

Taxonomy of *Electrogena antalyensis* (Kazanci & Braasch, 1986) (Ephemeroptera, Heptageniidae)

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ABSTRACT

Female imagines, subimagines, eggs and larvae of *Electrogena antalyensis* (Kazanci & Braasch) from Turkey are described for the first time. The results of a thorough analysis of larvae, based on the standard set of diagnostic characters for the identification of *Electrogena* species, are reported. The peculiarity of several characters places *E. antalyensis* in an isolated position within the genus *Electrogena*.

KEYWORDS: taxonomy, Turkey, *Ecdyonurus lateralis* group.

INTRODUCTION

The genus *Electrogena* Zurwerra & Tomka 1985, erected for the species belonging to the former *lateralis* group of genus *Ecdyonurus* Baton, can be considered still controversial. Even before 1985, the generic status of the *lateralis* group was much debated. There are taxonomic problems also at species level: many species were poorly described, often from a single developmental stage. In this situation is difficult even to count the number of species which can surely be ascribed to *Electrogena*. As a rough estimate, they could be about 40.

Fifteen presumably valid species are distributed over Europe (*E. affinis* (Eaton, 1883); *E. calabra* (Belfiore, 1995); *E. fallax* (Hagen, 1864); *E. grandiae* (Belfiore, 1981); *E. gridellii* (Grandi, 1953); *E. hellenica* (Zurwerra & Tomka, 1986); *E. hyblaea* Belfiore, 1994; *E. lateralis* (Curtis, 1834); *E. lunaris* Belfiore & Scillitani, 1997 (in: Belfiore et al., 1997); *E. macedonica* (Ikononov, 1954); *E. malickyi* (Braasch, 1983) (in: Braasch, 1983a); *E. ozrensis* (Tanasijevic, 1975); *E. quadrilineata* (Landa, 1969); *E. ujhelyii* (Sowa, 1981); *E. vipavensis* (Zurwerra & Tomka, 1986); *E. zebrata* (Hagen, 1864)). Several of these species were thoroughly described or redescribed in recent times (Belfiore, 1994; 1995; 1996; 1997; Belfiore & Desio, 1995; Belfiore et al., 1997; Belfiore & Sartori, in press; Belfiore et al., in press; Malzacher, 1996).

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The highest percentage of *Electrogena* species has been described from an area including Anatolia, Caucasus and Middle East: *E. anatolica* (Kazanci & Braasch, 1986); *E. antalyensis* (Kazanci & Braasch, 1986); *E. armeniaca* (Braasch, 1983) (in: Braasch, 1983b); *E. aspoecki* (Braasch, 1984); *E. azerbaijshanica* (Braasch, 1978); *E. boluensis* Kazanci, 1990; *E. bothmeri* (Braasch, 1983) (in: Braasch, 1983c); *E. braaschi* (Sowa, 1984); *E. dirmil* Kazanci, 1990; *E. galileae* (Demoulin, 1973); *E. hakkarica* (Kazanci, 1986); *E. kugleri* (Demoulin, 1973); *E. kuraensis* (Braasch, 1978); *E. meyi* (Braasch, 1980) (in: Braasch, 1980b); *E. monticola* (Braasch, 1980)(in: Braasch, 1980b); *E. necatii* (Kazanci, 1987); *E. pseudaffinis* (Braasch, 1980)(in: Braasch, 1980a); *E. squamata* (Braasch, 1978); *E. zimmermanni* (Sowa, 1984). The data on these species are generally very poor. A necessary step to clarify the taxonomy of *Electrogena* should be the careful redescription of all species from this part of its distributional range, based on the revision of type material and on the examination of freshly collected specimens. In particular, the detailed description of larval stage, using standard characters, proved to be the best way for characterizing doubtful species within the genus *Electrogena* (for a summary of methods and a survey of characters see Belfiore, 1996;1997).

