Aquatic Insects, Vol. 15 (1993), No. 4, pp. 239-247

0165-0424/93/1504-0239$25.00

Description of *Caenis nachoi* sp.n., with Keys for the Identification of the European Species of the *Caenis macrura* Group (Ephemeroptera: Caenidae)

Javier ALBA-TERCEDOR and Carmen ZAMORA-MUÑOZ

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The nymph and male imago of *Caenis nachoi* sp.n., a new species of the *Caenis macrura* group, from southern Spain are described and drawn, and biological data are included. Differences with closely related species (especially with *C.macrura* Stephens, 1835 and *C.martae* Belfiore, 1984) are discussed, and keys for the identification of the European species of the *macrura* group are included.

Keywords: *Caenis nachoi*, Ephemeroptera, Spain, Identification Keys, Taxonomy.

Javier ALBA-TERCEDOR and Carmen ZAMORA-MUÑOZ, Departamento de Biología Animal y Ecología (Unid. Zoología), Fac. Ciencias (Biológicas), Universidad de Granada, 18071 - Granada, Spain.

INTRODUCTION

During a two year sampling (1988-89) throughout the Genil River basin (Andalusia, southern Spain) we found some nymphs of an undescribed species of *Caenis* Stephens, 1835, which belong to the *macrura* group (after Malzacher, 1984). Due to the scarcity of captures, in 1991 we took new samples to look for additional material. Afterwards we reared the larvae in the laboratory to match adults and nymphs of this new species, which we name *Caenis nachoi* sp.n.

Caenis nachoi sp.n.

Material: Holotype (specimen no.1) ♂ adult (genitalia on slide no. 278, nymphal exuviae on slide no.281), Río Genazal, 500 m., Loja, U.T.M.30SUG9515, *ex nympha* 25.V.91 (emerged 8.VI.91), leg. J.Alba-Tercedor. Paratypes (specimens 2-8): 1 ♂ adult (no.2,genitalia on slide no. 279, nymphal exuviae in a vial), emerged 8.VI.91; 3 ♀♀ nymphs (specimens 4-6, mouth parts and foreleg of specimen no. 6 on slide no. 256), all from the same locality and date as the holotype; 1 ♀ nymph (specimen no.7) from the same location, 15.III.88; 1 ♀ nymph from Río Cubillas, 660 m.,U.T.M. 30SVG4128, 12.XI.88 (specimen no.8); 1 ♀ nymph (specimen no.7) from Arroyo del Salar, 480m., U.T.M. 30SVG0314, 6.II.89, leg. C.Zamora-Muñoz (foreleg on slide no. 284). All the material was collected in southern Spain, in Granada Province. It 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 Nacho, the senior author's son.

Male (in alcohol): General appearance: Body length 4.4 mm-5.5 mm; meso- and metanotum brown with black longitudinal sutures, pronotum and head lighter; scape and pedicel yellow-brown, flagellum yellowish, darker, basally, and not clearly enlarged (Fig. 34); hyaline wings, basal zone, costa and subcosta brownish; legs yellowish with brownish longitudinal edges, coxae and forelegs darker; abdomen yellowish-brown, two light spots on the central zone of sternites and two small light stripes on the anterior zone, especially clearly visible on sternites 1-5.

A projecting smooth tooth on the anterior corner of each side of pronotum longer than drawn by Malzacher (1976, Fig. 2) for *C.macrura*. Posterior corner of abdominal segments 7-9 with long lateral projections *ca*. half the segment length. A thin fleshy finger-like postero-median projection on the 2nd abdominal tergum (Fig. 33).

Genitalia (Figs.: 29-32): penes anvil shaped, with well-developed lateral lobes, and a central longitudinal incision, surface of penis lobes with a few small tubercles; forceps pigmented, densely covered with trichomes, only slightly curved, with a step on distal inner margin and with a terminal tuft of 6-8 strong spines parallel to the axis, not at an angle with it.

Nymphs (in alcohol): General aspect: Body length: 4.5-6.7 mm.; general colour yellowish with darker pigmentation; pattern of head and pronotum as in Figure 1; a dark spot on fore side of coxae (Fig. 2); abdominal terga 6-7 well pigmented except on lateral margins, pattern of the abdominal sternites as in Figs. 2 and 3.

