of the egg chorion. It is densely covered with round attachment structures in *C. simile* (Degrange 1960: 43, Figs. IV: 7, 8) while in *C. praetextum* the mosaic of multiangular depressions is clearly visible (Bengtsson 1913: 297, Fig. VII as *C. simile*; Degrange 1960: 43, Fig. III: 5 as *C.* sp.). Bengtsson's Swedish collection from the Zoological Institute of Lund University placed among "*Cloeon praetextum*" (as determined by S. Bengtsson) includes several females, imago and subimago, with eggs of the *simile* form and one female subimago with eggs whose appearance is in agreement with Bengtsson's (1913) description. This fact suggests that both of these species occur in Sweden and that they were both used by Bengtsson to describe his new taxon—in some stages at least. Since material collected by Bengtsson before 1914 do not include females and both males and nymphs of the two species are difficult to differentiate, I decided to designate the neotype of *Cloeon praetextum*, the above-mentioned female subimago. It was caught in Aneboda, at Lake Stråken (Småland), 29.VII.1916 (leg. S. Bengtsson) and remains in Bengtsson's collection in Lund.

This female is almost completely discoloured. It has no cerci or middle legs. The body is 7.5 mm and the wings are 7.0 mm in length. The following proportions between the segments of the legs were found:

	femur	tibia	tarsus			
fore leg	12.5	10.0	3.5	2.0	1.2	2.6
hind leg	13.0	10.0	2.8	1.3	0.9	2.4

Chorion of eggs is covered with swellings resembling irregular polygons, frequently with hardly visible margins. No attachment structures were observed. Eggs are 190–192 μm in length and 108–113 μm in breadth (Figs. 7–10).

Comparative analysis of the two species

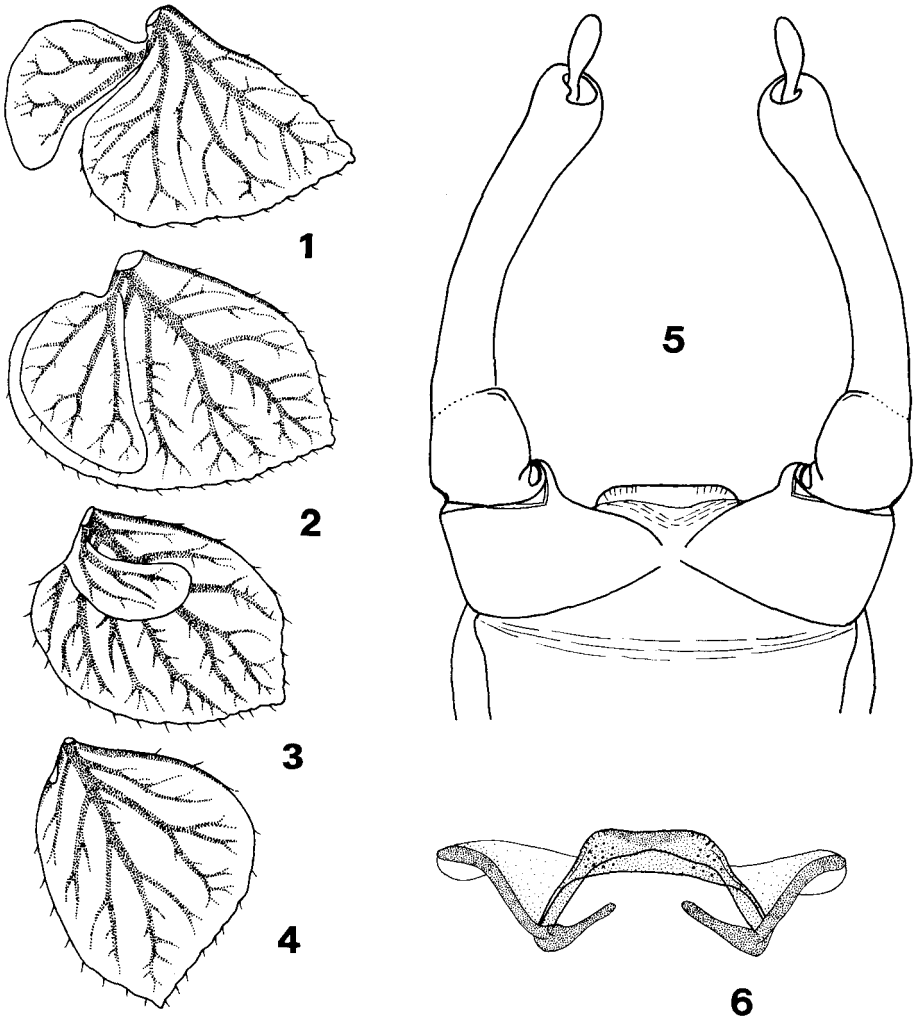
It was not possible to determine the reliable taxonomic differences between the two species because the available material was not sufficiently representative and fresh, and also because of the geographical variability. These differences should be analysed on numerous reared and well pigmented specimens. The features discussed here concern specimens collected chiefly from the European continent. They are preserved in alcohol and the two species have therefore a similar general coloration. The dimensions are also comparable.