In the present paper we deal with *E. antalyensis*, on the basis of several specimens recently collected from Western Turkey. This species was described originally only from male imagines. We add useful data for the identification of males, describe summarily females, subimagines and eggs, and give the results of a thorough analysis on larvae. Identification of material was made by comparison with paratypes (imagines). Conspecificity of larvae was stated by examination of eggs in mature nymphs.

Electrogena antalyensis (Kazanci & Braasch, 1986)

Ecdyonurus antalyensis Kazanci & Braasch, 1986

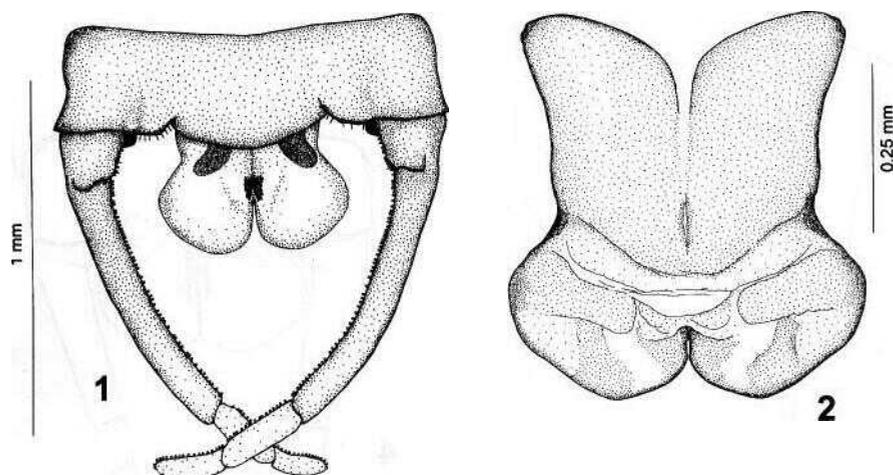
Electrogena antalyensis - Kazanci, 1990

Material (M. Tanatmis leg., if not differently specified; all material preserved in C. Belfiore collection; M, F: imagines; SM, SE: subimagines; L: larvae): TURKEY - Kütahya, Tavsanli-Harmancik road, Ayvali village, 39°34'36"N, 29°26'28"E, 840m, 3.VII.1996, 9 L; Kütahya, Tavsanli-Emet road, 15 Km before Emet, Ikbasli village, 39°24'58"N, 29°20'72"E, 1050m, 4.VII.1996, 1 P, 2 SM, 3 SE, 8 L; Kütahya, Kütahya-Simav road, 3 Km before Simav, 39°05'35"N, 29°02'69"E, 900m, 27.VI.1996, 9 L; Eskişehir, Sakarilica road, Tekeçiler village, 39°57'16"N, 30°31'15"E, 1040m, 9.VII.1998, 7 M, 1 SM; Eskişehir, Eskişehir-Saricakaya road, Sekiören stream, 39°53'94"N, 30°37'70"E, 1120 m, 17.VI.1998, 16 M, 1 F, 1 SM, 1 SF, 9 L; Ankara, Camlidere, 40°29'N, 32°29'E (N. Kazanci leg.), 9.VI.1978, 1 L; Antalya, Elmali, Göltarla, 36°34'N, 29°57'E (N. Kazanci leg.), 14.V.1982, 3 M (paratypes), 1 F; Greece - Island of Kos, Asklipion, 23-26.III.1989 (C. Belfiore leg.), 5 L (young).

Male imago (in alcohol)

Body 11-12 mm; forewing 9-10 mm; cerci 25-27 mm.

Fore part of head very long. Eyes small, pinkish in the fore part, dark grey in hind and lateral part. Thorax dorsally and ventrally dark brown. Pleurae with



Figs. 1-2. *Electrogena antalyensis*, male imago: (1) genitalia from ventral view; (2) penis from dorsal view.

milky areas corresponding to suturae. Wings slightly coloured with yellow. Veins well marked, brown. Costa and Subcosta darker and thicker toward basis. At basis of fore wings is present a dark irregular spot, of variable size. Coxae dark brown. Fore legs brown with slightly lighter tarsi. Mid and hind legs lighter, with dark markings at joints between femur and tibia. Abdominal segments uniformly dark brown with a thin light stripe at joints. In fresh material no markings are visible on tergites. After some months of preservation in alcohol, the pattern described by Kazanci & Braasch (1986) can be observed. Sternites with two small paramedian dark stripes, diverging backwards. Nervous ganglia are not visible.