Head with very developed genal projections (Figs. 1-7).

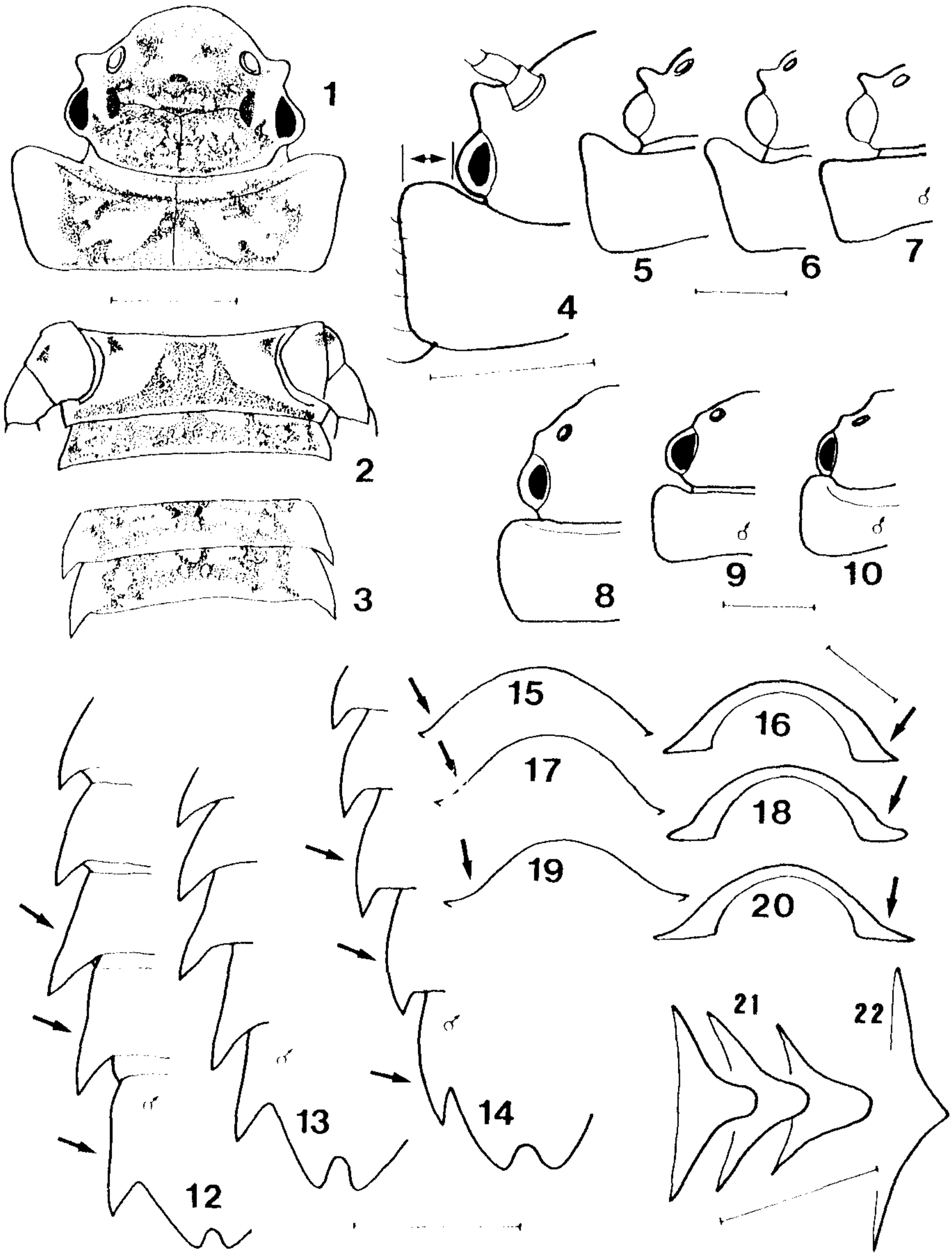
Thorax: lateral flanges of the pronotum flattened and well developed, so that the eye and the outer edge of the pronotum are widely separated (Figs. 1-7, 19 and 20), side of pronotum with bristles, an especially long and strong bristle on the hind corner (Fig. 4). Forelegs with a regular row of long bifid bristles, distally pennate (Figs. 23-25), variable (Figs. 23 and 24); claws with sparse, inconspicuous denticles; dorsal surface of femora, specially on 2nd and 3rd legs, densely sculptured with tiny sharp and narrow spines.

