



# A Redescription of *Ephemerella maculocaudata* Ikonomov with Notes on Balkan Species of the Genus *Ephemerella* (Ephemeroptera, Ephemerellidae)

Tomáš Soldán

Institute of Entomology, Czechoslovak Academy of Sciences, Praha

The genus *Ephemerella* Walsh consists of 11 species in Europe. Of these, two species are distributed only in North Europe, two are West-Mediterranean and seven are known from Southeastern Europe. Three species were described from Yugoslavia by Ikonomov (1961). Since then these species have never been collected. Moreover, the descriptions are based mainly on larvae and biology of these three species remained quite unknown. The findings of *E. maculocaudata* and *Chitonophora* sp. nympha *unicolorata* in Bulgaria (basin of the river Struma) enable detailed study of these insufficiently known species. In the present paper redescription (adult male and subimago described for the first time) and notes on biology of the former and study of larval morphology resulting in change of the status of the latter are presented. The data concerning remaining five Balkan species are summarized and critical characters distinguishing these species are keyed.

## *Ephemerella maculocaudata* Ikonomov

(Plate I — 1—6) *Ephemerella maculocaudata* Ikonomov, 1961, p. 56.

**Mature larva.** Body length 6.0 (5.5-6.8) mm, length of cerci 4.8 (4.5-5.2) mm. Head light brown or brownish with wide pale band along the epicranial suture and pale spots on genae; eyes black, antennae whitish yellow, scape and pedicel without bristles, setae on frons and clypeus. Labrum rounded, distinctly wider than long (length : width 2.0 : 3.8), with marginal fringe of stout setae; two groups of setae situated anterolaterally. Anterior margin of labrum arcuately incurved. Outer incisors of maxillae about twice wider than middle ones, slightly longer, with 4-5 bluntly pointed teeth; middle incisors with 2-3 teeth; inner incisors with bundle of bristles. Maxillae with bristles near lateral margins. Hypopharyngeal lingua oblongshaped, coarsely covered with microtrichia; superlinguae rounded as wide as lingua with marginal

fringe of setae. Maxilla with concave outer margin, 4-5 stout spines at apex. Maxillary palp without bristles, ratio segment 1 : segment 2 : segment 3 — 1.5 : 8.8 : 1.2. Glossae and paraglossae bluntly pointed, segment 3 of labial palps triangular, about twice longer than wide at the basis.

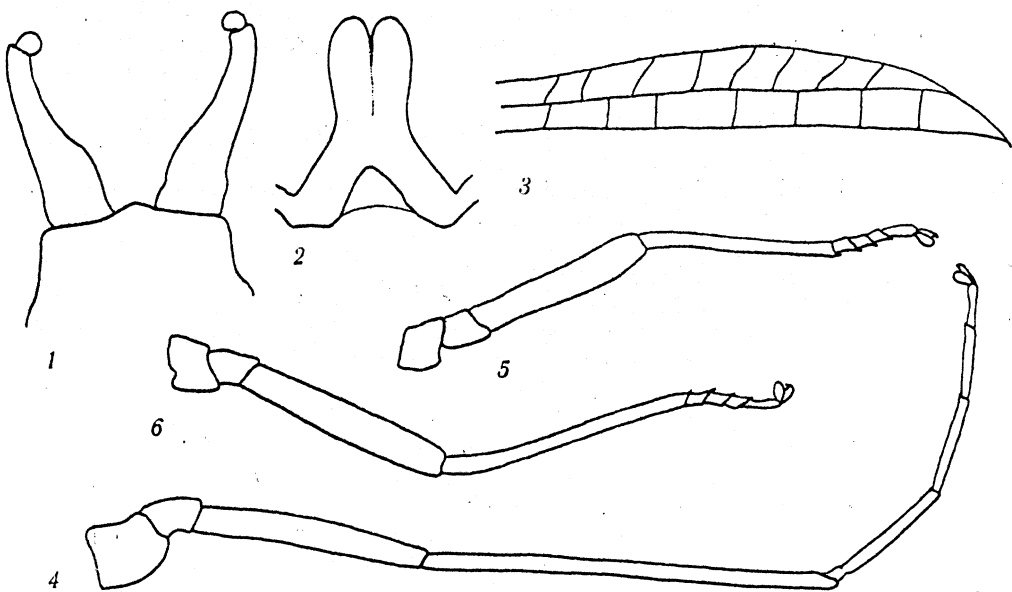


Plate I

1-6: *Ephemerella maculocaudata*, adult male: 1 — forceps; 2 — penis; 3 — pterostigma of fore wing; 4, 5, 6 — fore, middle and hind legs