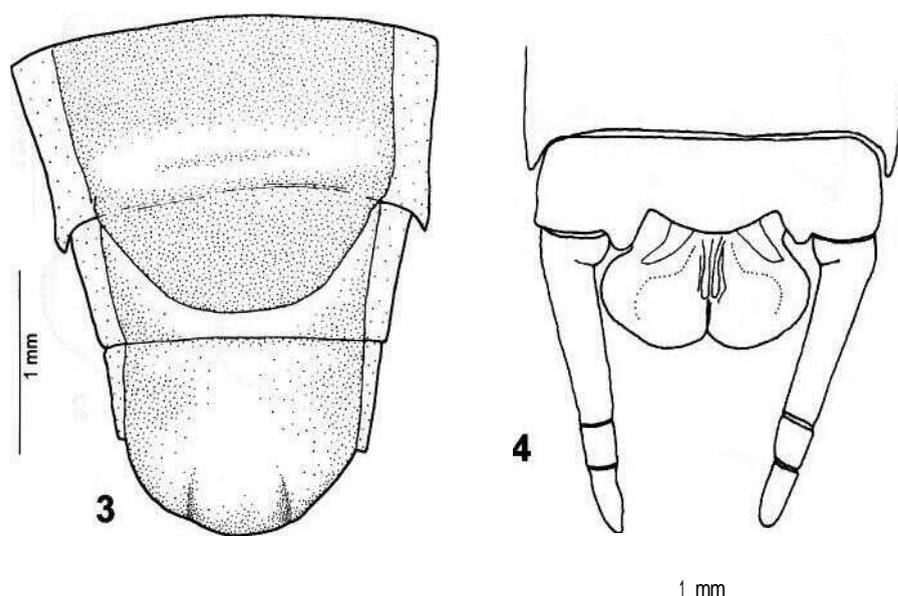
Genitalia (Figs. 1-2). Styli and proximal segments of gonopodes brown. The last two segments of gonopodes are lighter. Hind margin of styli widely convex. Paramedian projections small or absent. Penis lobes light, very characteristic in shape: they are wide, with outer part expanded.

Cerci uniformly brown, lighter toward the tip.

Female imago

Body 10-11 mm; forewing 9-10 mm.

General colouration like male imago, with the following differences: wings are transparent, a yellowish hue is visible only at costal area. Abdomen is lighter than male imago. Very faint reddish markings are on tergites, resembling in shape the marking of *E. affinis* (Belfiore et al., in press): a short median triangle and two large paramedian spots, wider in the fore part. Last three sternites are figured in Fig. 3. The median rib on the last sternites is scarcely prominent.



Figs. 3-4. *Electrogena antalyensis*: (3) female imago, last sternites; (4) male subimago, genitalia.

Subimagines

Male subimago can be easily recognized for the shape of penis lobes (Fig. 4), small eyes and strongly elongated fore part of head. This latter character is also useful for identification of female subimagines, together with the egg chorion. In both sexes eyes are black. Thorax is whitish, with paired brown stripes and spots on the dorsal side. Wings yellowish grey. Veins of the same colour except the basis of costa and subcosta, shaded with brown. Pore legs, coxae, trochanters and tarsi brown, femur and tibia of mid and hind legs lighter. Abdomen brown, very uniformly coloured: no marking are visible on tergites.

Egg

220x160 μ n. The attachment structures (KCTs) are lacking. Whole surface is covered with tiny ridges and looks somewhat shagreened. The latter character is unique among *Electrogena* species.

Larva

Body (full grown): 11-13 mm.