Adult males

Both species have pale green, distinctly flattened turbinate eyes with a broad black rim around the upper margin (Fig. 30, 31). In *C. praetextum* they are proportionally slightly higher and seen from above, slightly longer. Legs of *C. praetextum* are slightly more slender and in the hind leg the second segment is almost 2× shorter than the first, while in *C. simile* it is usually only 1.5× as short as first segment. In *C. praetextum* the second segment of the forceps is usually more stumpy and with a distinct ventral swelling at the end (Figs. 5, 15). The third segment of the forceps is more broadened terminally in this species (Figs. 5, 15, 18). Differences in the general shape of the forceps can be better observed in the material from the Alps than in that from Poland. The penis is relatively shorter and more enlarged in *C. praetextum,* having an irregularly rounded terminal margin. In *C. simile* it is fairly distinctly of trapezoid form (Figs. 6, 16, 17).

Adult female and subimagines

In female *C. praetextum* the longitudinal veins, especially near the wing base, are distinctly brown and clearly visible. In female *C. simile* they are usually light and not distinctly contrasted with the wing membrane. Differences in the proportions of segments of the hind legs in the females and the subimagines of both sexes are similar to those in imago males. *C. praetextum* imago and subimago female can be easily determined on the basis of egg chorion.



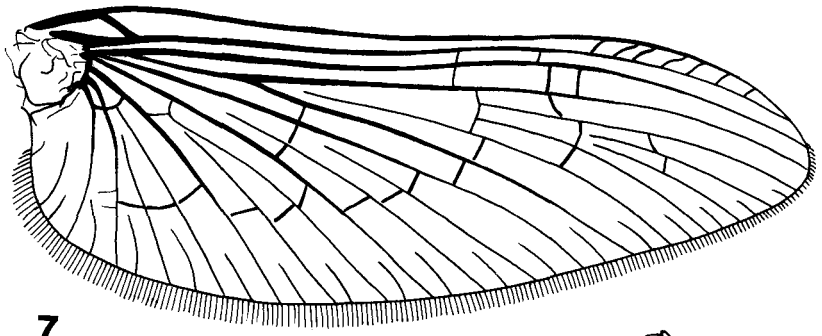
Figs. 1–6. Cloeon simile Eaton, mature nymph and imago male. — 1, 2, 3, and 4. First, third, sixth and seventh gill. — 5. Genitalia from ventral surface. — 6. Penis from ventral side. Material from Southern Poland.