Pro-, meso- and metanotum light brown with paler smudges, wing pads yellowish. Conspicuous whitish yellow band in the middle of thorax. Ventral side of thorax whitish, thoracic sterna light brown. Legs yellowish, with conspicuous dark bands on coxae, femora, tibiae and tarsi, bands sometimes fused. Femora with club-like setae and hairs; tibiae and tarsi with bluntly pointed setae on posterior margins; claws strong and bent with denticles. Distal denticle almost as large as the apex of claw. The ratio femur : tibia : tarsus 8.0 : 7.5 : 4.5 for fore legs, 8.2 : 8.0 : 4.5 for middle ones and 10.5 : 11.5 : 5.5 for hind legs.

Abdominal terga dark brown or pitch brown with inconspicuous paler band in the middle, pale yellowish on the sides. Sterna dark brown, yellowish on the sides, sterna I-VIII sometimes with inconspicuous diffused dark spots. Segments IV-IX with distinct posterolateral spines and rows of club-shaped setae on lateral margins. Posterior margins of sterna with groups of spatulate setae in the middle. Gills pale yellowish with three fused rounded spots at the basis, longer than wide, incurved posterolaterally. Lamellar portion biramous consisting of 4-5 lamellae, lamellae dark pigmented. Cerci dark brown or blackish in basal half, whitish yellow in apical half with stout pointed setae on each segment.

**Subimago.** Body length 6.7 (6.3-7.0) mm, length of cerci 4.0 (3.8-4.5) mm. Head whitish yellow, frons and clypeus with dark stippling, a pair of dark brown spots on occiput; eyes greyish, ocelli brownish. Scape and pedicel yellowish, flagellum brown.

Prothorax with a pair of large dark brown spots on sides. Meso- and metathorax brownish yellow with darker smudges, pale medial band well apparent. Wings unicolorous, brownish grey with pale ciliae. Longitudinal veins slightly darker, cross veins inconspicuous. Ventral side of thorax yellowish brown. Legs yellowish, femora with dark slipping at base, tarsal segments bordered black at the posterior margins; fore and hind tibiae longer than femora. Abdomen yellowish or whitish, sterna and terga with conspicuous large dark spots on sides which can be fused on segments I, II and III. Cerci whitish with dark hairs.

**A d u l t m a l e.** Body length 6.2 (5.9-6.5) mm, length of cerci 7.5 (6.5-8.0) mm, length of fore wing 6.1 (6.0-6.2) mm. Head brown, antennae yellowish brown with flagellum paler at apex. Dorsal portion of eye dark orange or rusty, ventral portion greyish black. Pronotum brown, meso- and metanotum pitch brown, unicolorous.

Thoracic sterna dark brown, prosternum paler. Wings colourless and translucent, fields *c* and *sc* milky. Veins of the same colour as wings, pterostigma with simple, not forked and bent cross veins; About 7-10 cross veins in pterostigma. Femora of fore legs yellowish brown, tibiae and tarsi whitish, the ratio femur : tibia : tarsal segments 1.4 : 1.9 : 3.5 : 1.1 : 0.7 : 0.6 : 0.7. Middle and hind legs unicolorous, whitish; the ratio femur : tibia : tarsus 1.5 : 1.5 : 0.7 for middle leg, 1.7 : 2.0 : 0.9 for hind leg.

Sterna I-II and VII-X dark brown, unicolorous, medial spots sometimes apparent also on sterna V and VI. Terga I-II and VII, IX with dark brown stippling. Forceps base and penis light brown, forceps paler. Low triangular projection in the middle of forceps base. Segment 1 of forceps strong, three times longer than wide at base with nearly straight outer margin and 1-2 low rounded projections at base. Segment 2 rounded, oval, about twice longer than wide. Penis lobes contiguous and rounded at apex, slightly tapered toward to forceps base. Cerci whitish, slightly darker at basis, not ringed.

