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## RESEARCH ARTICLE

# Redescription of *Caenis hoggariensis* Grandi, 1951 (Insecta: Ephemeroptera: Caenidae)

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## Abstract

Based on newly available material from Algeria, males and nymphs of *Caenis hoggariensis* Grandi, 1951 are redescribed, and new diagnostic characters are introduced and discussed.

Key words: Caenini, mayflies, Palearctic, taxonomy.

## Zusammenfassung

Anhand neu verfügbaren Materials aus Algerien werden Männchen und Nymphen von *Caenis hoggariensis* Grandi, 1951 erneut beschrieben sowie neue differentialdiagnostische Merkmale eingeführt und diskutiert.

## Introduction

GRANDI (1951) described males of a new *Caenis* species collected by ANTONIO GIORDANI SOIKA in the Hoggar Mountains of Algeria, and named it *Caenis hoggariensis* Grandi, 1951. VERRIER (1952) subsequently described the nymph and adult female of this species. All these descriptions were fragmentary and insufficient, not fulfilling modern taxonomic criteria. Therefore, a redescription is given here based on newly available material collected in 1980 by the late ROLAND GRIMM in the same geographic area (see SCHAWALLER & STANICZEK 2021).

## Material and methods

The investigated material is stored in 75% ethanol. It was examined with a Wild M3 binocular. Line drawings were made with the aid of a ZEISS camera lucida on a Leitz Laborlux microscope and digitised in Photo Filtre 6.5.2. Eggs used for SEM analysis were extracted from a female imago, dehydrated through a stepwise immersion in ethanol and then dried by critical point drying (Leica EM CPD300). The mounted material was coated with a 5 nm Au/Pd layer (Leica EM ACE200) and subsequently examined and photographed with a Zeiss EVO LS 15 scanning electron microscope. Digital photographs were edited in Adobe Photoshop Classic 23.5.0 to improve tonality and sharpness. All material is stored at SMNS (Staatliches Museum für Naturkunde Stuttgart, Stuttgart, Germany).

*Caenis hoggariensis* Grandi, 1951

(Figs. 1a–g, i; 2)

GRANDI (1951: 173); VERRIER (1952: 292).

## Material examined

Algeria, Hoggar, Atakor, Afilal-Gheltas near Tamanrasset, 11.03.1980, 14 ♂♂, 16 nymphs. Same data but 24.03.1980, 8 ♀♀, all leg. GRIMM.

## Redescription

## Male imago

## Measurements, ratios and colouration

Body length: 3.7–4.2 mm; wing length: 3.3–3.8 mm. Ratio of forefemur : foretibia = 0.55–0.60; ratio of foretibia : foretarsus = 1.54–1.85; ratio of foreleg : hind leg = 1.49–1.66; ratio of first segment of foretarsus : 2nd : 3rd : 4th : 5th = 1 : 1.4–1.8 : 1.2–1.4 : 1.0–1.2 : 1.3–1.5.

Colouration of cuticle: Mesothorax yellowish brown; margins, sutures and scutellum, as well as transverse ridge of metanotum and sclerites of tergum IX, brown to dark brown. Pronotum brownish yellow; other parts lighter.

Epidermal pigmentation reduced. Frons greyish brown; vertex with more or less pronounced longitudinal dashes. Abdominal terga greyish brown; the middle ones lighter.

## Morphology

Head: Eyes small; often only slightly bigger than lateral ocelli. Base of antennal flagellum strongly dilated, dilated part short, about as long as and 0.7 times as wide as pedicel (Fig. 1e).

Thorax: Prosternal triangle more or less broadened, apically rounded. Tarsus of foreleg short, tarsomeres subequal in length.

Abdomen: Lateral filaments of abdominal segments short. Without finger-like process on tergum II.

Genitalia and sternum IX as in Fig. 1a–b. Penis lobes triangular, variable in length, penis with a narrow ventral sclerite. Apophyses of styliger sclerite short. Central sclerite triangular and rounded. Forceps (Fig. 1c) straight, of moderate length (0.25 mm); with an apical tuft of spines; these spines almost entirely fused except for tips (Fig. 1d). Sclerites and forcipes of brownish colour, often reduced.

#### Female imago

Body length 5.5–6.5 mm; wing length 4.0–4.5 mm. Female very similar to male in the proportions of the stronger sclerotized body parts and colouration (e.g., longitudinal dashes on vertex).