Diagnostic characters. The number of the standard diagnostic characters useful for the identification of *Electrogena* larvae is growing up as the knowledge of the genus *Electrogena* increases. The latest set (22 characters) was proposed by Belfiore et. al. (in press). Here we add three further multistate character (S_BFF,

S_GLO, S_HEA) regarding respectively the relative length of bristles on hind margin of femora, the shape of glossae and the shape of head. Mean, range and variance are reported for each quantitative character. Character states of *E. antalyensis* are compared with mean values and ranges of other species examined by the standard set of diagnostic characters: *E. calabra*, *E. fallax*, *E. grandiae*, *E. gridellii*, *E. hyblaea*, *E. lateralis*, *E. malickyi*, *E. ujhelyii*, *E. zebrata*: Belfiore, 1996; *E. lunaris*: Belfiore et al., 1997; *E. galileae*: Belfiore & Sartori, in press; *E. affinis*: Belfiore et al., in press. Quantitative characters were measured from all larvae listed in the material, with the exception of the specimen from Ankara, whose gills were lacking, and the five very young larvae from the Island of Kos. Therefore 35 individuals were completely analysed.

Meristic characters:

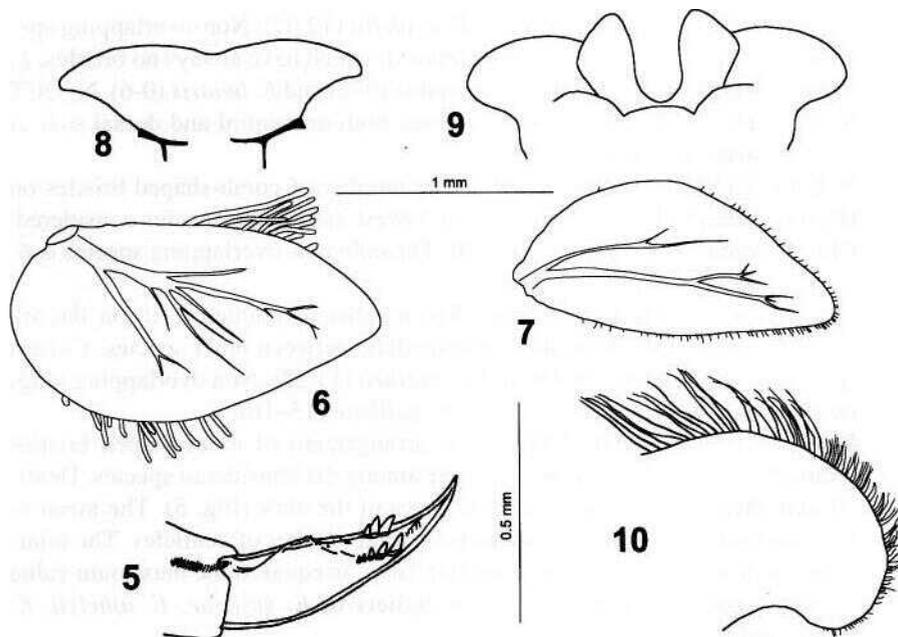
1. N_PLP: 2.03; 0.0-6.0; 2.5874. The number of hairs near the fore margin of the first segment of maxillary palpus is the lowest among the species considered. Closest species is *E. fallax* (4.53). Many species have non-overlapping ranges: *E. galileae* (7-19), *E. zebrata* (7-25), *E. lateralis* (7-23), *E. hyblaea* (10-27), *E. lunaris* (12-28), *E. ujhelyii* (13-27) and *E. affinis* (19-54).
2. N_PLH: 0. No long hairs are on the hind margin of first segment of maxillary palpus, like all other species except *E. affinis*.
3. N_OUT: 12.96; 6.5-24.0; 16.3731. The number of bristles on the outer margin of galea-lacinia is very high. Only *E. ujhelyii* has more bristles at this location (33.40). Closest species is *E. gridellii* (12.02). Non-overlapping species are *E. galileae*, *E. malickyi*, *E. zebrata*, which have always no bristles, *E. affinis* (0-1), *E. hyblaea* (0-1), *E. grandiae* (0-2) and *E. lunaris* (0-6). N_OUT bristles are distributed, in *E. antalyensis*, both on ventral and dorsal side of maxilla, near outer margin.
4. N_CBS: 15.93; 13.0-18.0; 1.0903. The number of comb-shaped bristles on the fore margin of galea-lacinia is the lowest among the species considered. Closest species is *E. lateralis* (17.30). The only non-overlapping species is *E. zebrata* (19-25).
5. N_TCB: 10.34; 8.0-12.0; 0.7613. The number of pointed teeth on the 5th comb-shaped bristle is variable, intermediate between other species. Closest species are *E. gridellii* (10.18) and *E. hyblaea* (11.22). Non overlapping ranges are those of *E. lunaris* (5-7) and *E. galileae* (13-16).
6. N_CLW: 6.66; 4.0-9.0; 2.1143. The arrangement of tooth-shaped bristles (denticles) on the tarsal claws is unique among the considered species. Denticles are present in two rows on both sides of the claw (Fig. 5). The mean of this character was obtained counting the total number of denticles. The minimum value (4), reported from only one larva, is equal to the maximum value of other species, found only in few outliers of *E. galileae*, *E. ujhelyii*, *E. affinis* and *E. zebrata*.
1. N_BVF: 1.00; 1.0-1.0; 0.0000. Only one bristle is present on ventral side of femora, near the hind margin. This character state is shared with all species