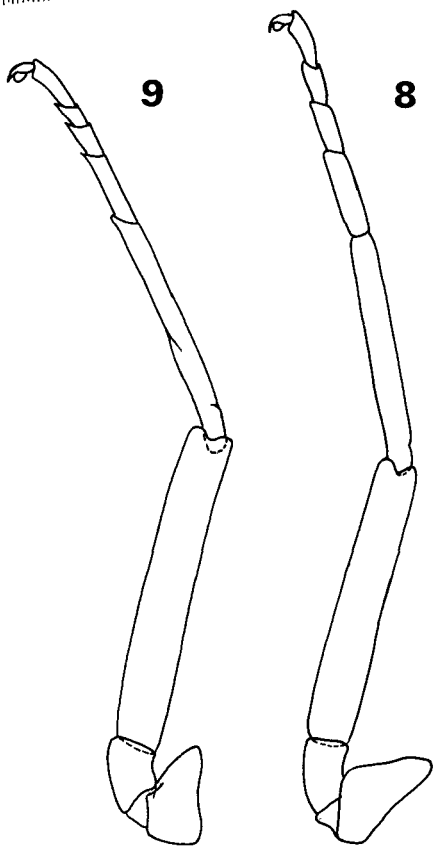
Eggs

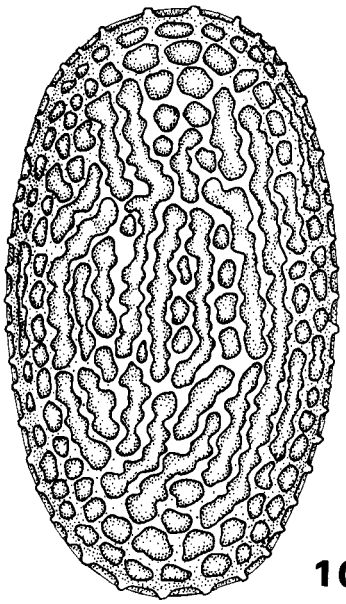
The eggs of the two species show certain geographical variability with regard to dimensions and chorion sculpture. Eggs of *C. praetextum* from Lake Hańcza are covered with regular polygons (Fig. 22). The egg sculpture of females from Austria is similar to that of the neotype (Fig. 10), while the eggs from France are an intermediate form between the eggs from Sweden and Poland. In *C. simile* this variability is chiefly manifested by the greater size of attachment structures in material from England as compared with those from continental material.

Nymphs

Appearance of nymphs of the two species agrees with the description given by Macan (1949) for *C. simile*. Upon analysing the structure of mouthparts, pilosity of legs and tails, and the microstructure of the body surface, no distinctive features were found. Some, though hardly observable differences appear in the shape of