#### Egg

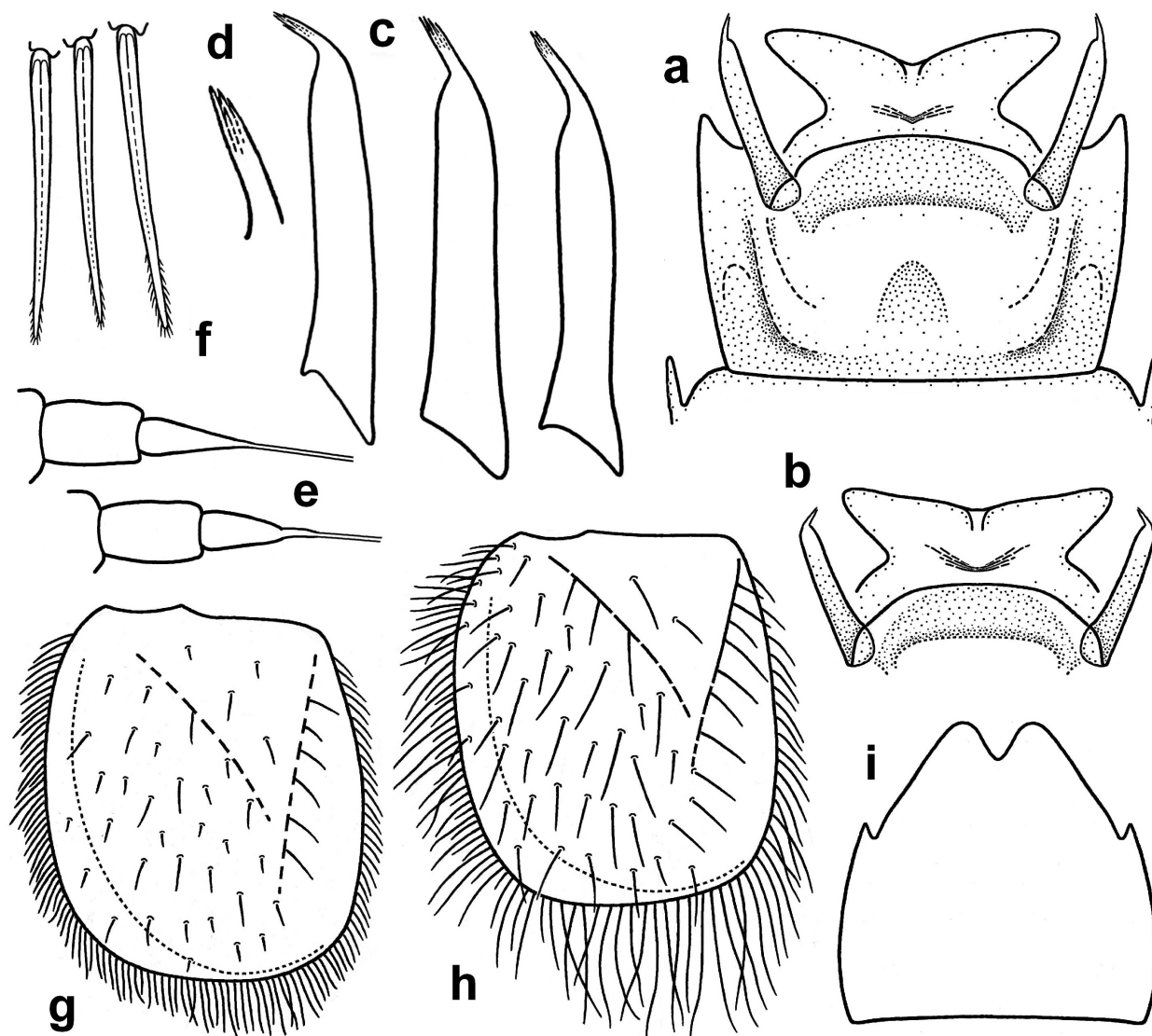
Chorion smooth. Micropyle thin, of moderate length. Two flat epithemata with very small knobs (Fig. 2).

