
The Status of Knowledge of the Genus *Ecdyonurus* in the Iberian Peninsula, with Description of Two New Species of the *E. venosus* Group from Spain (Ephemeroptera: Heptageniidae)

Javier Alba-Tercedor¹ and Tomáš Derka²

¹University of Granada, Spain; ²Comenius University, Bratislava, Slovakia

Abstract

As a result of studies of material of *Ecdyonurus* from Spain, nymphs and adults of two new species, *E. baeticus* sp. n. and *E. olgae* sp. n., are described. Three species described by Navás must be considered as *nomina dubia* (*E. diversus* Navás, 1923, *E. excelsus* Navás, 1927 and *E. fluminum* var. *speciosus* Navás, 1915). Variability in adults of *E. venosus* is figured and discussed.

Keywords: Nymphs, imagoes, Ephemeroptera, Heptageniidae, new species, *Ecdyonurus baeticus* sp. n., *Ecdyonurus olgae* sp. n., Spain.

Introduction

The knowledge of mayflies in the Iberian Peninsula is still far from being complete, especially in the genus *Ecdyonurus*. Up to now 13 species of this genus have been recorded in Spain and Portugal (Alba-Tercedor & Jáimez-Cuéllar, 2003): *E. angelieri* Thomas, 1968; *E. aurantiacus* (Burmeister, 1839); *E. codinae* Navás, 1924; *E. dispar* (Curtis, 1834); *E. diversus* Navás, 1923; *E. excelsus* Navás, 1927; *E. fluminum* var. *speciosus* Navás, 1915; *E. forcipula* (Pictet, 1843–45); *E. helveticus* (Eaton, 1883); *E. insignis* (Eaton, 1870); *E. macani* Thomas & Sowa, 1970; *E. torrentis* Kimmins, 1942 and *E. venosus* (Fabricius, 1775). All except *E. helveticus* belong to the *venosus* group, in accordance with the species groups defined by Jacob and Braasch (1984, 1986).

In this paper, the nymphs and imagoes of two new species of the *E. venosus* group are described and figured. In addition, a study of Navás' species and a discussion on

Address correspondence to: Javier Alba-Tercedor, Departamento de Biología Animal y Ecología (Unidad de Zoología), Facultad de Ciencias, Universidad de Granada, 18071-Granada, Spain. E-mail: jalba@ugr.es

identification problems in view of additional variable characters and inconsistencies in the literature concerning the winged stages of *E. venosus* are presented.

The Iberian Species of Genus *Ecdyonurus* Described by Navás

It is difficult to study the taxonomy of Iberian Ephemeroptera without all of Navás' species available. Of the four Iberian species of genus *Ecdyonurus* described by him (*E. codinai*, *E. fluminum* var. *speciosus*, *E. diversus*, and *E. excelsus*), Thomas (1968b) could find in the Museo of Barcelona type material of only *E. codinai*, which made possible a new illustration of the genitalia of *E. codinai*. Recently Haybach and Thomas (1999) published a complete redescription of the imagoes of this species, based on new material collected from South Portugal. There were no syntypes of *E. fluminum* var. *speciosus* but two specimens which Navás himself had identified and labelled, long after the description. However, Thomas (1968b) found that one specimen was close to *E. aurantiacus* (sub nom. *E. pазsiczkyi*), while the other belonged to the *angelieri-ruffii-wautieri* group. We therefore think that *E. fluminum* var. *speciosus* must be considered as a *nomen dubium*.

With respect to *E. diversus*, the original figure of the genitalia shows very narrow and elongated penis lobes (Navás, 1923: Fig. 4). Clearly this species does not belong to genus *Ecdyonurus*, but is probably a species of the *Rhithrogena germanica* group. Similarly, the original drawing of the genitalia of *E. excelsus* suggests that it cannot be assigned to genus *Ecdyonurus* but probably is some species of the *Rhithrogena semicolorata* group.

Thus of the four Iberian species described by Navás as belonging to the genus *Ecdyonurus*, only one (*E. codinai*) remains as a valid species name:

E. codinai Navás, 1924: 6, Fig. 2

E. Codinai—Thomas & Haybach, 1999: 80–84, Figs. 1–12.

Type locality: Venta de Cárdenas, Ciudad Real, Spain, 8.VI.1923.

Type material: in Navás' collection at the Museo de Zoología del Ayuntamiento in Barcelona there is only one badly damaged male (see Alba-Tercedor & Peters, 1985).

E. fluminum var. *speciosus* Navás, 1915: nomen dubium.

E. fluminum var. *speciosa* Navás, 1915: 456, Fig. 1.

? *E. aurantiacus* (Burmeister, 1839); *pro parte* (see Thomas, 1968b).

Type locality: Río Algás, Arnes, Tarragona, Spain, 27.VIII.1913.

Type material: unknown. In Navás' collection remains only a very badly damaged female without type label, captured in Biel, Zaragoza, Spain, 11.VI.1931 (see Alba-Tercedor & Peters, 1985).

E. diversus Navás, 1923: 16, Fig. 4: nomen dubium.

Rhithrogena diversa (Navás, 1923); comb. nov.

Type locality: Santa Eulàlia, Barcelona, Spain, 14.VII.1922.

Type material: location unknown.

E. excelsus Navás, 1927: 70, Fig. 6: nomen dubium.

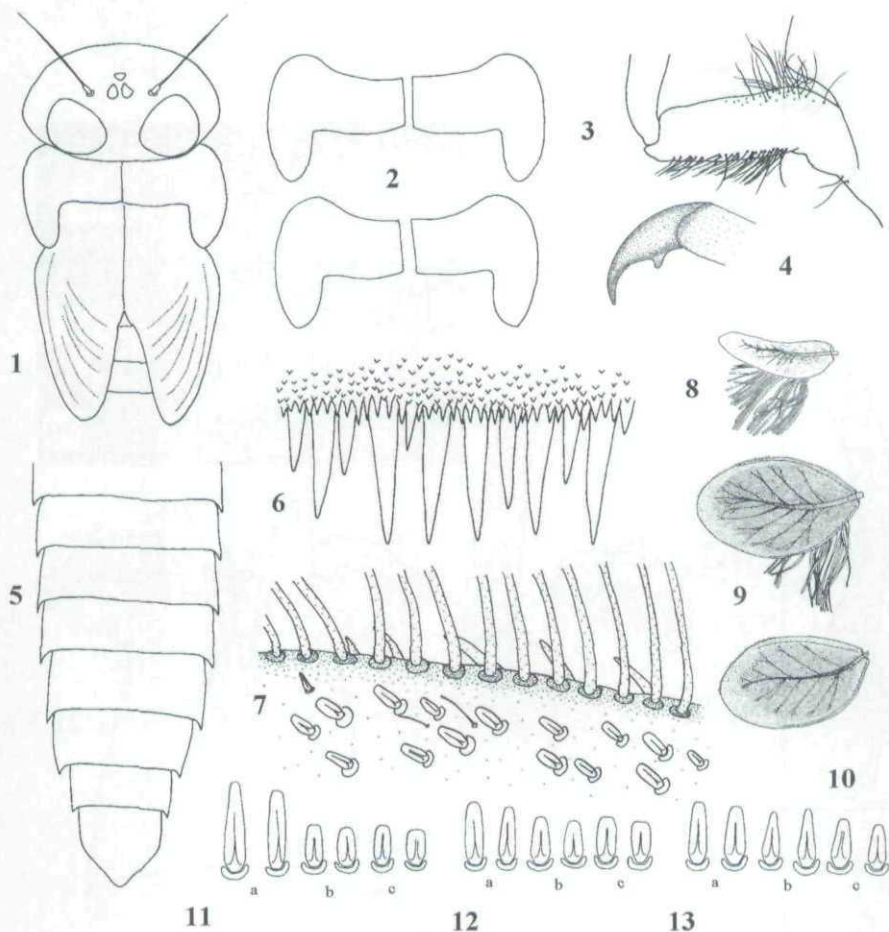
Rhithrogena excelsa (Navás, 1927); comb. nov.