Abdomen: posterolateral projections of abdominal segments long and directed somewhat outwards, 9th abdominal sternite deeply notched (Figs. 12 and 13); hind margins of abdominal tergites 7 and 8 with long setae. Microtrichia of the second gill as in *C.macrura* (see Malzacher, 1984, Taf.18: Fig.4).

Body surface with fan shaped microtrichia, similar to those described by Malzacher (1986) for *C. macrura macrura* (Fig.35).

DISCUSSION

According to Dr. Malzacher (in a letter) the taxonomical situation of the *C. macrura* complex in the Mediterranean is difficult and far from clear, there being many local forms or races. It is difficult to decide whether a number of them are



Figs. 1 - 22. *C. nachoi* sp.n. (1 to 7, 12, 13, and 19 to 21), *C. macrura* (10, 15, 16 and 22) and *C. martae* (8, 9, 14, 17 and 18), nymphs: pattern of head and pronotum (1), metasternum and 1st abdominal sternite (2), and 4th and 5th abdominal sternites (3); variability of head and pronotum (4 to 10); ventral view of 5th to 9th abdominal segments; dorsal contour of the pronotum in posterior view (15 to 19) and in frontal view (16-20); and dorsal projection on the 2nd abdominal tergite (21 and 22). (Scale line 0.5 mm).

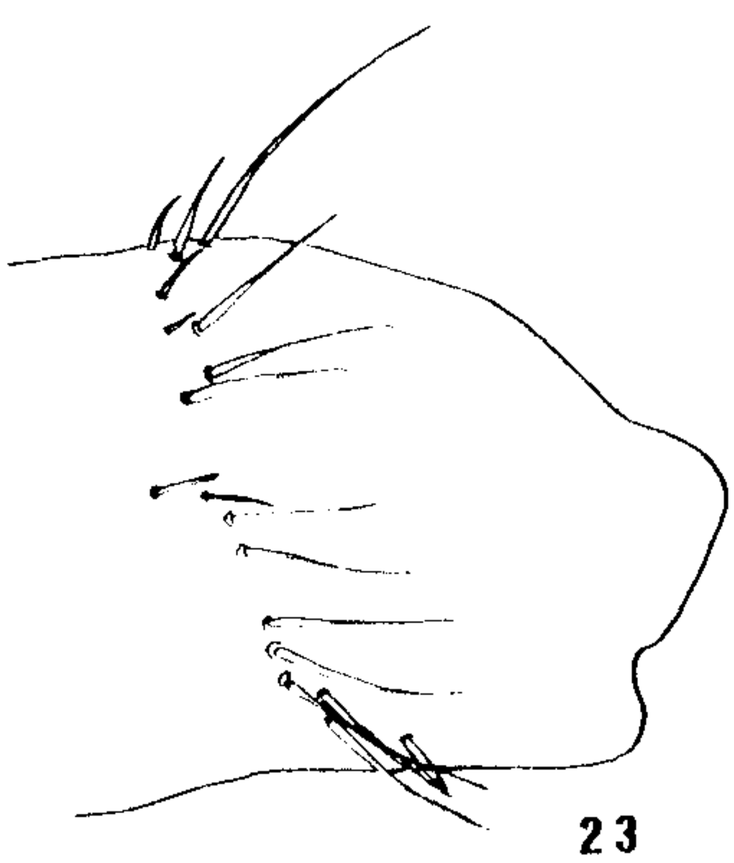
species, subspecies or whether they represent a high range of variability within a single species, and DNA methods will be needed to solve the taxonomical status of some European species of the genus *Caenis*. Nevertheless, in the meantime we consider that the new taxon is morphologically distinct enough to be described as a new species.