except *E. galileae*, *E. ujhelyii*, most populations of *E. zebrata* and *E. fallax*, which share more than 6 bristles. The single bristle of *E. antalyensis* looks however quite different from other species: it is very long and pointed, about 1/3 long as the bristles of the hind row.

8. N_HFF: 0. There are some hairs on the fore margin of femora, but they were not counted, being shorter than neighbouring bristles. The only species with hairs twice long as neighbouring bristles are *E. galileae* and *E. affinis*.

Ratio characters:

9. R_1GI (Fig. 6): 1.60; 1.32-1.81; 0.0168. First gill plate is the shortest and the widest among all species. Closest species is *E. affinis* (1.79). *E. gridellii* (1.88-2.87), *E. malickyi* (2.12-3.26), *E. hyblaea* (2.25-3.28), *E. calabra* (2.28-3.87), *E. grandiae* (2.01-3.87) and *E. fallax* (2.23-3.43) have non overlapping ranges.
10. R_7GI (Fig. 7): 2.03; 1.74-2.35; 0.0271. Also the seventh gill plate is very short. Only *E. affinis* has lower R_7GI (1.94). *E. fallax* has non overlapping range (2.69-4.38).
11. R_LBR: 4.79; 4.18-5.96; 0.1106. Total width/width of lateral lobes of labrum is intermediate between species considered. Closest species are *E. zebrata*



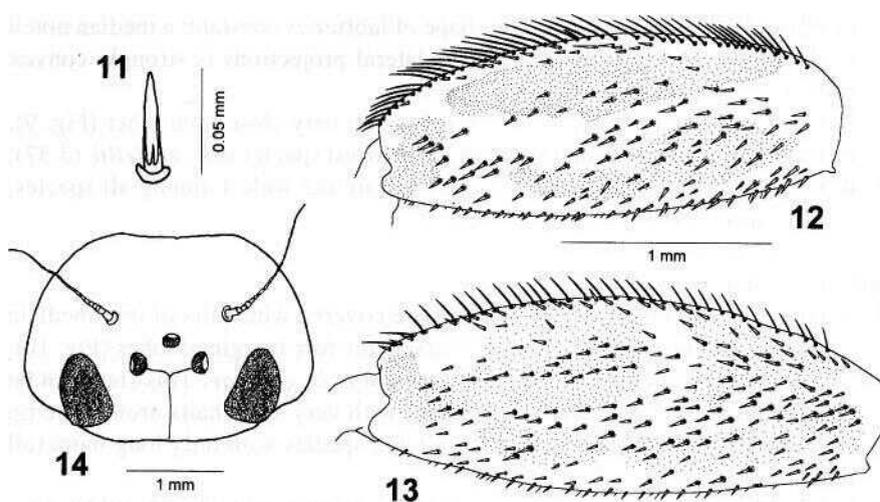
Figs. 5-10. *Electrogena antalyensis*, larva: (5) tarsal claw; (6) first gill; (7) seventh gill; (8) labrum; (9) glossae and paraglossae; (10) lobe of hypopharynx.