Type locality: Spain: Sierra de Guadarrama, 1.VI.1926, Panticosa, Huesca, 10.VI.1918, Alós, Lérida, 8.VIII.1918.

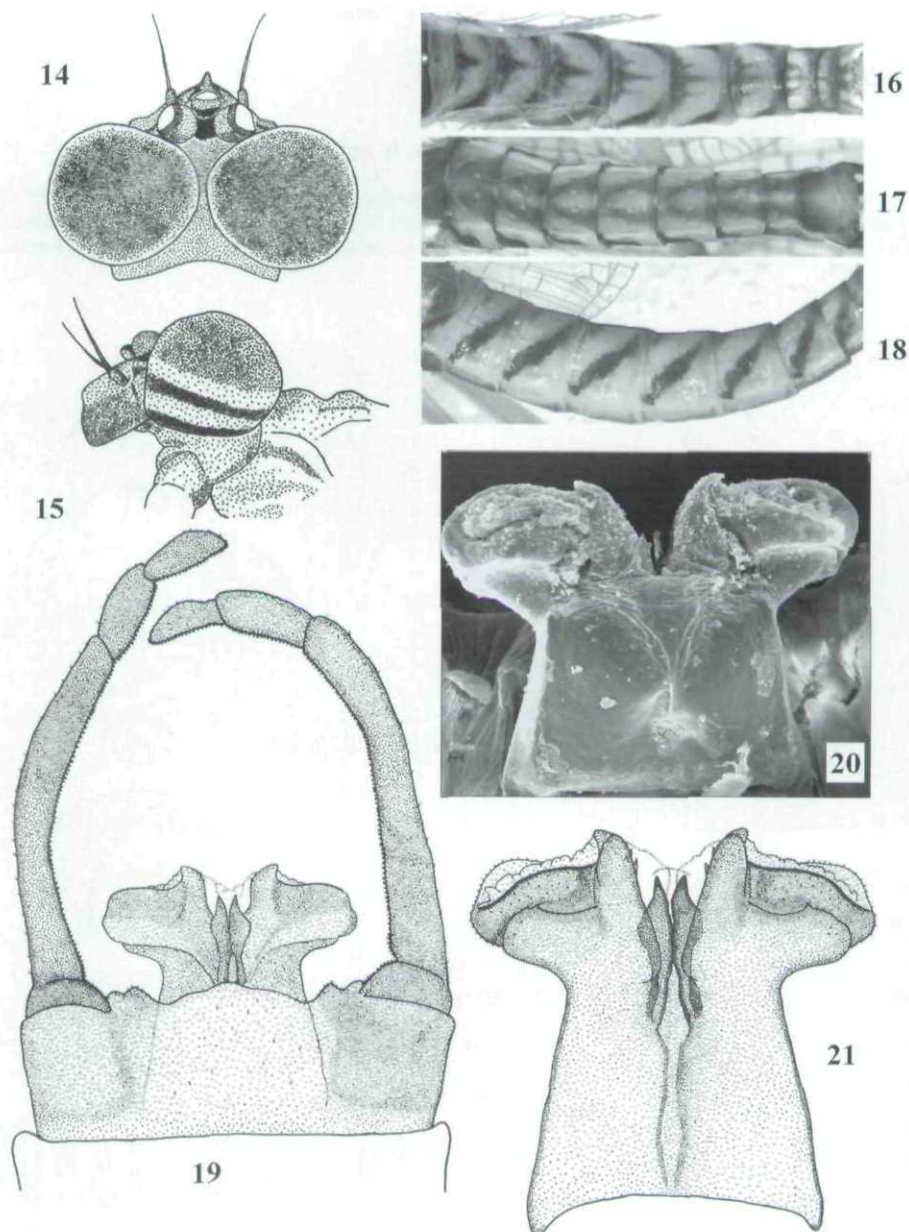
Type material: location unknown.

Ecdyonurus baeticus sp. n. (Figs. 1–25)

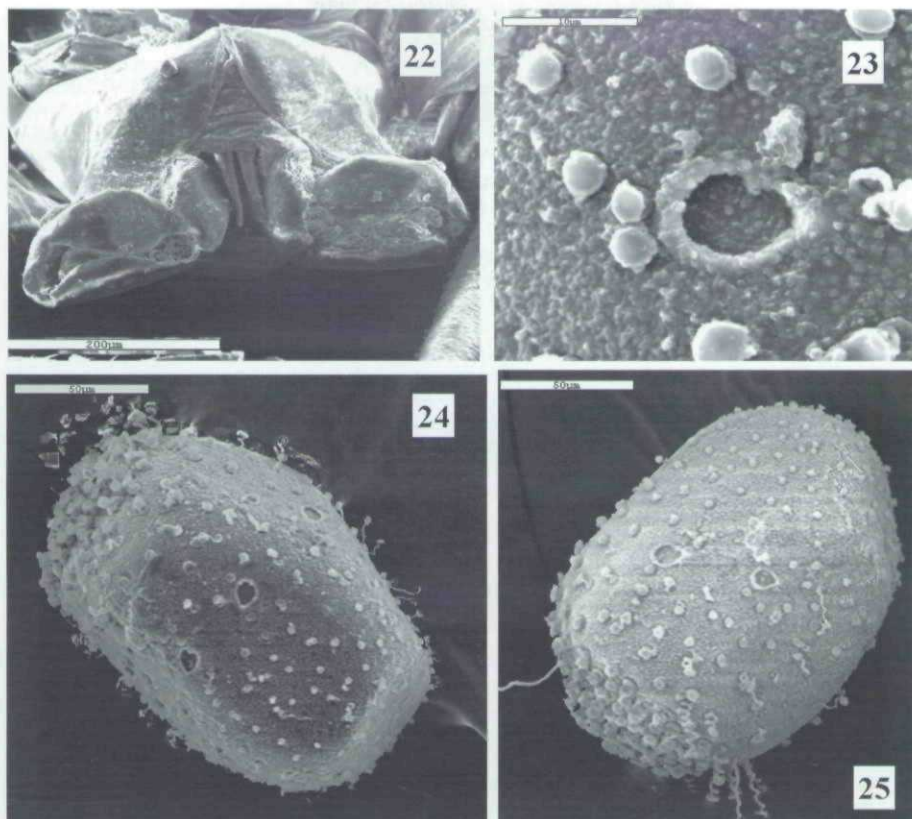
Material: Holotype: one male imago (genitalia on slide), Spain, Río Guadalfeo, Sierra Nevada (Prov. Granada), 220 m. a.s.l., U.T.M.: 30S VF 459 405, 14.III.2003, T. Derka & J. Alba-Tercedor leg. Paratypes: four male imagoes (three genitalia on slides), two female imagoes, one male subimago, two female



Figures 1–13. Nymph of *Ecdyonurus baeticus* sp. n. (1) head and thorax; (2) Pronotum; (3) maxillary palp; (4) claw; (5) abdomen; (6) hind margin of 5th abdominal tergite; (7) surface of hind margin of fore femur; (8–10) 1st, 2nd and 7th gill, respectively. (11–13) bristles on the dorsal surface of fore, middle and hind femur, respectively, with a, b and c identifying the bristles of the proximal, central and distal part of the femur, respectively.