**A d u l t f e m a l e.** Body length 6.4 (6.0-6.8) mm, length of cerci 6.8 (6.0-7.0) mm, length of fore wing 6.2 (6.0-6.3) mm. Head whitish with a pair of dark spots on occiput, frons and antennae darker; eyes greyish black. Pronotum dark brown with apparent lighter band in the middle; meso- and metanotum dark brown, unicolorous. Thoracic sterna brown with hyaline whitish nerve ganglia. Wings translucent, slightly brownish, longitudinal veins slightly darker. Pterostigma as in males; hind wings colourless, transparent, veins of the same colour or greyish. Fore legs yellowish brown, femora darker at apex, ratio femur : tibia : tarsus 1.3 : 2.0 : 1.9. Middle and hind legs whitish yellow, ratio femur : tibia : tarsus 1.5 : 1.5 : 1.0 for middle legs, 1.7 : 2.3 : 1.0 for hind legs. Abdominal terga dark brown with distinct light brown band in the middle, tergum  $\times$  unicolorous. Sterna light brown with diffused transversal dark brown smudges and hyaline brownish nerve ganglia. Cerci whitish, yellowish at base, not ringed.

**M a t e r i a l e x a m i n e d.** 250 larvae, 10 subimagos, 5  $\delta\delta$ , 7  $\text{♀♀}$ . Struma river, Kulata, 25. 6. 1978; 16 larvae, Struma river, Blagoevgrad 10. 6. 1977; 2 larvae, Bistrica, Sandanski 5. 6. 1977; 3 larvae, Vrapica river, Momchilgrad 27. 6. 1978; Golyama river, Biser 29. 6. 1978 leg. and coll. Soldán.

**D i s t r i b u t i o n.** Originally known only from the Vardar river basin in Yugoslavia (I k o n o m o v, 1961). Recent findings have shown that this species is distributed also in the basin of Marica river and Struma river in Bulgaria, but probably do not occur in the Danube basin. It undoubtedly occurs in Greece as well. Probably East-Mediterranean species replaced by *E. mesoleuca* at localities north to Yugoslavia and Bulgaria.

Biology. Larvae live at lowland larger rivers localities, although they were found in stream as well (Bistrica, Sandanski). They are mostly found among vascular hydrophytes at places with relatively slow current. This species is usually abundant or common where it occurs (Struma, Kulata). Adults fly at dusk after sunset, subimagoes emerge in the afternoon. Life cycle is probably the same as that of *E. mesoleuca* (cf. Landa, 1968). Adults fly in late June and early July, eggs hatch in spring and larvae develop quickly during spring months.

*Ephemerella mucronata unicolorata* (Ikonomov) stat. nov.

*Chitonophora* sp. nympha *unicolorata* Ikonomov, 1961: 15

Judging from the original description of larva (adult and subimago unknown), this species undoubtedly belongs to the *E. mucronata* species-group. This group originally belonging to the genus *Chitonophora* Bengtsson, which is synonymic with the genus *Ephemerella* (subgenus *Ephemerella* s. str.), consists of *E. mucronata* (Bengtsson, 1909) and *E. krieghoffi* (Ulmer, 1919) but these species are most probably conspecific (cf. Puthz, 1978). Larvae are distinguished only by several characters on gills and abdominal terga, adults by some details in shape of penis lobes. *E. mucronata unicolorata* differs from *E. mucronata* only in colour patterns of body and legs. Moreover, colour pattern in both *E. mucronata* and *E. krieghoffi* are extremely variable, especially in young larvae. Keffermüller (1979) analysed both species and described intermediate form from Poland as a subspecies of *E. krieghoffi*. I suppose that after a detailed analysis of morphological characters of material *E. mucronata* × *E. krieghoffi* from different areas of Europe and North Asia *E. krieghoffi* will fall into a synonymy of *E. mucronata* or become a subspecies of this species. This is the reason that Balkan species of this group is transferred into subspecific rank of *E. mucronata*. In order to state its proper status, further study of larvae and especially of so far unknown imagoes is necessary.