C. macrura (*sub nom. C. halterata*) was first recorded in the Iberian Peninsula (Portugal) by Eaton (1884). Lately this species was recorded in Spain in different ecological papers on aquatic macroinvertebrates (González del Tánago *et al.*, 1981; López-Llaneza, 1984; Muñoz *et al.*, 1986; Prat *et al.*, 1985). However, because this species has not been recorded in Spain in any taxonomical paper (Alba-Tercedor, 1981, recorded *C. pusilla* Navás, 1913 misidentified as *C. macrura* ?), we consider these records dubious, especially after study of nymphs and adults (kindly provided by Dr. García de Jalón, Univ. Madrid) used for an earlier record of *C. macrura* in Spain (González del Tánago and García de Jalón, 1981): they are in fact *C. luctuosa* (Burmeister, 1839). Therefore, *C. nachoi* sp.n. represents the first verified record of the *macrura* complex in Spain. Eaton (1884: Plate XLII, Figs. 3 and 4) has drawn (without any description) the nymph of a unnamed species of the *macrura* group from Portugal, with long postero-lateral projections of abdominal segments 7-9, and with fairly conspicuous genal protuberances. This may perhaps be *C. nachoi* sp.n.; even though rare, it could have a large distribution within the Iberian Peninsula.

C. nachoi sp.n. is close to *C.martae* Belfiore, 1984 and to *C.macrura* Stephens, 1835, but the new species can be easily distinguished by the following characteristics:

a) *Nymphs:* head with conspicuous genal projections, which are absent in the other species; eyes and lateral edges of pronotum well separated (Figs. 1 and 4-7, and 8-10); lateral flanges of the pronotum more flattened (increasing flattening can be observed from *C.macrura* to *C.martae* and further to *C.nachoi* sp.n., see Figures 15 to 20); lateral margins of abdominal segments 7-9 not regularly convex, with lateral projections directed somewhat outwards; length of the 2nd segment of maxillary palpus slightly longer than the 3rd (Fig. 28) while in *C.macrura* (Fig. 26, Eaton, 1884: lam. XLII; *sub nom. C.halterata;* Grandi, 1942: Fig. XVI, 1) and in *C.martae* (Fig. 27) the 2nd segment of the maxillary palpus is shorter than the 3rd. Moreover the postero-median projection of the 2nd abdominal tergum both in *C.nachoi* sp.n. and in *C.martae* is long, narrow and rounded at the end (Fig. 21 and Belfiore, 1984: fig. 3), but in *C.macrura* this is comparatively shorter, wider and somewhat pointed at the end (Fig. 22, and Belfiore, 1984: Fig. 4).

b) Adults: a fleshy finger-like projection on the 2nd abdominal tergum (Fig. 33), which is absent in *C.macrura* and may or may not be present in *C.martae*. Belfiore (1984) described this characteristic as the only one to distinguish *C.martae* and *C.macrura*, and Malzacher (1984) used it in his keys for the identification of the European species of the genus *Caenis*; however, it is necessary to point out