Figures 14–21. Male imago of *Ecdyonurus baeticus* sp. n. (14, 15) head, dorsal and lateral views, respectively; (17, 18) abdomen, dorsal, ventral, lateral views, respectively. (19) general outline of male genitalia; (20) penis dorsal, SEM critical point dried, gold coated, 15 KV; (21) the same, mounted in Hoyer's liquid.



Figures 22–25. *Ecdyonurus baeticus* sp. n., SEM, critical point dried, gold coated, 15KV. (22) apical view of penis; (23) detail of micropyle; (24, 25) eggs.

subimagoes, Spain, Río Guadalfeo, Sierra Nevada (Prov. Granada), 220 m. a.s.l., U.T.M.: 30S VF 459 405, 14.III.2003, T. Derka & J. Alba-Tercedor leg. One male imago (with nymphal and subimaginal exuviae), confluence of Río Laroles & Bayárcal, Sierra Nevada (Prov. Granada), 680 m. a.s.l., U.T.M.: 30S VF 499 409, 27.IV.1999, J. Alba-Tercedor leg.

Other material (all from Sierra Nevada, Spain): one female imago with exuviae, Río Bayárcal, (Prov. Granada), 560 m. a.s.l., U.T.M.: 30S VF 992 925, 19.VI.1984; one female imago with exuviae, one mature and 18 immature nymphs, Río Bayárcal, (Prov. Granada), 560 m. a.s.l., U.T.M.: 30S 992 925, 10.VII.1984; one male (genitalia on slide), one female imago, one female subimago, one immature nymph, Río Darri-cal, (Prov. Almería), 360 m. a.s.l., U.T.M.: 30S VF 9786, 20.II.2001, J. Alba-Tercedor & P. Jáimez Cuéllar leg.; one female imago, Río Darri-cal, (Prov. Almería), 360 m. a.s.l., U.T.M.: 30S VF 9786, 30.V.2000, J. Alba-Tercedor & P. Jáimez Cuéllar leg.; two male imagoes with exuviae skins, one female subimago with exuviae, one mature and three immature nymphs, Río Dilar, (Prov. Granada), 940 m. a.s.l., U.T.M.: 30S VF 449 410, 10.VII.1983, J. Alba-Tercedor leg.; one female imago, Río Dúrcal, (Prov. Granada), 760 m. a.s.l., U.T.M.: 30S VF 492 952, 29.VII.1980, J. Alba-Tercedor leg.; one female imago with exuviae, Río Laroles, (Prov. Granada), 560 m. a.s.l., U.T.M.: 30S VF 999 925, 2.VI.1982, J. Alba-Tercedor leg.; one mature and 14 immature nymphs, Río Laroles, (Prov. Granada), 1020 m. a.s.l., U.T.M.: 30S VF 981 968, 9.VI.1984, J. Alba-Tercedor leg.; two female imagoes, 17 immature nymphs, Río de Nechite, (Prov. Granada), 840 m. a.s.l., U.T.M.: 30S VF 990 960, 9.VI.1984, J. Alba-Tercedor leg.; one mature and 16 immature nymphs, Río de Válór, (Prov. Granada), 940 m. a.s.l., U.T.M.: 30S VF 921 948, 9.VI.1984, J.

Alba-Tercedor leg.; four immature nymphs, Río Chico, (Prov. Granada), 800 m. a.s.l., U.T.M.: 30S VF 632 872, J. Alba-Tercedor leg.; two male imagoes, confluence of Río Laroles & Bayárcal, (Prov. Granada), 680 m. a.s.l., U.T.M.: 30S VF 499 409, 20.II.2001, J. Alba-Tercedor & P. Jáimez Cuéllar leg.; one male imago, confluence of Río Laroles & Bayárcal, (Prov. Granada), 680 m. a.s.l., U.T.M.: 30S VF 499 409, 7.III.2003, T. Derka leg.; one female imago, Río Guadalfeo, (Prov. Granada), 860 m. a.s.l., U.T.M.: 30S VF 481 408, 17.VII.2000, J. Alba-Tercedor & P. Jáimez Cuéllar leg.; one female imago with exuviae, Río Guadalfeo, (Prov. Granada), 220 m. a.s.l., U.T.M.: 30S VF 459 405, 13.III.2001, J. Alba-Tercedor & P. Jáimez Cuéllar leg.; two mature and 10 immature nymphs, 15 exuviae skins, Río Guadalfeo, (Prov. Granada), 220 m. a.s.l., U.T.M.: 30S VF 459 405, 7.III.2003, J. Alba-Tercedor & T. Derka leg.; one male imago, Río Trevélez, (Prov. Granada), 1540 m. a.s.l., U.T.M.: 30S VF 477 409, 25.IV.2000, J. Alba-Tercedor & P. Jáimez Cuéllar leg.; 11 male imagoes, Río Aguas Blancas, (Prov. Granada), 1140 m. a.s.l., U.T.M.: 30S VG 689 210, 10.VI.1979, J. Alba-Tercedor leg.; one female, one male imago, Río Aguas Blancas, (Prov. Granada), 1140 m. a.s.l., U.T.M.: 30S VG 689 210, 20.VI.1979, J. Alba-Tercedor leg.; 15 male imagoes (one genitalia on slide), Río Aguas Blancas, (Prov. Granada), 1140 m. a.s.l., U.T.M.: 30S VG 689 210, 22.VI.1979, J. Alba-Tercedor leg.; three male imagoes, Río Aguas Blancas, (Prov. Granada), 1140 m. a.s.l., U.T.M.: 30S VG 689 210, 10.V.1980, J. Alba-Tercedor leg.; one female imago with exuvia nymph, one mature nymph, Río Aguas Blancas, (Prov. Granada), 1140 m. a.s.l., U.T.M.: 30S VG 689 210, 10.V.1982, J. Alba-Tercedor leg. In addition, many other nymphs from different localities in the Sierra Nevada were examined. The material is preserved in 70% alcohol, some male genitalia are mounted on slides with Hoyer's liquid and sealed with nail varnish. The material is in the senior author's collection in the Department of Animal Biology and Ecology (Zoology), University of Granada, Spain.

Etymology: the new species is named after 'Baetica' province, the name given by the Romans to what is now approximately Andalusia, in Southern Spain.

Nymph (in alcohol). Length (mm): body (male: 9.5–11.2, female: 9.7–15.0; $n = 14$). General body colour yellowish to light brown, abdomen of late instars with easily visible colouration of the adult. Head trapezoidal with the widest part at the level of the eyes (Fig. 1). Mouthparts: labrum without specific features, one row of median bristles typical for the *venosus* group (Belfiore & Buffagni, 1994); superlinguae of hypopharynx with long hairs on outer margin and distally on the lobes, as is typical for the *venosus* group. Mandibles with 11–18 prosthecal bristles; characters introduced by Haybach (1999) for the maxillae and labial palp, largely those used by Belfiore (1994, 1996) for *Electrogena* are: number of comb-shaped bristles (N_{CBS}) = 19–22 plus 2–3 smaller bristles; number of teeth on 5th CBS (N_{TCB5}) = 13–16; number of hairs on dorsal upper side (N_{DOR}) = 10–13; number of hairs on outer margin of maxillae (N_{OUT}) = 2–4; number of hairs on ventral basal part of maxillae (N_{VEN}) = 16–24; a small group of hairs at the base of the maxillary palp (N_{PLBas}) = 1–4; no hairs present on the outer base of the first segment of maxillary palp (N_{PLH}) = 0; numerous setae present on the outer margin of the first segment of maxillary palp (N_{PLS}) >40 and on the inner side of the first segment of maxillary palp (N_{PLP}) >25 (Fig. 3); Labial palp: the number of hairs of the group on the dorsal side of its first segment, is variable (N_{LPH}) >40. Thorax: pronotum (Figs. 1 and 2): lateral projections relatively large, asymmetrical, slightly curved outwards at the apex; width of semipronotum/length of caudal projection (way of measurement following Bauernfeind & Humpesch, 2001) is 2.0–2.6. Legs (Figs. 4, 7, 11, 12 and 13): a row of large pointed bristles behind the row of long hairs at the hind margin of the distal part of fore femur, submarginal bristles rounded (Fig. 7); bristles of the upper surface of the femora as in Figures 11–13, apically rounded or roughly spatulate, only the bristles in the central part of 3rd femur of fully grown female