*E. mucronata* is recorded from Scandinavia and the USSR, *E. krieghoffi* from Central and West Europe (cf. Keffermüller, 1979). *E. krieghoffi* is recorded from Romania by Bogoescu (1958), *E. krieghoffi*, *E. mucronata* and *Ephemerella* (*Chitonophora*) sp. from Bulgaria by Russev (1960, 1961, 1964). Some of these specimens might correspond with original description of *Ch. unicolorata* by Ikonomov (1961). I found several larvae of this type in several streams of the Pirin mountains (e. g. Bistrica, Sandanski; Stream, Petrič at altitudes of 600-800 m). Species of *E. mucronata* species group live in streams but also in larger rivers (Russev, 1961, 1964). Ikonomov (1961) found larva of *Ch. unicolorata* in a submontane stream: "Die Larve wurde in Gebirgsbächen mit schnell fliessenden, klarem und kaltem Wasser der Perister- und Ogosovo-Geb. in einer Höhe von 650-950 m gefunden."

*Ephemerella ikonomov* Puthz

*Ephemerella spinosa* Ikonomov, 1961: 61 (nec Mayo).

This species is undoubtedly closely related to *E. ignita*. Larvae are distinguished only by several characters, mainly by absence of a pair of projections on posterior margin of abdominal sterna. This species is known only in larval and subimaginal stage from the only locality in West Macedonia. In order to elucidate the proper status of this species, further material of both larvae and imagoes from the type localities is needed. Bionomy and life cycle remain un-

known. I k o n o m o v (1961) states that "Die Larve wurde in einigen Bächen des Westmazedoniens in einer Höhe von 400-1200 m, wo das Wasser klar, gut aerirt und mit kleinen Temperaturschwankungen, gesammelt."

## Remaining Balkan Species of the Genus *Ephemerella*

*Ephemerella ignita* (Poda) is a widespread species with wide ecological range common in brooks, streams as well as large lowland rivers. It is recorded from Romania by B o g o e s c u (1958), from Bulgaria by R u s s e v (1957, 1960, 1961, 1964, 1966) from Yugoslavia by I k o n o m o v (1961), and from Greece (as *Ephemerella* sp.) by D e m o u l i n (1955). I have seen numerous materials of larvae and adults from Albania, Bulgaria, Romania, and Turkey.

*Ephemerella notata* Eaton has been reported only from Bulgaria and Yugoslavia (R u s s e v, 1959, 1960, 1964, 1966; I k o n o m o v, 1961) so far. I found larvae also in Romania (Otul and Muresul riv.). While in Central Europe larvae live solely in smaller highland rivers, in the Balkan they are found only in larger lowland rivers (e. g. Vardar, Arda, Marica and others).

*Ephemerella mesoleuca* (Brauer) is a rare lowland species inhabiting large river localities. R u s s e v (1966) found larvae in the Marica river near Svi-lengrad. Larvae live also in the Danube (Calafat-Vidin) and in the Muresul in Romania. I caught both larvae and imagoes also at several localities of the river Struma (Bulgaria, Greece). Larvae always live together with larvae of *E. maculocaudata* and they are relatively much less numerous. *E. maculocaudata* probably replaces *E. mesoleuca* at Balkan localities (both species have very similar life cycle and bionomy) while Central European localities (Poland, Czechoslovakia, Hungary) are inhabited solely by *E. mesolenca*. I k o n o m o v (1961) did not find *E. mesoleuca* in Yugoslavia.

*Ephemerella (Torleya) major* Klapálek is an abundant, widespread species recorded from Romania (B o g o e s c u, 1958), Bulgaria (R u s s e v, 1960, 1964), and from Yugoslavia (I k o n o m o v, 1961), although it is more rare than *E. ignita*. Larvae live only in submontane streams and rivers. This species is undoubtedly spread also in Greece and Turkey.

## A key to Balkan Species of the Genus *Ephemerella*

### Larvae

- 1(2) Body broad and emarginated, abdomen shorter than head and thorax, hind legs longer than abdomen. Gills oval, more than twice as long as wide. Segment 2 of labial palps with straight or convex inner margin. Claws strongly hooked and tapered at apex . . . . .  
E. (*Torleya*) *major* Klapálek.
- 2(1) Body without emargination, slender, abdomen longer than head and thorax, hind legs shorter than abdomen. Gills less than twice as long as wide. Segment 2 of labial palps with convex, rounded inner margin. Claws bent, not hooked.
- 3(10) Gills produced posteromedially into tongue-shaped projections with concave hind margin. Fringed part of gills 3-5 consists of two branches with numerous (8-20) small elongated lobes.
- 4(7) Claws with last (distal) teeth 2.5-3 times longer than the others. Cerci with conspicuous black transversal strip, segments of cerci with both spines and setae narrow, light bend in the middle of head and thorax.