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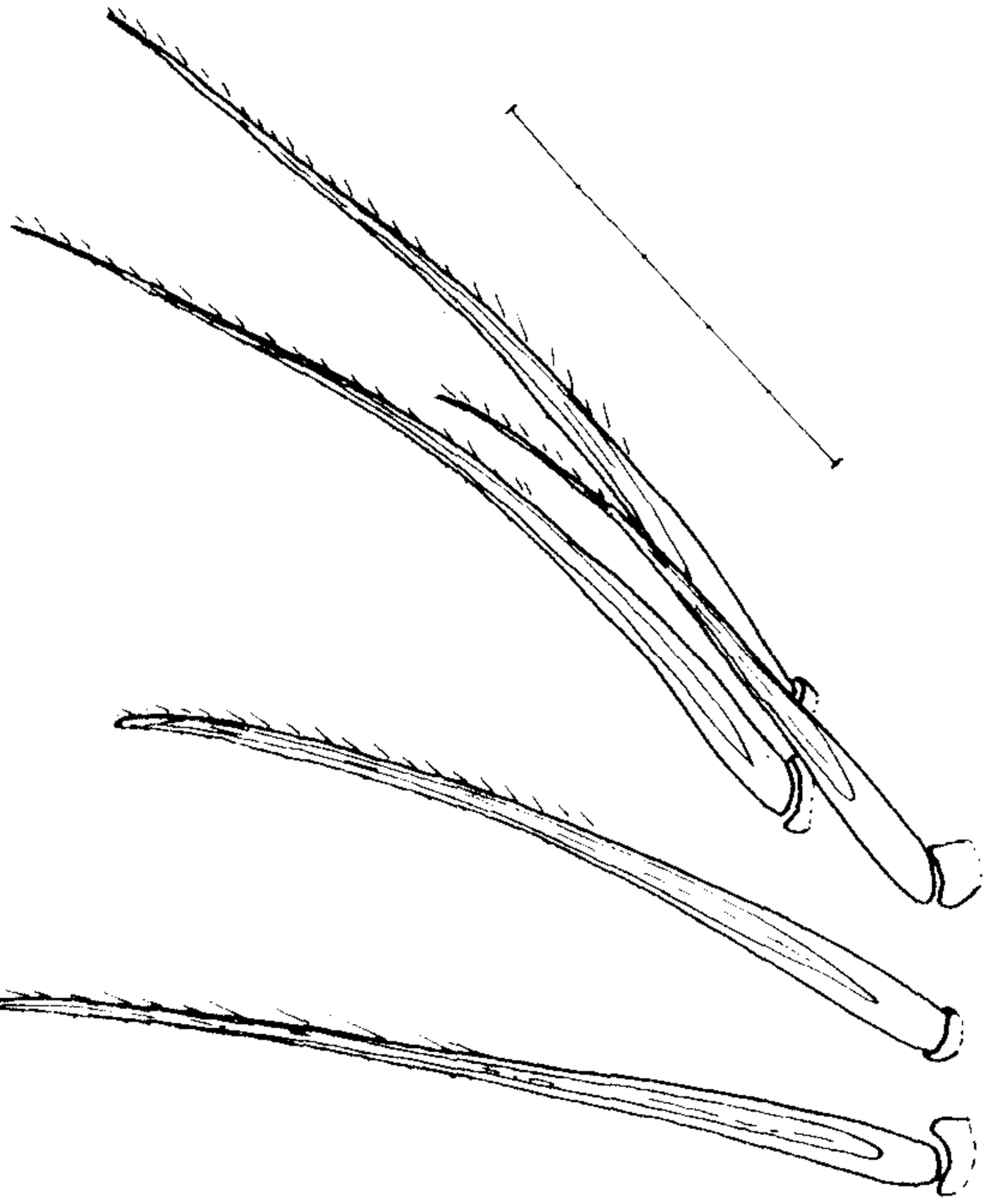