nymph are pointed; tarsi with distal darker ring, tarsal claws brown, with a large basal tooth and 2–3 small apical denticles (Fig. 4). Abdomen: hind margin of central part of tergites with long and narrow, apically pointed teeth (Fig. 6), with numerous sub-marginal denticles arranged in several rows; no differences were observed in the shape of the teeth of male and female nymphs; sternites (Fig. 5) with small lateral projections, the ratio of the length of projection/width of sternites is approximately 0.25. Gills (Figs. 8–10): 1st gill relatively long and narrow (Fig. 8), 4th gill oval shape (Fig. 9), 7th gill as in Fig. 10 (without a tuft of tracheal filaments).

Male imago (in alcohol). Length (mm): body 9.0–12.0; fore wings 9.0–12.1; hind wings 3.9–4.5; forelegs 9.85–10.45 (femur = tibia: 2.8–3.0; tarsal segments: T1 = 0.5–0.7, T2 = 1.05–1.10, T3 = 1.05–1.10, T4 = 0.75–0.85, T5 = 0.5; gradation of tarsal segments: 2 = 3 > 4 > 1 >= 5); cerci 27 = 30 ($n = 36$). General body colour yellowish to brown. Head (Figs. 14 and 15) yellowish, with some brownish maculae; fronto-clypeal region forms a relatively short rostrum (in dorsal view), ending in a narrow elongation; ocelli: upper part grey, a light brown ring in the equatorial zone, and a basal black or dark ring; eyes very close to each other, but not touching, laterally with alternate pale-grey and dark stripes (Fig. 15), upper part dark grey or blackish; in dorsal view the upper pale-grey stripe forms a paler ring outlining the compound eyes (Fig. 14). Thorax: dorsally yellowish with a dark longitudinal central band, laterally whitish to yellowish with brownish sclerotised parts, and brown ventrally. Wings: transparent hyaline with the costal area yellowish, pterostigma, as well the tip of forewings, not reticulated (in pterostigma only 2–3 transversal veinlets are forked), transversal veins of fore wings with brownish tinge, especially those in the basal 2/3 and in costal, subcostal and radial area. Legs: forelegs dark-brown (apical part of femora darker), middle and hind legs yellow-brown with distal dark transversal bands. Abdomen (Figs. 16–18): tergites with a central posteriorly pointed, triangular brown mark flanked by smaller triangles, the hind margins without a dark band, but with an oblique stripe (Fig. 16), extending laterally (Fig. 18) resulting in a characteristic pattern. Sternites yellowish with two light central spots, two oblique light stripes, and two oblique dark bands (Fig. 17). Cerci yellowish, proximal part brownish with darker rings in the basal part of each segment (alternating light-brown and dark-brown rings every two segments). Genitalia (Figs. 19–22): styliger plate brown with two short and rounded latero-marginal teeth (Fig. 19); shape of the penis somewhat variable, penis lobes quite expanded (Figs. 19–21); basal sclerites from yellowish to light brown, in dorsal view the basal sclerites partially cover the basal part of the lateral sclerites (Figs. 20 and 21); lateral sclerites yellowish to brown. Although the shape may vary they are always slightly curved (Figs. 20 and 21); apical sclerites yellowish, relatively narrow with slightly curved lateral margins, generally the apical part curves outwards (Figs. 19–21).

Female imago (in alcohol). Length (mm): body: 9–14; forewings: 10–14, cerci: 24–26, ($n = 9$). Colouration similar to male, pattern of abdomen very similar to the male.

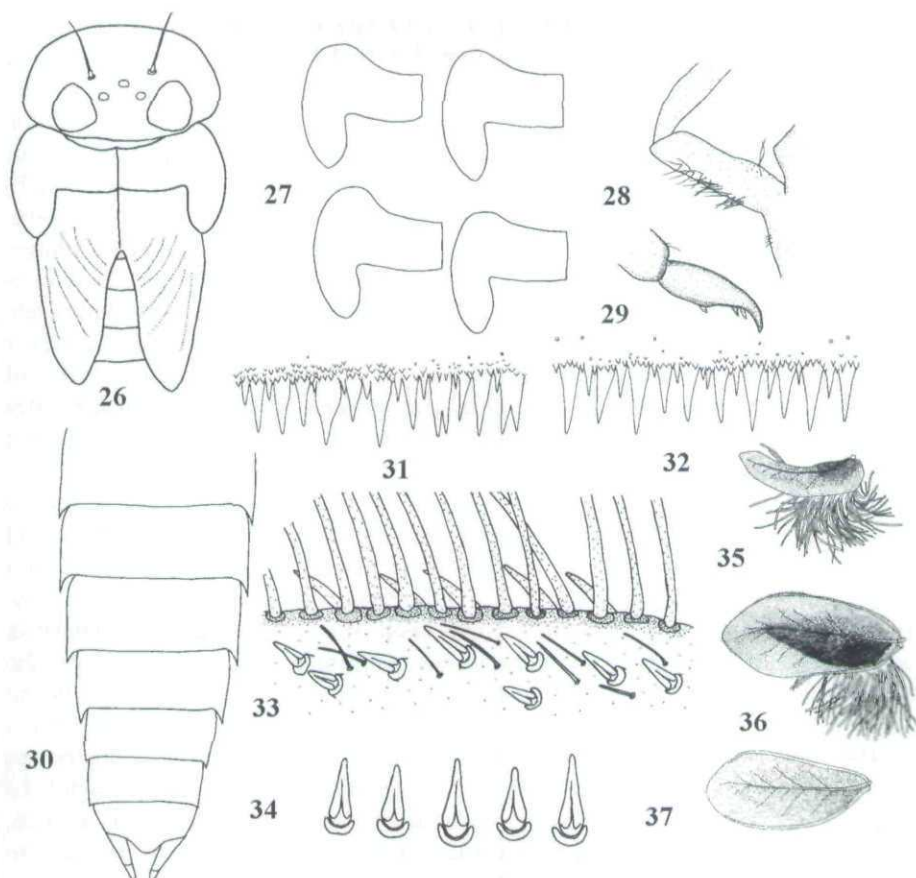
Eggs (Figs. 23–25): Length (mm): ca. 160 μ m. Oval shaped, surface rough, covered with sparse KCT ('knob-terminated coiled threads', according to the

terminology of Koss, 1964) attachment structures. With polar concentration of large KCT attachment structures, and with 2–3 micropyles (Fig. 23) located in a subequatorial position.