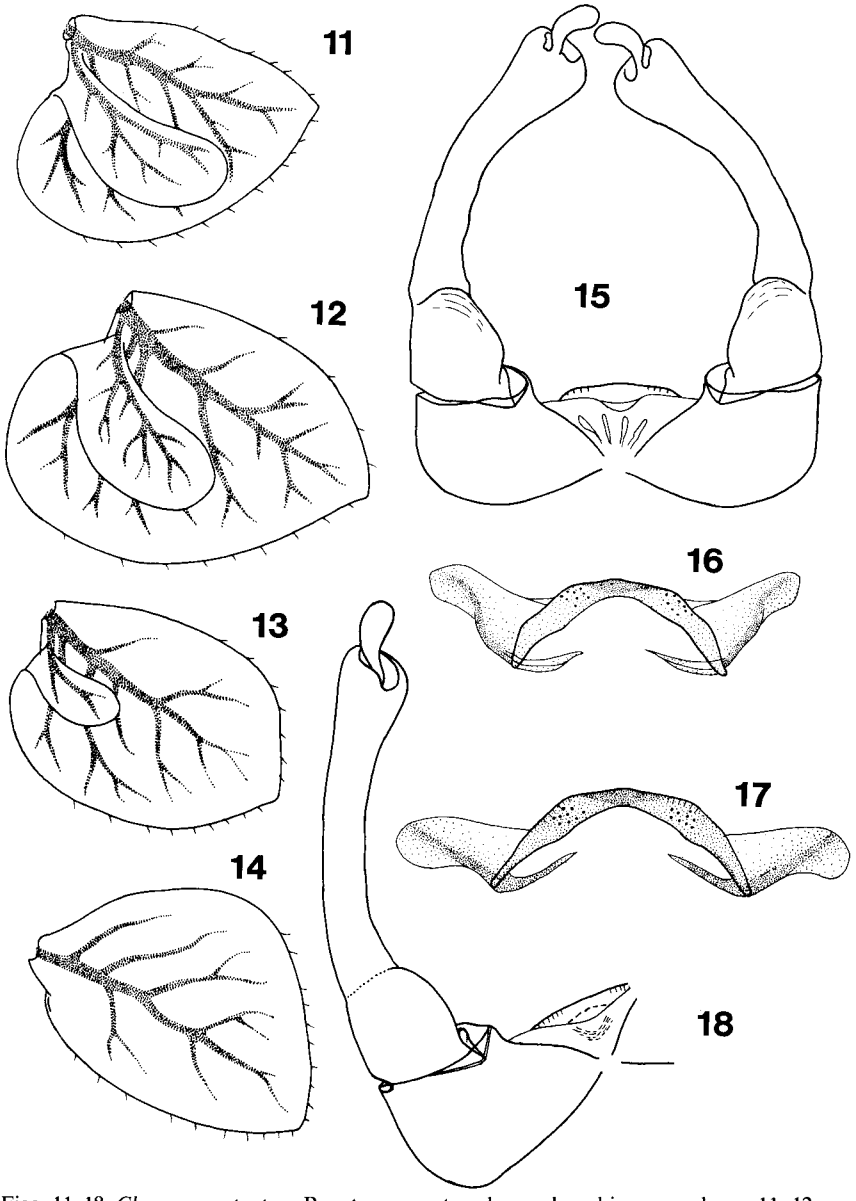




Figs 7–10. *Cloeon praetextum* Bengtsson, neotype subimago female. — 7. Wing. — 8 and 9. First and third leg. — 10. Egg. Material from lake Stråken, Sweden.

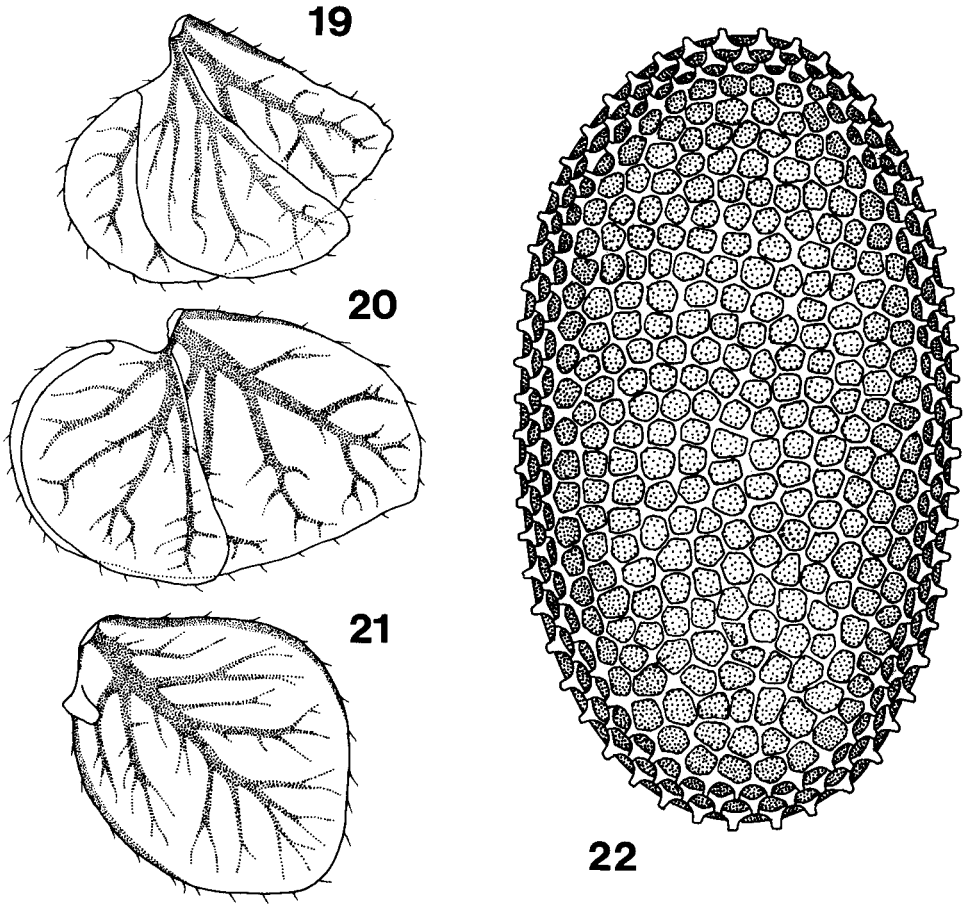
the gills. The gills of *C. simile* are more pointed at the end, and with a more distinctly undulating margin. The seventh gill is usually more distinctly asymmetrical and the dorsal flap on a few of the first gills is usually more markedly narrowed at the end (Figs. 1–4, 11–14). In both species the dorsal flap sometimes appears also on the seventh gill in the form of a marginal rudiment or a swelling hardly visible under the microscope.