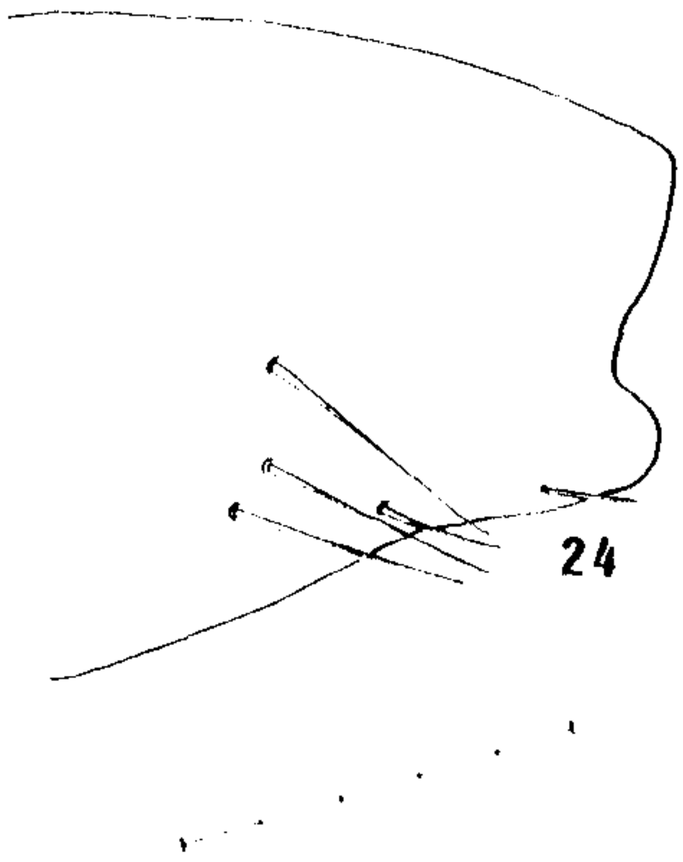

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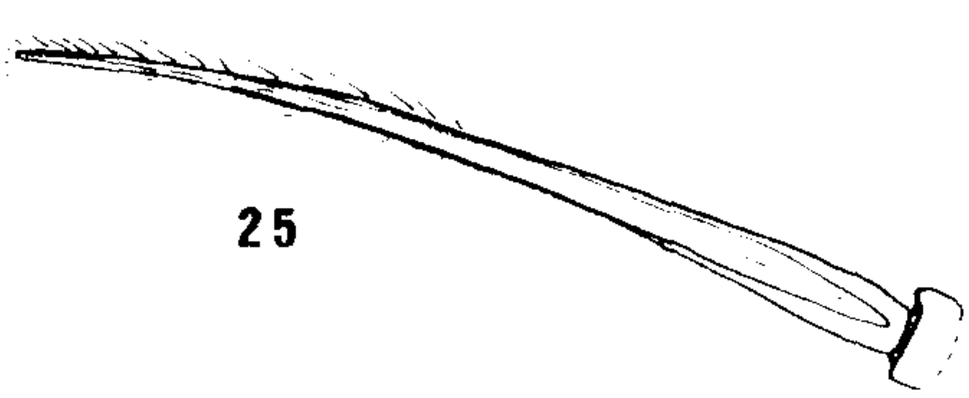

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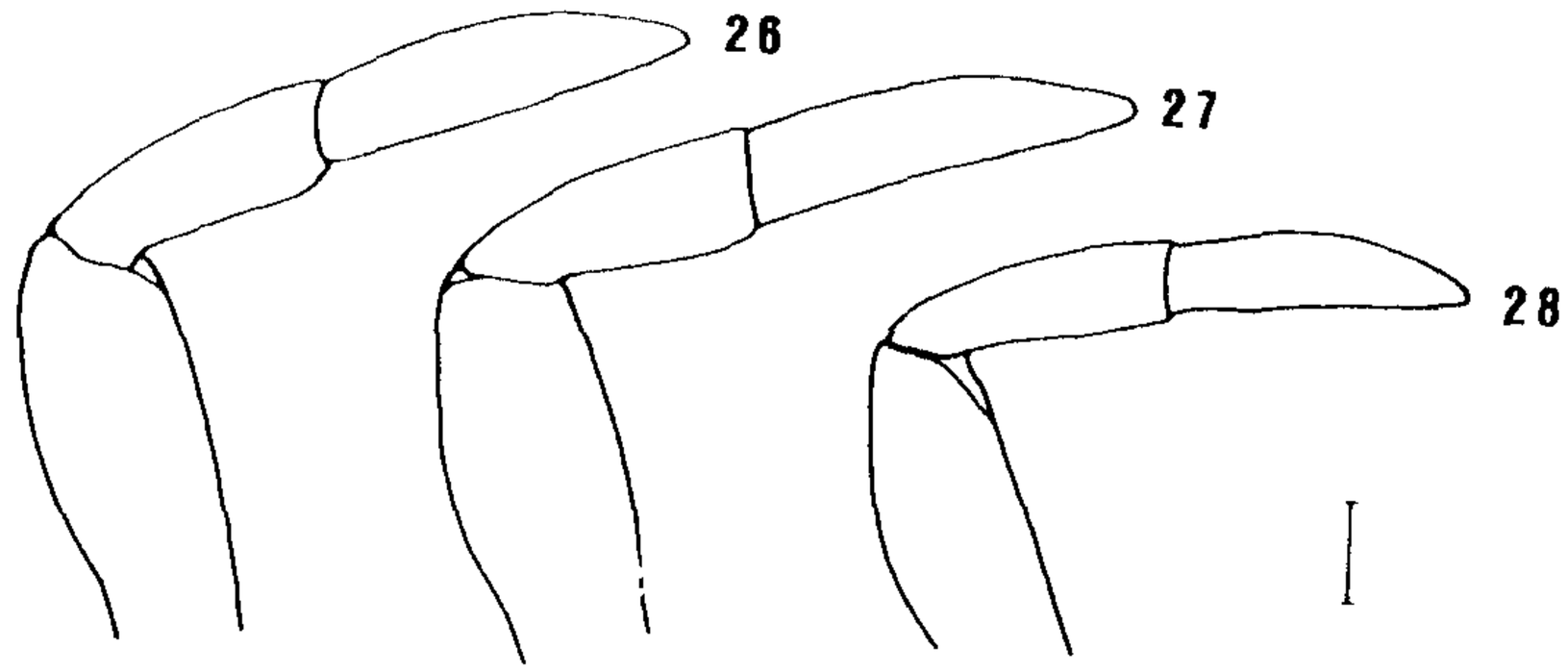