Affinities. Using the triangular pattern on the central part of abdominal tergites, the new species can be grouped together with species considered by some authors (i.e. Thomas, 1968b; Braasch & Soldán, 1985) to form the *E. ruffii*-group (*E. ruffii* Grandi, 1953, *E. russevi* Braasch & Soldán, 1985, *E. puma* Jacob & Braasch, 1986). Combination of such characters as: the abdominal pattern of adults, male genitalia (general outline of penis and its sclerites), shape of pronotum, lateral abdominal projections, and 1st gill of nymphs allows the new species to be easily distinguished from *E. ruffii*, *E. russevi*, and *E. puma* (compare Figs. 1, 2, 4–6, 8, 16 and 18–21 with corresponding figures in: Grandi, 1960, Fig. 32; Fontaine, 1964, Pl I: Figs. 2, 3, Pl. II: Figs. 3, 4, 6, 7, Pl. III: Figs.: 2, 7, 9; Braasch & Soldán, 1985, Figs. 1, 4, 6; Jacob & Braasch, 1986, Figs. 2–5, 7; Bauernfeind & Humpesch, 2001, Figs. 474, 487). The male genitalia of the new species is very close to those of *E. angelieri* Thomas, 1968, for this reason we studied material of this species (one adult and its exuviae) from the type locality (Hautes-Pyrénées, Vallée d'Aure, La Neste de Couplan à Artiguesse, 1500 m.s.s.l., 25.VII.1965, France) collected and identified by Prof. Alain Thomas (Figs. 45–50), and an additional male imago from Andorra (Santa Coloma). The abdominal segments of *E. angelieri* and venation of forewings have a pattern quite different from *E. baeticus* sp. n. (Figs. 16–18). According to Thomas (1968a): (a) the abdominal tergites have wide lateral stripes ('latéralement, les tergites 2–8 sont traversés par une bande oblique large'), and the sternites have a reddish polygonal dot posteriorly ('les sternites portent dans leur partie postérieure une tache polygonale rougeâtre'); (b) longitudinal veins are dark. Moreover, the lateral pattern on the eyes of *E. angelieri* has three successive transversal bands: a whitish narrow line, a dark band, and a whitish band (compare with Fig. 15). The male genitalia, although similar in the two species, are clearly different (compare Figs. 19–21, with Thomas, 1968a, Figs. 20–21, and with Figs. 49–50). According to Haybach and Thomas (1999), in Central Europe, as a rule, the shape of the penis lobes is generally characteristic, while in the Mediterranean region the shape of the penis is similar in all of the *E. venosus* group. It is therefore necessary to look at such additional distinguishing characters as the colouration (especially of the abdomen), the size and shape of the eyes, and the wing venation. Nymphs of *E. angelieri* can be easily separated from those of *E. baeticus* sp. n. by the presence of sharp bristles on the surface of all femora (compare Figs. 7, 11–13 with Figs. 45–48), and by the pilosity of the mouth parts which are very similar to *E. venosus* (Haybach, pers. comm.).

Ecdyonurus olgae sp. n. (Figs. 26–44)

Material (preserved in alcohol): Holotype: one male imago (genitalia mounted on a slide with Hoyer's liquid, sealed with nail varnish), Spain, Madrid, Pedriza, Sierra de Guadarrama, Rio Manzanares, UTM 30T VL 230 138, 7.X.1982, R. Meneu leg. Paratypes: two male imagoes, same locality of the holotype, 7.X.1982, 11.X.1982, R. Meneu leg. Nymphal exuviae: three individuals 1.X.1982, five individuals 2.X.1982. The material is in the senior author's collection in the Department of Animal Biology and Ecology (Zoology), University of Granada, Spain.



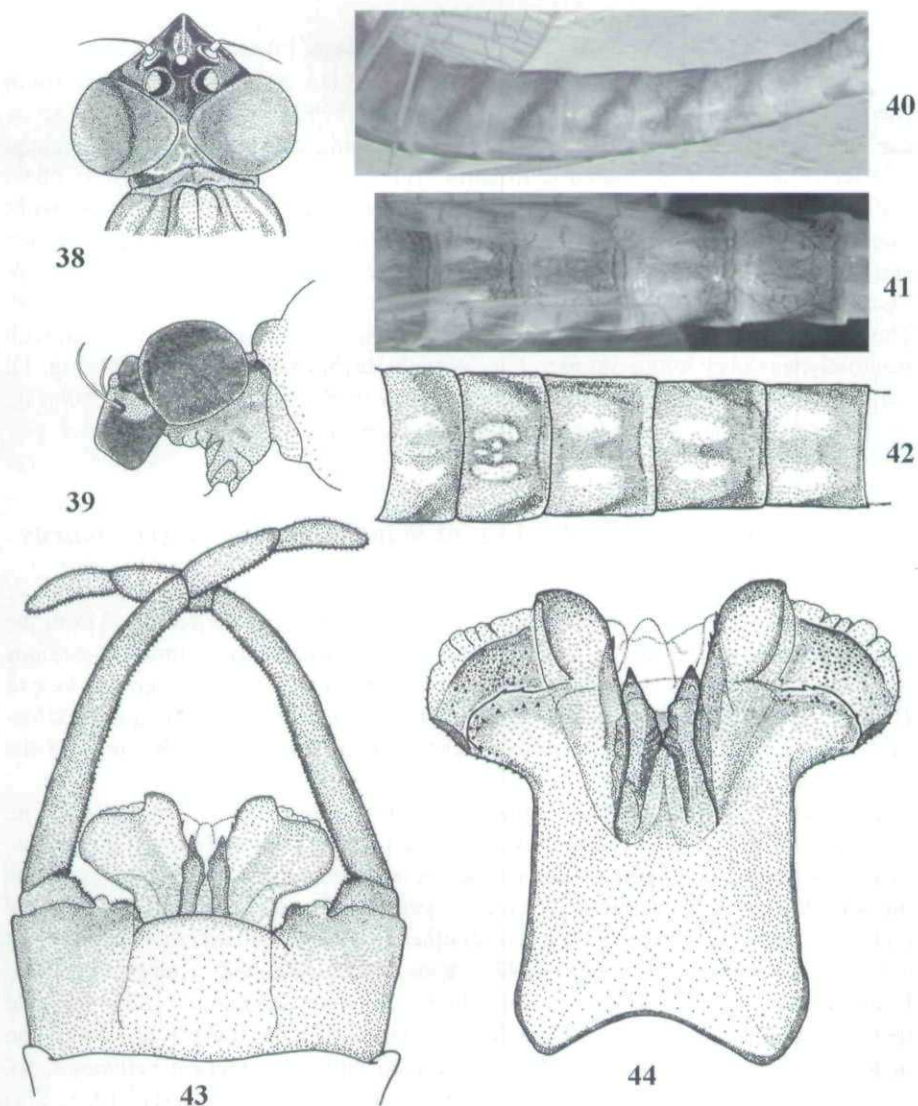
Figures 26–37. Nymph of *Ecdyonurus olgae* sp. n. (26) head and thorax; (27) pronotum; (28) maxillary palp; (29) claw; (30) abdomen. (31, 32) hind margin of 5th abdominal tergite of male and female, respectively; (33) surface of hind margin of fore femur; (34) bristles on dorsal surface of femora; (35–37) 1st, 2nd and 7th gill, respectively.

Etymology: the new species is named for Olga, mother of the junior author.