#### Nymph

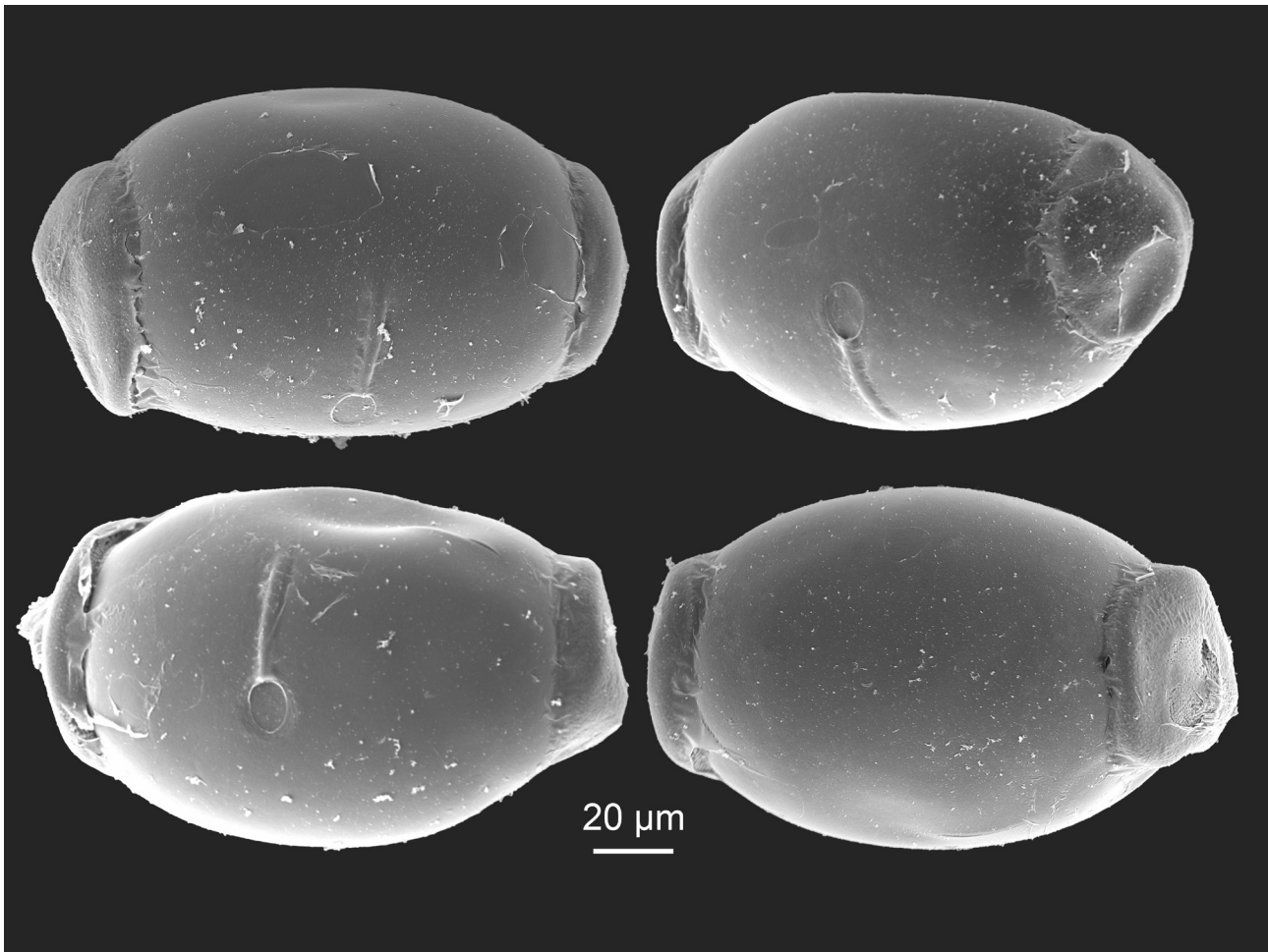
##### Measurements and colouration

Male larva (subadult): body length 5 mm, length of cerci 3 mm; female nymph (subadult): body length 6–7 mm, length of cerci 5 mm.

Colouration of cuticle: pale, yellowish-brown. Epidermal pigmentation: frons and transverse band on vertex greyish brown. Mesonotum with 3–5 small dashes, often reduced. Abdominal terga with transverse bands.



**Fig. 1.** *Caenis* spp. – **a–e.** *C. hoggariensis*, male. **a, b.** Sternum IX with genitalia. **c.** Different shape of forcipes. **d.** Detail of tip of forceps with fused apical spines. **e.** Antennal pedicel and base of flagellum. – **f–g.** *C. hoggariensis*, nymph. **f.** Bristles of transverse row on forefemur. **g.** Operculate gill. – **h.** *C. luctuosa*, nymph, operculate gill. – **i.** *C. hoggariensis*, nymph, hind part of sternum IX.



**Fig. 2.** *Caenis hoggariensis*, egg at 600x magnification (SEM).

#### Morphology

Structure of cuticle inconspicuous. Besides on operculate gill, setation very sparse.

Head. Genae bulging out. Labrum with broadly rounded corners and a median, semi-elliptical indentation. Mandibles with dorsolateral field of moderately (basally) to long bent bristles. Apical incisivus of left mandible with four denticles, subapical incisivus with two; incisivi of right mandible with 3 and 2 denticles, respectively. Labial palp with numerous, long, very thin bristles, second palpomere about 2.0–2.3 times the length of the apical one (along the centre line).