Material. Cloeon simile Etn.: Sweden: 1 nymph ♀, matured, Bromölla, Skåne, 12.VI. 1915. Leg. S. Bengtsson. Poland: 5 ♂ imago, 5 ♀ imago, 7 ♂ ♀ subimago, 15 nymphal exuviae, 17 nymphs, Kraków, culture tanks in the garden of Inst. Environm. Biol., alt. 200 m, 20.VII – 15.VIII.1973 (reared), leg. R. Sowa.— France: 1 ♂ i., 1 ♀ i., Lac d'Annecy, Haute-Savoie, alt. 448 m, 28.IX.1958; 5 ♂ i., 1 ♀ i., 1 ♀ si., 8 n., Lac du Lait, Massif de la Vanoise, Savoie, alt. 2180 m, 5.IX.1973; 4 ♂ i., 4 ♂ si., 3 ♀ i., 2 ♀ si., numerous n.e., a pond in Réaumont, Bas Dauphiné, alt. 335 m,



Figs. 11–18. *Cloeon praetextum* Bengtsson, matured nymph and imago male. — 11, 12, 13 and 14. First, third, sixth and seventh gill. — 15 and 18. Genitalia from ventral side. — 16 and 17. Penis from ventral side. Material from Lunzer Obersee, Austria (11–14), from lake Faucille, France (15 and 16) and from lake Hańcza, Northern Poland (17 and 18).

20.IX.1957; 7 ♂ i., Lac de Laffrey, Plateau de la Matheysine, alt. 911 m, 1.VI.1955; 2 ♂ si., 1 ♀ i., 2 n.e., Grenoble, culture tank at the Inst. Zool. alt. 210 m, 15.IX.1957 (reared), leg. Ch. Degrange. — England: 1 ♂ i., 1 n.e., Hodsons Tarn, Westmorland, 13.X.1975; 1 ♀ i., 1 n.e., id., 15.X.1978 (reared), leg. T. T. Macan. — *Cloeon praetextum* Bngtss.: Poland: 1 ♂ i., 1 ♀ si., Lake Hańcza, near Suwałki, alt. 227 m, 20.VIII.1965, leg. R. Sowa. — Austria: 2 ♂ i., 1 ♀ i., 2 n.e., Lunzer Obersee, 16.IX.1973, leg. T. T. Macan. — France: 3 ♂