Nymph (in alcohol). Only exuvial skins from reared material are available. Length (mm): body (male: ca. 11.1, female: ca. 12.5). General body colour yellowish to light brown, tergites with light maculae. Head (Fig. 26): shape trapezoidal, the widest part at the level of the eyes. Mouthparts: labrum without specific features, one row of median bristles typical of the *venosus* group (Belfiore & Buffagni, 1994); superlinguae of hypopharynx with long hairs on the outer margin and over the top of the lobes, as typical of the *venosus* group; mandibles with 11–13 prosthecal bristles. Maxillae: number of comb-shaped bristles (N_CBS) 22–24 plus 2–3 smaller bristles; number of teeth on 5th CBS (N_TCB5) = 18–19; number of hairs on dorsal upper

side (N_DOR) = 8–12; number of hairs on outer margin of maxillae (N_OUT) = 0; number of hairs on ventral basal part of maxillae (N_VEN) = 7–13; a small group of hairs at the base of the maxillary palp (N_PLBas) = 4–7; no hairs present on the outer base of the first segment of maxillary palp (N_PLH) = 0; numerous setae present on the outer margin of the first segment of maxillary palp (N_PLS) = 30–40; without or with only a few setae on the inner side of the first segment of maxillary palp (N_PLP) = 0–2 (Fig. 28). Labial palp: the field of setae on the dorsal side of its first segment (N_LPH) = 19–25. Thorax: pronotum (Figs. 26 and 27): lateral projections large, sometimes asymmetrical, with the apex somewhat pointed; width of semipronotum/length of caudal projection (measured according to Bauernfeind & Humpesch, 2001) is 2.0–2.3; legs (Figs. 29, 33 and 34): pointed bristles present on the upper surface of all femora (Fig. 34); a row of pointed and large bristles behind the row of long hairs at the hind margin of the distal part of fore femur, submarginal bristles pointed (Fig. 33). Tarsi with distal darker ring, tarsal claws with one proximal and two subdistal teeth (Fig. 29). Abdomen (Figs. 30–32): hind margin of central part of tergites with pointed teeth (different shapes can be observed in male and female nymphs, Figs. 31 and 32), with numerous submarginal denticles arranged in several rows; sternites (Fig. 30) with small lateral projections, the ratio between projection length and width of sternites is = 0.25 (Fig. 30); gills (Figs. 35–37): 1st gill narrow and elongated, darker at the proximal part (Fig. 35); 4th and 7th gills elongated, with almost parallel margins, a conspicuous pigmented zone extending over the central and proximal surface; 7th gill without tuft of tracheal filaments (Figs. 36 and 37).

Male imago (in alcohol). Length (mm): body ca. 12; forewings ca. 11.1; hindwings ca. 4; fore legs ca. 11.25 (femur = tibia: 3.1; tarsal segments: T1 = 0.75, T2 = 1.3, T3 = 1.3, T4 = 1.0, T5 = 0.5; gradation of tarsal segments: 2 = 3 > 4 > 1 > 5), cerci 26. General body colour yellowish-brown. Head (Figs. 38 and 39): eyes very close to each other, but not touching (Fig. 38), generally grey without visible stripes, but colouration of eyes is not well preserved (Fig. 39); ocelli with the upper part light grey, and bases dark grey to blackish; a narrow light stripe between rostrum and median ocellus, a blackish band along this stripe, and blackish maculae between ocelli and the compound eyes (Fig. 38). Antennae pale yellowish. Thorax: dorsally light brown, pleurae yellowish with light brown sclerotisation. Wings transparent, hyaline, subcostal area yellowish, longitudinal veins yellowish, most of the transversal veins dark tinged, pterostigma, as well the tip of forewings, not reticulated (in pterostigma only 2–3 transversal veinlets are forked). Legs: forelegs brown, tibiae and tarsi lighter than femora, 2nd and 3rd legs yellowish, distal part of femora darker. Abdomen (Figs. 40–42): general colour yellowish, segments 8–10 light brown; tergites with a posterior marginal band extending laterally, and connected medially with a central band, more conspicuous in the posterior 2/3, and flanked with two longitudinal oval light zones (Figs. 41 and 42); laterally each segment with brown stripes, obvious up to segments 5–6; these lateral stripes are connected dorsally with the brown band on the hind margin of each segment (Fig. 40); sternites without any conspicuous spot, ganglia invisible. Cerci yellowish, with light brownish rings at the base of each segment (alternating light-brown rings with dark-brown rings every two segments).



Figures 38–44. Male imago of *Ecdyonurus olgae* sp. n. (38, 39) head, dorsal and lateral views, respectively; (40) abdomen in lateral view; (41, 42) same in dorsal views; (43) general outline of male genitalia; (44) penis dorsal, mounted in Hoyer's liquid.

Genitalia (Figs. 43 and 44): forceps and styli yellowish-brown; styli plate with two wide, short, rounded latero-marginal teeth (Fig. 43); penis with moderately expanded lateral lobes; in dorsal view the basal sclerites partially cover the basal margin of the lateral sclerites (Fig. 44); lateral sclerites relatively broad, with roughly parallel margins; apical sclerites very broad and rounded (Fig. 44).

Female imago. Unknown.

Affinities. The penis with short, wide, rounded lateral lobes, resembles several of the Mediterranean species of the *E. venosus* group. It is especially close to *E. codinai* Navás, 1924 (Thomas, 1968b; Haybach & Thomas, 1999). However, *E. olgae* sp. n. can be distinguished from *E. codinai* by the following combinations of characters: absence of conspicuous pointed teeth on the submarginal sides of the styliger plate, and basal part of the second segment of forceps not swollen (compare Fig. 43 with: Thomas, 1968b: Pl.II, Fig. 1 and Haybach & Thomas, 1999: Figs. 8 and 9), swollen and differently shaped apical sclerites of penis (compare Fig. 44 with Haybach & Thomas, 1999: Fig. 19); different abdominal pattern (compare Figs. 40–42, with Thomas, 1968b: Pl. I, Fig. 1 and Haybach & Thomas, 1999: Figs. 5 and 6), head with fronto-clypeus very long (compare Fig. 38 with Haybach & Thomas, 1999: Fig. 1), outline of eyes in lateral view (compare Fig. 39 with Haybach & Thomas, 1999: Fig. 2), and pterostigma, as well the tip of forewings, not reticulated.

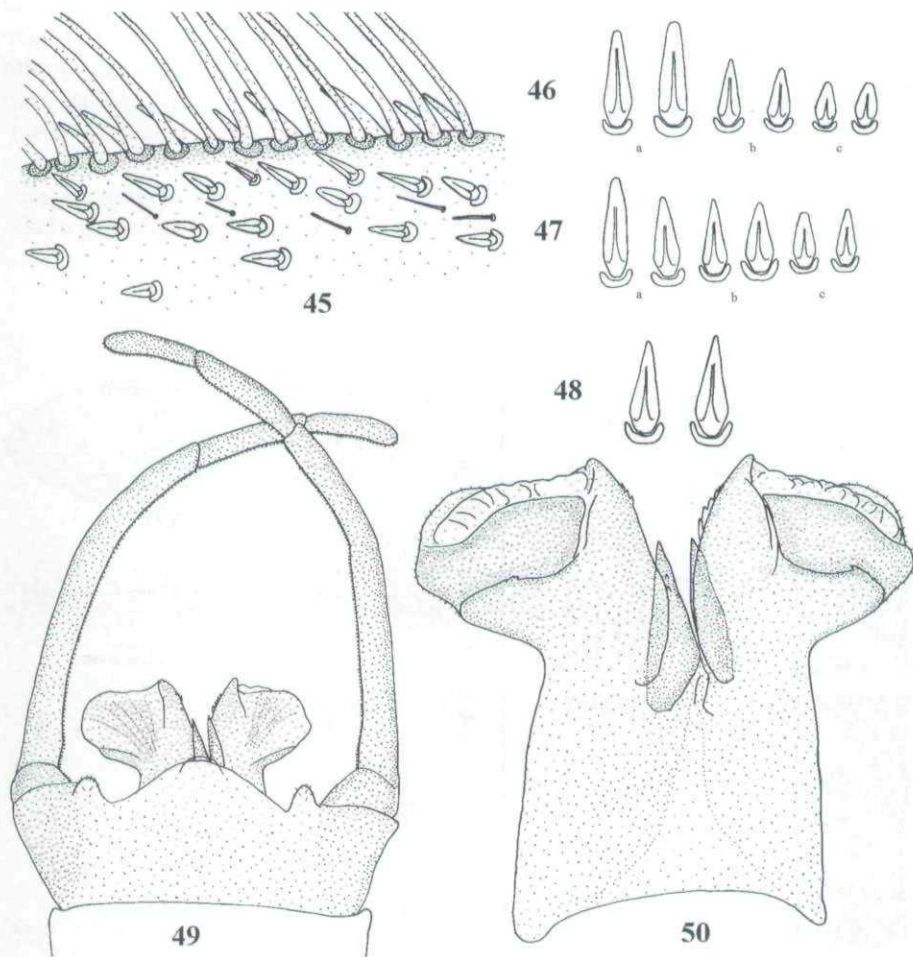
Some Problems of Identification of Winged Stages of *Ecdyonurus venosus* (Fabricius, 1775)