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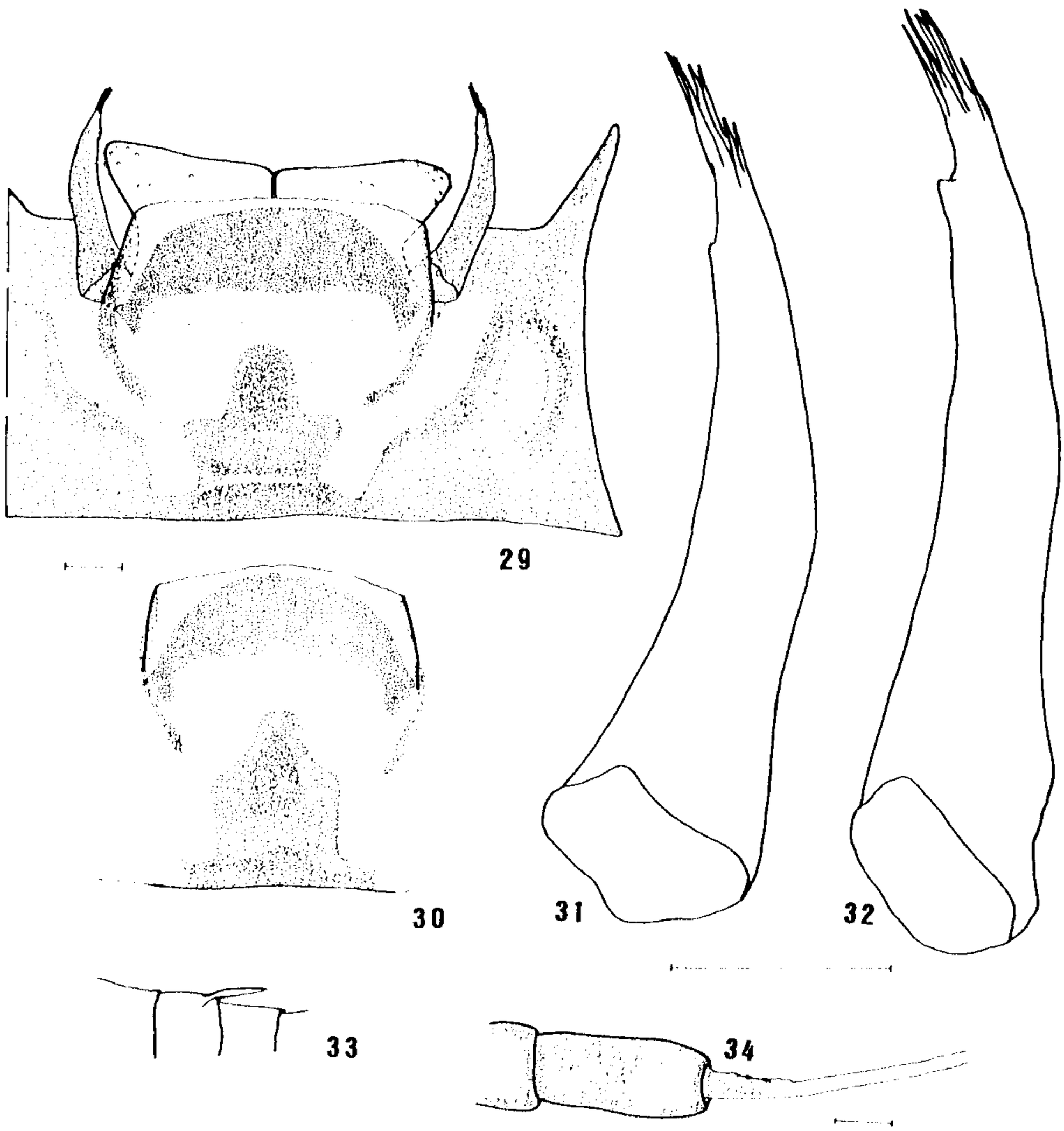