Thorax. Sides of pronotum more or less convex, diverging anteriorly. Coxal processes semi-elliptical, margin slightly denticulated, with few long, thin bristles. Femora and tibiae of mid and hind legs marginally with thin, moderately long to long bristles; on dorsal surface short to moderately long, blunt bristles. Forefemur on dorsal side

with transverse row of about 15 long, thin bristles (10 + 5), apically acute or slightly blunt and more or less frayed (Fig. 1f). Hind margin at level of transverse row and apically densely provided with similar bristles. Foretarsus ventrally with inner row of about 12 short, simple bristles, sometimes also with an outer row of 2–4 bristles. Mid tarsus ventrally with an inner and an outer row of about 20 short bristles, all more or less merging, apical halves pinnate. Hind tarsus with 20–25 similarly arranged bristles, most of them pinnate. Claws slender, apically moderately bent; foreclaw with few, very small denticles, often nearly invisible; denticles on mid claw somewhat stronger; hind claw additionally with a second group of similar denticles located apically from the basal group.

Abdomen. Abdominal segments with posterolateral processes of moderate length. Lateral margin densely provided with moderately long to long bristles, the longest one apically hair-like. Tergum I medially with a transverse



**Table 1.** Differential diagnostic characters of *Caenis hoggariensis* and *Caenis luctuosa*.

		<i>Caenis hoggariensis</i>	<i>Caenis luctuosa</i>
1	Nymph, operculate gill, bristles on dorsal side	short to moderate	moderate to long, the longest twice as long or longer as in <i>C. hoggariensis</i>
2	Nymph, operculate gill, marginal bristles	mostly short, ratio length of longest bristle to length of gill about 0.16	mostly long, ratio length of longest bristle to length of gill about 0.4
3	Nymph, operculate gill, number of marginal bristles	110–120	80–90
4	Nymph, bristles of transverse row on forefemur	long and thin	short, blunt or spatulate
5	Male imago, proportions of genitalia	see Fig. 1a, b	see MALZACHER (1984; table 4, figs. 1–5)
6	Male imago, apex of forceps	with spines largely fused	with clearly separated spines
7	Male imago, base of antennal flagellum	strongly dilated, margins straight	moderately dilated, margins bowed

row of moderately long bristles. Posteromedian process of tergum II very short and broadly triangular, nearly invisible in lateral view. Hind margin of terga VII and VIII with long bristles, that of terga IX and X with denticles. Hind part of sternum IX strongly protruding posteriorly, with a deep V-shaped indentation (Fig. 1i), on dorsal side with a circular shagreen field consisting of densely arranged granules. Operculate gill square with rounded corners (Fig. 1g). Marginal bristles of moderate length and densely arranged; 110–120 bristles altogether; bristles on medial hind margin a little longer; length of gill 5–6 times length of longest bristle. Dorsal side of operculate gill scattered with short to moderate bristles; those bristles also along weakly developed Y-shaped ridges. Ventral side of operculate gill with a row of more or less elongated microtrichia reaching posteromedial corner of gill, running very close to median part of hind margin but quite distant from posterolateral margin.

#### Differential diagnosis

*Caenis hoggariensis* can be distinguished from all other *Caenis* Stephens species by the following combination of characters: Male: base of antennal flagellum strongly dilated; dilated part about as long as pedicel (Fig. 1e); forceps with a tuft of long spines, for the most part fused together (Fig. 1c–d); penis with triangular lobes; apophyses of styliger sclerite short (Fig. 1a–b); abdominal tergum II without finger-like process. Larva: hind part of sternum IX strongly protruding posteriorly, with deep V-shaped indentation; labial palp with second palpomere about 2.0–2.3 times the length of the third one; cuticle without shield- or funnel-shaped microtrichia. Forefemur on dorsal side with transverse row of about 15 long, thin, apically acute or slightly blunt bristles; margins of operculate gill densely provided with about 110–120 short or moderate bristles, the longest (from hind margin) reaching

about one-fifth of gill length; dorsal side of operculate gill scattered with short to moderate bristles.

#### Discussion

Most of the characters described herein lie within the variation range of *Caenis luctuosa* (Burmeister, 1839), and there are only subtle differences between the two species (see Table 1). Both species belong to the so-called TPA-group (with apical tuft of spines on forceps, penis with triangular lobes and antennal flagellum basally dilated; for details see MALZACHER 2012, 2022). *Caenis luctuosa* and *C. hoggariensis* are the only two species of this group recorded from the Western Palearctic realm and are therefore very likely sister species. The separation of the stem species probably took place when desert areas between the Hoggar region and southern Europe expanded again after a pluvial period, e.g., 7–11 mya in the Late Miocene (see ZHANG et al. 2014).

GRANDI and VERRIER assumed that the fused apical forceps tuft represented a second segment of the forceps. However, as the apical ends of these spines are not entirely fused, but still well separated, this assumption is not valid. Moreover, a species with two-segmented forceps would rather point to a placement as sister to all other remaining Caenidae. At the same time, there is no doubt as to a close relationship of *C. hoggariensis* and *C. luctuosa*. and the TPA-group species are highly developed and apomorphic within the tribe Caenini (MALZACHER 2012).

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