During the present study, very large nymphs (ca. 20–25 mm) were collected from the Castril river (Prov. Granada, South of Spain). After rearing a large number of nymphs we obtained numerous winged specimens of a species that, at first, seemed close to *E. venosus* but attempts to identify them with published literature was quite confusing: some characters did not fit those described for this species. We noticed the following problems.

According to descriptions and figures of several authors (i.e. Kimmins, 1942, Fig. 3; Landa, 1969, Fig. 17, 5v; Elliott & Humpesch, 1983, Figs. 4, 22b, and the picture of an emerging male imago on the interior cover; Reisinger et al., 2000: figures on the top of page 75), the subimagoes of *E. venosus* do not have transverse shaded bands on the wings, distinguishing it from other species with distinctly banded wings such as *E. torrentis* (Kimmins, 1942; Landa, 1969; Elliott & Humpesch, 1983; Bauernfeind, 1997; Reisinger et al., 2000). In contrast, Eaton (1883–88) said that the subimagoes of *E. venosus* have wings with dark transverse stripes and bands, but he added: similar to those described under *Heptagenia sulphurea*, so, perhaps he meant: cross-veins bordered or washed with black. Bogoescu (1958: 171) also described similar transversal bands ('Aripile cenusii, cu benzi transversale fumurii').

Similarly, in the the genitalia it was published that the hind margin of the styliger plate does not have latero-marginal teeth (Kimmins, 1942: Fig. 4 ; Elliott & Humpesch, 1983: Figs. 23b; Bauernfeind & Humpesch, 2001: Fig. 484) or if they exist, they are inconspicuous (Kimmins, 1942: 490; Bogoescu, 1958: Fig. 102; Landa, 1969: Fig. 17, 3v, and text on page 215; Thomas, 1968a: 63; Bauernfeind & Humpesch, 2001: 138). Moreover, the apical sclerite of the penis is figured with roughly parallel margins (Kimmins, 1942: Fig. 4; Landa, 1969: Fig. 17; Elliott & Humpesch, 1983; Studemann et al., 1992; Bauerfeind & Humpesch, 2001: Fig. 477).

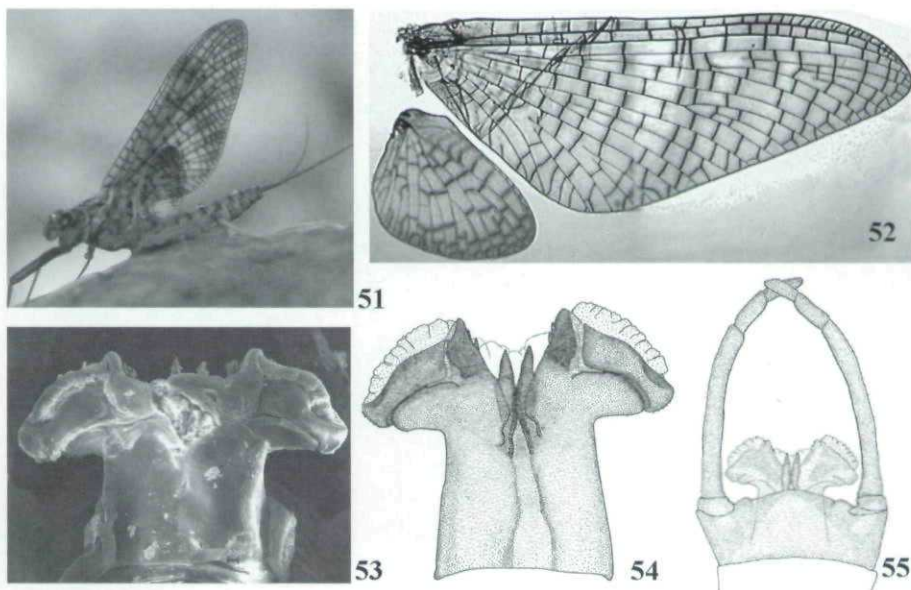
However, subimagoes from the Castril river have very conspicuous transverse shaded bands on the wings (Figs. 51 and 52), similar to what most of the recent authors considered being typical of *E. torrentis* (see Reisinger et al., 2000: figures on page 76). Moreover, in the genitalia, the styliger plate has very obvious short latero-marginal teeth (Fig. 55), and generally the apical sclerites of the penis have a widening on the outer margin, so that the margins are not parallel (Figs. 53 and 54). In the future this could be considered as a variable character. In addition when looking at the shape of hind wings (Fig. 52) and comparing it with Eaton (1883–88, plate XXIII,



Figures 45–50. *Ecdyonurus angelieri* Thomas, 1968. (45) Surface of hind margin of fore femur; (46–48) bristles on dorsal surface of fore, middle and hind femur, respectively, with a, b and c, identifying the bristles of the proximal, central and distal part of the femur, respectively; (49) general outline of male genitalia; (50) penis dorsal, mounted in Hoyer's liquid.

Fig. 46), the wings are clearly wider, similar to what Kimmins (1942: Fig. 3) figured for *E. torrentis*. But, according to Haybach (pers. comm.) Eaton's *E. venosus* does not match Kimmins' *E. venosus* and probably is *E. torrentis*.

In conclusion, there are variabilities or inaccuracies in the literature which, added to the apparently high variability of the discussed characters of the genitalia, could cause difficulties in assigning some Southern European populations to *E. venosus*. In any case, it is necessary to define what is a typical pattern in the subimaginal wings of *E. venosus*, studying the possible variability on wing pattern. Because, as we commented before, there are modern publications, like those of Elliott and Humpesch (1983) and Reisinger et al. (2000), with new drawings and pictures where it seems that at least the British and Central European populations have cross-veins bordered or washed with black but no transversal shaded bands. However, it seems that there are some exceptions. Thus Haybach (pers. comm.) reared material of *E. venosus* with untypical banded wing colouration but never as pronounced as in the material from the south of Spain. Another possibility could be that what, at the moment, is considered as *E. venosus* (including South Spanish material) represents in fact a complex of species with very similar genitalia. If so, it will be necessary to undertake a wide study, including molecular analyses, to compare material from the whole area of distribution of the species. This would help to solve the problem.



Figures 51–55. *Ecdyonurus venosus* (Fabricius, 1775) from the Castril river in the South of Spain. (51) Female subimago, habitus; (52) wings; (53) penis dorsal, SEM, critical point dried, gold coated, 15KV; (54) the same, mounted in Hoyer's liquid; (55) general outline of male genitalia.