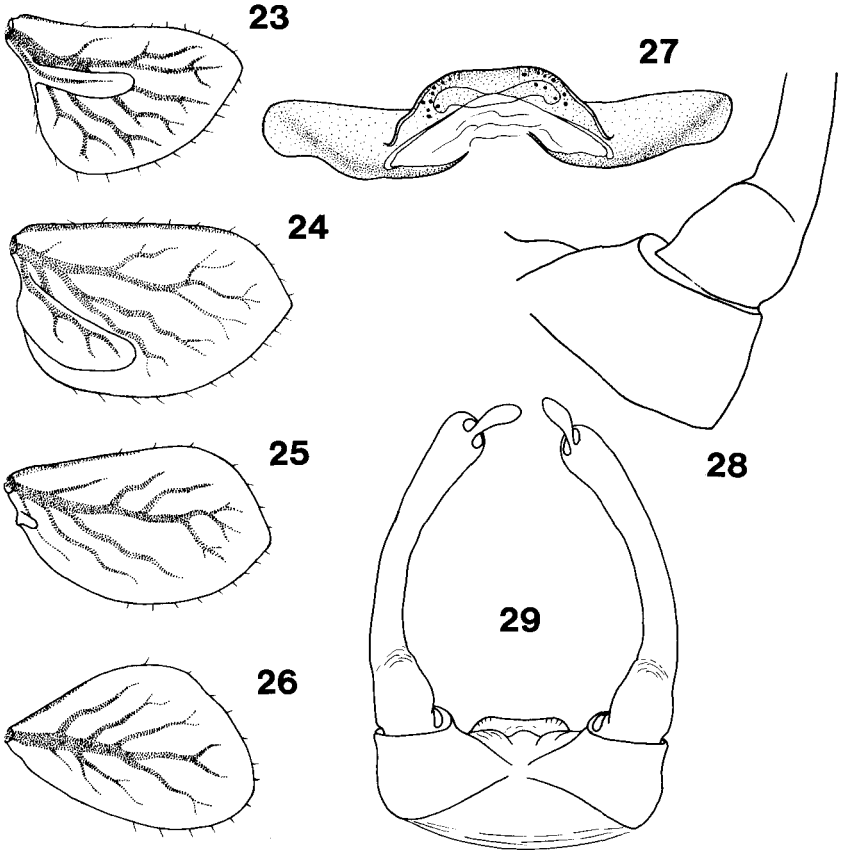
Figs. 19–22. *Cloeon* sp., matured nymph and *C. praetextum* Bengtsson, egg of female subimago. — 19, 20 and 21. First, third and seventh gill. — 22. Egg. Material from Narew River (19–21) and from lake Hańcza, Northern Poland.

i., 2 ♀ i., 1 ♂ si., 7 n.e., Lac Punay, Massif du Taillefer, Isère, alt. 1695 m, 18.VIII.1963; 4 ♂ i., 2 n., Lac Faucille, Massif des Rousses, Isère, alt. 2063 m, 27.IX. 1963; 18 ♂ i. and si., 11 ♀ i. and si., 9 n.e., Lac de l'Infernet, Massif de Belledonne, Isère, alt. 1950 m, 18.IX.1955, leg. Ch. Degrange.

Cloeon schoenemundi Bengtsson, 1936
Figs. 23–29.

This little known species was originally described on the basis of nymphs, probably not full-grown ones, caught by C. Wesenberg-Lund in Denmark (Furusöen). One of these nymphs sent as *Procloeon bifidum* Bengtss. by Bengtsson to E. Schoenemund was used by the latter (Schoenemund 1930: 92, Figs. 161, 162) in describing nymphal features of the genus *Procloeon* Bengtss. Describing the new species, Bengtsson (1936) corrected his own mistake and gave the corected features of nymphs of the two genera. I do not know what happened to the nymphs of the type series of this species; I identified the material from France quoted below as *C. schoenemundi* on the basis of a striking resemblance in the shape of the gills. Due to the small number of specimens, this material cannot be regarded as a satisfactory supplement to the insufficient original description. Therefore, the species should be further investigated, especially on the basis of Danish populations.

The nymphs, with body length of 9–11 mm, do not show any observable differences in their ex-



Figs. 23–29. *Cloeon schoenemundi* Bengtsson, mature nymph and imago male (23–28), and *C. degrangei* n.sp., imago male (29). — 23, 24, 25 and 26. First, third, sixth and seventh gill. — 27. Penis from ventral side. — 28. Fragment of forceps from ventral side. — 29. Genitalia from ventral side. Material from France.

ternal morphology and maculation as compared with nymphs of the two species discussed above. Only their gills are distinctly more slender, less asymmetrical, having the dorsal flap poorly developed or, in the case of the sixth gill, rudimental (Figs. 23–26).

No well preserved winged specimens are available. The genital organs of only one of the two adult males can be observed. But even in this specimen the genital organs are partly damaged. The penis resembles that of *C. praetextum* while the preserved fragments of the forceps and the burbinate eyes are more similar to *C. simile* (Figs. 27, 28). Body length is 9 and 10 mm, wing lengths 8.5 and 9 mm. The structure of the chorion does not differ from that of *C. simile* eggs. The size of the eggs is also comparable. Body length of female is 9.0–10.5 mm, wing length 8.0–9.5 mm. Proportions of legs segments for the imagines of two sexes:

♂	femur	tibia	tarsus			
fore leg	10.2	12.2	4.8	4.4	2.9	1.9
middle leg	8.0	6.2	1.6	1.0	0.7	1.5
hind leg	8.5	6.2	1.6	1.0	0.7	1.5
♀						
fore leg	7.9	6.5	1.6	1.2	0.8	1.7
middle leg	7.9	5.8	1.5	0.9	0.6	1.6
hind leg	8.7	6.1	1.6	1.0	0.7	1.6

Material: France: 2 ♂ i., 2 ♂ si., 3 ♀ i., 2 ♀ si., 7 n.e., a pond in Réaumont, Bas Dauphiné, alt. 335 m. III–IV.1957 (reared), leg. Ch. Degrange.