- 5(6) Cerci with broad black transversal strip at base (basal half of cerci black). Segment 3 of labial palps triangular about twice as long as wide at base. Gills with well apparent inner triangular projection at base . . . . . *E. (E) maculocaudata* Ikonomov.
- 6(5) Cerci with narrow black transversal strip in the middle (basal half of cerci pale). Segment 3 of labial palps oval and narrow, more than 3 times longer than wide at base. Gill with inconspicuous triangular projection at base . . . . . *E. (E.) mesoleuca* Brauer.
- 7(4) Claws with teeth approximately equal in length. Cerci unicoloured or ringed. Segment of cerci only with spines, without setae. Head and thorax with pale spots and smudges, without light band in the middle.
- 8(9) A pair of rounded protuberances on posterior margins of abdominal sterna. Femora of fore legs with groups of spines, middle and hind femora without spines on posterior margins. Cerci ringed . . . . . *E. (E.) ignita* (Poda).
- 9(8) Posterior margins of abdominal sterna without any protuberances. Femora of fore legs with three spines in transversal row, middle and hind femora with stout spines on the posterior margins. Cerci unicolorous . . . . . *E. (E.) ikonomovi* Puthz.
- 10(3) Gills not produced posteromedially with hind margin straight or slightly convex. Fringed part of gills 3-5 consists of two branches with only 3-6 large rounded or oval fringes.
- 11(12) Segment 2 of maxillary palps longer than segment 3. Gills 3-5 with apparently bluntly convex hind margin. 1-2 distal teeth of claws enlarged, about twice as long as the others, abdominal sterna with a pair of dark spots and divergent strips . . . . . *E. (E.) notata* Eaton.
- 12(14) Segment 2 of maxillary palps shorter than segment 3. Gills 3-5 spatulate with nearly straight posterior margin. Teeth of claws equal in length, abdominal sterna without margins . . . . . *E. mucronata unicolorata* Ikonomov.

*Known adults*

- 1(2) Segment 2 of forceps extended at apex. Sternum IX of female arcuately incurved in the middle. Penis lobes fused in more than 3/4 of its length . . . . . *E. (Torleya) major* Klapálek.
- 2(1) Segment 2 of forceps not extended at apex. Sternum IX of female rounded and convex. Penis lobes fused at most in 1/2 of its length.
- 3(4) Segment 3 of forceps more than 3 times longer than wide. Penis lobe widely V-separated. A pair of conspicuous dark spots and divergent strips on abdominal sterna . . . . . *E. (E.) notata* Eaton.
- 4(3) Segment 3 of forceps at most twice as long as wide. Penis lobes not separated, contiguous. Abdominal sterna unicolorous without markings.
- 5(6) Segment 3 of forceps bluntly pointed at apex, penis lobes oblong shaped. Cerci ringed. Longitudinal veins of female wings yellowish brown. . . . . *E. (E.) ignita* (Poda).
- 6(5) Segment 3 of forceps rounded, penis lobes pointed or rounded at apex. Cerci unicoloured, whitish. Longitudinal veins of female wings colourless, translucent.
- 7(8) Penis lobes sharply pointed at apex with straight inner margin, contiguous; forceps dark brown . . . . . *E. (E.) mesoleuca* Brauer.
- 8(7) Penis lobes rounded at apex with convex inner margin, divided in apical half; forceps brownish . . . . . *E. (E.) maculocaudata* Ikonomov.

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Повторное описание *Ephemerelella maculocaudata* Икономов с заметками о балканских видах *Ephemerelella* (Ephemeroptera, Ephemerelellidae)

Томаши Золдан

(Резюме)

На основании материала, собранного в Болгарии, вновь описывается недостаточно известный вид *Ephemerelella maculocaudata*. Впервые описываются самец, имаго и биология этого нового для фауны Болгарии вида.

*Chitonoptera* sp. nympha *unicolorata* Икономов рассматривается как подвид *E. mucronata* (*E. mucronata unicolorata* Икономов stat. nov.).

Суммировано и критически рассмотрено также распространение остальных балканских видов рода *Ephemerelella*. Указан ключ определения личинок и взрослых форм.