Acknowledgements

We are very grateful to Dr Ernst Bauernfeind (Natural History Museum of Vienna, Austria), and Dr Arne Haybach (Mainz, Germany) for their invaluable advice, suggestions and corrections of the first draft of the manuscript, and Dr John Flannagan for helping us with the English. Similarly, we are indebted to Professor Alain Thomas (Université Paul Sabatier, Toulouse, France) for the gift of material of *E. angelieri*. Pablo Jáimez-Cuéllar helped to capture and rear some nymphs. We are especially grateful to Renault España Comercial S.A., and its franchise holder in Granada (Fajisa Automoción Granada, S.A.) for the recent donation of a Kangoo 4x4 vehicle which helped us to do additional trips to collect material. This research benefited from grants from the Spanish DGICYT (project REN2001-3438-C07-06/HID) and the Slovak Grant Agency for Science (project No. VEGA 1/7032/20). We would also like to thank the anonymous referees and the Editor for constructive suggestions which greatly improved the article.

References

- Alba-Tercedor J, Jáimez-Cuéllar P (2003): Checklist and historical evolution of the knowledge of Ephemeroptera in the Iberian Peninsula, Balearic and Canary Islands. In: Gaino E, ed., *Research Update on Ephemeroptera & Plecoptera*. Perugia, Università degli Studi di Perugia, pp. 91–97.
- Alba-Tercedor J, Peters WL (1985): Types and additional specimens of Ephemeroptera studied by Longinos Navás in the Museo de Zoología del Ayuntamiento, Barcelona, Spain. *Aquatic Insects* 7: 215–227.
- Bauernfeind E (1997): Discriminating characters in Central European species of genus *Ecdyonurus*. In: Landolt P, Sartori M, eds., *Ephemeroptera & Plecoptera: Biology-Ecology-Systematics. Proceedings. VIIIth International Conference on Ephemeroptera*. Lausanne, Fribourg, pp. 418–426.
- Bauernfeind E, Humpesch UH (2001): *Eintagsfliegen Zentraleuropas (Insecta: Ephemeroptera): Bestimmung und Ökologie*. Wien, Verlag des Naturhistorischen Museums Wien.
- Belfiore C (1994): Taxonomic characters for species identification in the genus *Electrogena* Zurwerra and Tomka, with a description of *Electrogena hyblaea* sp. n. from Sicily (Ephemeroptera, Heptageniidae). *Aquatic Insects* 16: 193–199.
- Belfiore C (1996): Identification and discrimination of *Electrogena* species by numerical methods (Ephemeroptera, Heptageniidae). *Systematic Entomology* 21: 1–13.
- Belfiore C, Buffagni A (1994): Revision of the Italian species of the *Ecdyonurus helveticus*-group: taxonomy of the nymphs (Ephemeroptera: Heptageniidae). *Mitteilungen der Schweizerischen Entomologischen Gesellschaft* 67: 143–149.
- Bogoescu C (1958): Ephemeroptera. *Fauna Republicii Populare Romîni. Insecta*, Vol. VII, fasc. 3. Bucharest, Academii Republicii Populare Romîni.
- Braasch D, Soldán T (1985): Ein neuer *Ecdyonurus* der *ruffii*-Gruppe aus Bulgarien (Heptageniidae, Ephemeroptera). *Entomologische Nachrichten und Berichte* 29: 67–68.

- Burneister H (1839): *Handbuch der Entomologie*, II. Band, 2. Abt. Fam. Ephemerina. pp. 788–804 & 1015.
- Curtis J (1834): Descriptions of some nondescribed British Species of Mayflies of Anglers. *Lond Edinb Phil Mag Ser 3*, 4: 120–122.
- Eaton AE (1883–88): A revisional monograph of recent Ephemeridae or Mayflies. *Trans Linn Soc Lond, Zoology 3*: 1–352 + 65 pl.
- Elliott JM, Humpesch UH (1983): A key to the adults of the British Ephemeroptera. *Fresh-water Biological Association Scientific Publication 47*: 1–101.
- Fabricius JC (1775): *Systema Entomologiae* pp. 303–304.
- Fontaine J (1964): *Ecdyonurus wautieri* sp. n. espèce nouvelle d'Heptageniidae rencontrée dans la région lyonnaise (Ephéméroptère). *Bulletin Société Linnéenne de Lyon 3*: 84–91.
- Grandi M (1960). *Ephemeroidea*. Bologna, Fauna d'Italia. Ed. Calderini.
- Haybach A (1999): Beitrag zur Larvaltaxonomie der *Ecdyonurus venosus*-Gruppe in Deutschland. *Lauterbornia 37*: 113–150.
- Haybach A, Thomas A (1999): Rediscovery of *Ecdyonurus codinai* Navás, 1924 in Portugal (Insecta: Ephemeroptera: Heptageniidae). *Ephemera 1*: 79–84.
- Jacob U, Braasch D (1984): Neue und statusrevidierte Taxa der *Ecdyonurus helveticus*-Grossgruppe (Ephemeroptera Heptageniidae). *Entomologische Abhandlungen Staatliches Museum für Tierkunde Dresden 48*(6): 53–62.
- Jacob U, Braasch D (1986): *Ecdyonurus puma* sp. n. aus Montenegro (Jugoslawien) (Ephemeroptera, Heptageniidae). *Reichenbachia 23*(3): 176–180.
- Kimmins DE (1942): The British species of the genus *Ecdyonurus* (Ephemeroptera). *Annals and Magazine of Natural History, ser. 11, vol. IX*: 486–507.
- Koss RW (1964): Morphology and taxonomic use of Ephemeroptera eggs. *Ann Ent Soc Am 61*: 696–721.
- Landa V (1969): *Jepice-Ephemeroptera*. Praha, Fauna ČSSR 18.
- Navás L (1915): Neurópteros nuevos o poco conocidos (Quinta Serie). *Real Academia de Ciencias y Artes de Barcelona 11*(27): 455–481.
- Navás L (1923): Excursions entomologiques de l'istiu de 1922. *Arxius Inst Ciencies Barcelona*: 1–34.
- Navás L (1924): Mis excursiones entomológicas del verano de 1924. *Broteria, Ser. Zool., 21*: 115–150.
- Navás L (1927): Veinticinco formas nuevas de insectos. *Boletín. Sociedad Ibérica. de Ciencias Naturales 26*: 48–75.
- Pictet FJ (1843–45): *Histoire naturelle générale et particulière des Insectes Névroptères. Famille des Ephémérines*. Baillière, Paris and Kessmann et Cherbuliez ed., Genève. 300 S. (1843), 49 Tafeln (1845).
- Reisinger W, Bauernfeind E, Loidl E (2001): *Entomologie für Fliegenfischer Vom Vorbild zur Nachahmung*. Stuttgart, Verlag Eugen Ulmer.
- Studemann D, Landolt P, Sartori M, Hefti D, Tomka I (1992): Ephemeroptera. *Insecta Fauna Helvetica*, 9. Fribourg, Société Entomologique Suisse.
- Thomas A (1968a): Sur la taxonomie de quelques espèces d'*Ecdyonurus* du sud-ouest de la France. *Annales de Limnologie 4*: 51–71.
- Thomas A (1968b): Quelques *Ecdyonurus* et *Rhithrogena* européens de la collection Navás (Ephemeroptera). *Annales de Limnologie 4*: 209–218.

Copyright of Aquatic Insects is the property of Taylor & Francis Ltd and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.