Cloeon degrangei n.sp.
Figs. 29, 32, 33.

Type locality: France, la Gaude River.
Type material: *Holotype* imago ♂ "France, la Gaude River, Alpes Maritimes, alt. 250 m, 4.VIII.1967, leg. Ch. Degrange". In coll. Brit. Mus. (Nat. Hist.), London. — *Paratypes*: same data as holotype, 8 i. ♂, in coll. Sowa.
Diagnosis: C. degrangei n.sp. differs from other taxons of the *simile* group by the following combination of characters: body very pale, wings with delicate colourless veins, turbinate eyes relatively large and uniformly pale, forceps slender, body small.
Derivation of name: Dedicated to the collector, Prof. Charles Degrange, Sci. & Med. Univ., Grenoble.

Description

Adult male (alcohol preserved)

Body length 6 mm, wing 5 mm, cerci 10–11 mm.

Body very pale. Thorax dirty-yellowish, portions of mesonotum light-brown. Abdomen whitish-grey, segments 2–7 transparent. Sides of segments with single longitudinal violet line (trachea), distinctly visible against the pale background of abdomen. Wings transparent with delicate, light and hardly visible veins. Pterostigma smoky-whitish. Turbinate eyes large, mushroom-shaped in profile, light yellowish. A dark narrow rim around the upper margin (Figs. 32, 33). Legs slender, pale whitish grey. Proportions of leg segments: fore leg: 6.8, 8.2, 3.3, 2.9, 2.0, 1.0; middle leg: 5.1, 3.7, 1.1, 0.7, 0.5, 1.0; hind leg: 5.7, 3.9, 1.1, 0.6, 0.4, 0.9. Cerci uniformly whitish. Forceps whitish, basal segments meet on ventral surface. Second segment slightly swollen on ventral surface, gradually passing into third segment. Penis of *C. simile* type (Fig. 29).

Imago female, subimagines and nymph—unknown.

Cloeon sp.
Figs. 19–21

Here I have classified 3 nymphs caught in the middle course of the Narew River in Poland. In general, they are very similar to *C. simile* nymphs, although they differ by their strongly developed gills with an upper process (Figs. 19–21).

Material: 1 fully grown nymph, 2 half-grown nymphs, the Narew River at Strobla, Northern Poland, 17.VIII.1966, leg. W. Mironiuk.