(4.72) and *E. gridellii* (4.83). The shape of labrum is constant: a median notch is always present, the fore margin of lateral projections is strongly convex (Fig. 8).

12. R_GLA: 3.66; 2.91-4.51; 0.1201. Glossae are very close each other (Fig. 9). R_GLA is the highest among all species. Closest species is *E. gridellii* (3.37).
13. R_GLB: 2.60; 2.25-2.94; 0.0212. Glossae are the widest among all species. Closest species is *E. calabra* (2.64).

Qualitative characters:

14. S_HLB: the tips of hypopharynx lobes are covered with hairs of intermediate length, long at maximum 1/3 as the hairs on the fore margin of lobes (Fig. 10). The only species with a similar arrangement is *E. galileae*. This state can be considered intermediate between species with very short hairs around the tip (*E. lateralis*, *E. lunaris* and *E. ujhelyii*) and species with only long hairs (all remaining species).
15. S_GLO (shape of glossae outline): glossae are very asymmetric, subtriangular (Fig. 9). All other species share glossae *Ecdyonurus-liaae*, quadrangular, more or less symmetrical.
16. S_PGL: paraglossae are not very long, symmetrical, generally with rounded apex.
17. S_PNT: in most individuals the sides of pronotum are rounded and laterally expanded. Some individuals have an evident step at hind comers, not present in the remaining material.
18. S_BFE: bristle on upper surface of fore femora are very long and pointed (Fig. 11).
19. S_BFF (length of bristles of the row on the hind margin of femora, relative to femur width): bristles in the row on hind margin of femora are very short, especially those of mid and hind femur (Fig. 12-13). This character state is peculiar to *E. antalyensis*.
20. S_TAR: tarsi are darker only at apex.
21. S_7GI: the shape of seventh gill is like most of other species, asymmetrical, with straight lower margin and widely rounded upper margin (Fig. 7).
22. S_PLB: bristles on hind margin of the first segment of maxillary palpus are similar in length to most other species, which share an intermediate length between *E. affinis* (long bristles) and *E. galileae* (very short bristles). These bristles are absent at the basis of segment and their number increases toward the distal part.
23. S_LBB: paramedian bristles on the ventral surface of labrum are arranged in a single row, like most of other species. They are however very short and dumpy. Only *E. galileae* has these bristles arranged in two rows.
24. S_HEM: no light markings are on head, like all species but *E. affinis* and *E. galileae*.
25. S_HEA (shape of head outline): head shape is very characteristic (Fig. 14), getting distinctly narrower in the fore part.



Figs. 11-14. *Electrogena antalyensis*, larva: (11) bristle on the upper side of fore femur; (12) fore femur, from dorsal view; (13) hind femur, from dorsal view; (14) head.

Diagnosis and affinities

E. antalyensis is a very peculiar species within *Electrogena*. Males can be easily recognized for the widely rounded penis lobes, small eyes and large fore part of head. The latter character and eggs allow the clean identification of females. Also larvae are very characteristic. S_GLO (triangular glossae) and S_BFF (short hairs on hind margin of femora) are the outstanding features which strongly discriminate *E. antalyensis* from all other species described by recent criteria. These characters allow the identification also of damaged individuals or very young larvae, like those collected from Greece.

Some problems can arise considering the status of *E. antalyensis*. Two apparently related species were described (very poorly) from neighbouring countries, i. e. *E. aspoECKi* (Island of Chios: Braasch, 1984) and *E. bothmeri* (Iran: Braasch, 1983c), both described from a single male subimago. A definitive word on this matter could be said only after the examination of further material from the type localities.

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