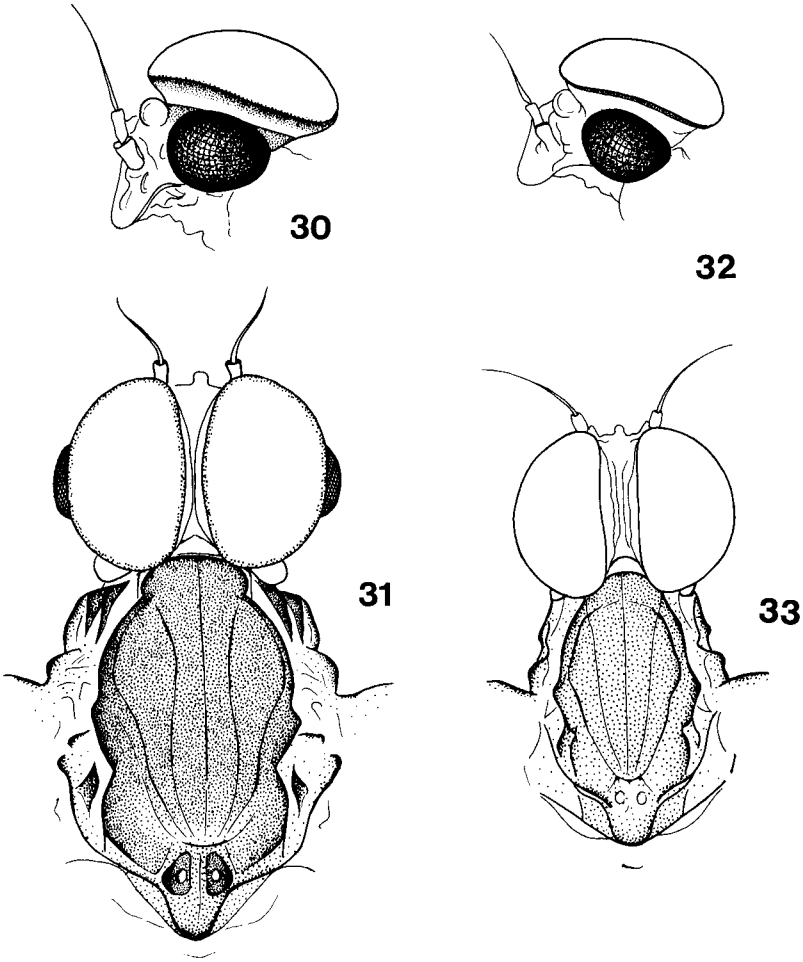
Remarks about other European species

Verrier (1949, 1949a) described two species in the genus *Procloeon* Bengtsson found in France, which should be classified in the group of species discussed here. These are *Cloeon hovassei* (Verr.) and *C. rabaudi* (Verr.). The lack of specimens from the type series and also evident mistakes in the original description of both species make their identification difficult. In the case of *C. hovassei* it is most probable that Verrier found either *C. simile* or *C. praetextum* in the two described stages. Nymphs of *C. rabaudi* also seem to belong to one of these two species The description seems to suggest that this is case, except for the general shape of the nymph (Verrier 1949: 185, Fig. 1). Recently, I have received five slides of nymph parts, chiefly gills of Verrier's collection from Lyon determined by him as "*Procloeon hovassei*" and "*P. rabaudi*". Since no other data are given on these slides, it is difficult to tell if they are a part of the original series. In my opinion the prepared fragments belong to *C. simile*. The collection also contains several imago males identified as "*P. hovassei*". They originate from lakes Oredon and Juets and are not therefore of the type series. These males belong to *C. simile* and in part also to *C. praetextum*. A separate problem is the description of imagines of *C. rabaudi*. Judging from the coloration of the male and female, the general appearance of the male and the proportion of the leg segments (Verrier 1949: 187, Fig. 3), Verrier's taxon does not belong to the *simile* group but most probably to the *C. dipterum* (L.) group.

C. languidum Grandi, 1959, described from Romagna (Cesena) in Italy, also belongs to the *simile* group. Its penis is relatively shorter, and it differs markedly from other species of the group by having a distinct side arrangement of the basal segments of the forceps (Grandi 1959, 1960, 1960a).

Remarks on the distribution and ecology

Most data on the distribution and ecology of *C. simile* from the European continent and Scandinavia need revision since they may refer to more than one species. However, it seems that *C. simile* and *C. praetextum* are widely distributed in Europe (Puthz 1978) and their identification will be easier on the basis of future



Figs. 30–33. *Cloeon simile* Eaton (30 and 31) and *C. degrangei* n.sp. (32 and 33), imago male. — 30 and 32. Head from the left side. — 31 and 33. Head and fragment of abdomen from above. Material from Southern Poland and France.

regional keys. Nymphs of these two species live on organic bottom sediments and among aquatic macrophytes in various types of stagnant water in lowland and submontaneous regions. In the french Alps they also inhabits lakes up to an altitude of 2000 m. They also live in the calm marginal parts of large and medium-sized lowland and submontaneous rivers. They usually accompany species of the *dipterum* group, but invariably in much smaller numbers. The life-cycle of *C. simile* has only been examined in detail in England (Macan 1970) where this species has a summer and winter generation. Nymphs are present in their habitats throughout the whole year but growth is arrested in winter. A similar life cycle for this species was observed in Southern Poland.

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