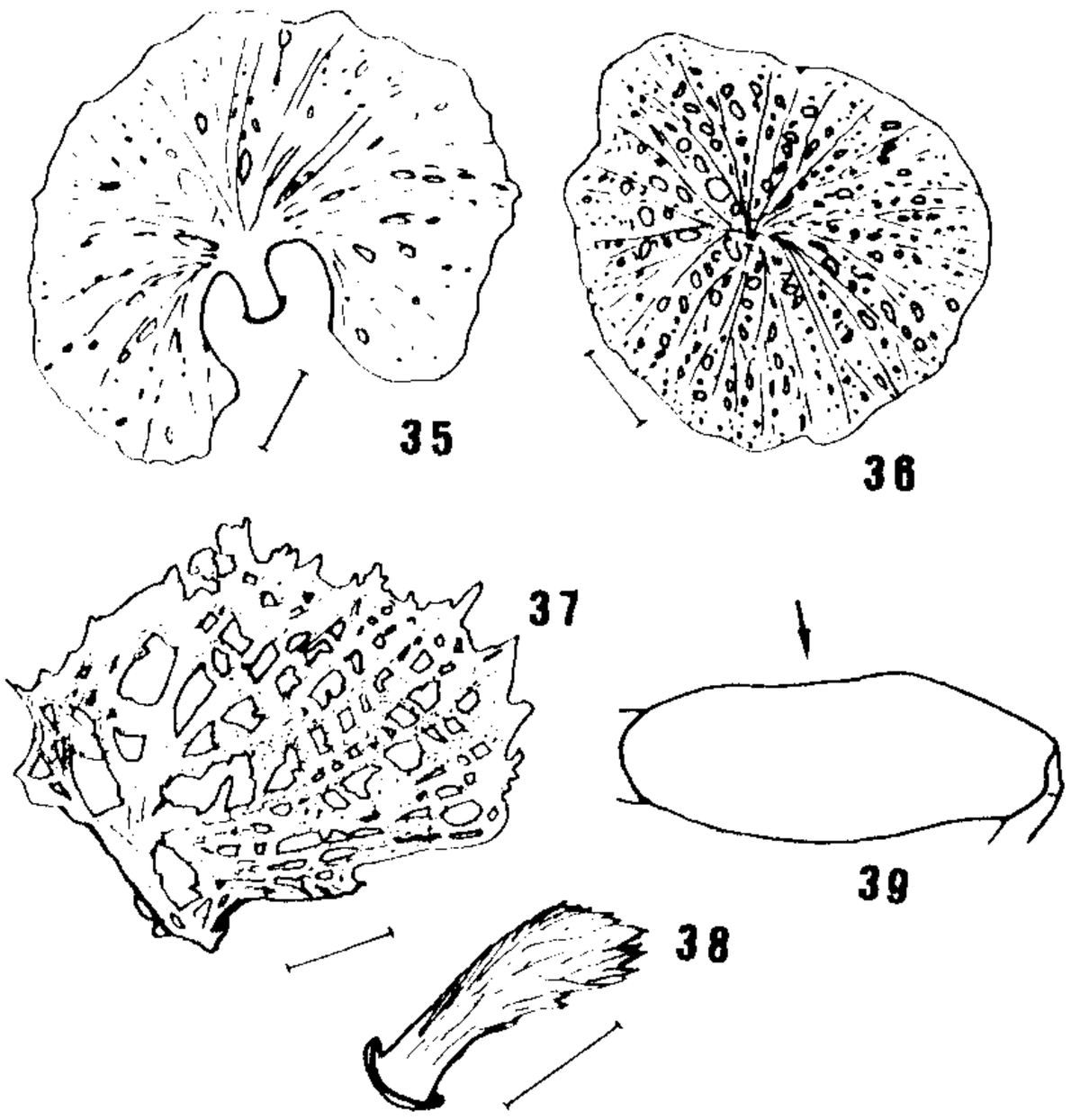
Figs. 23-28. *C. nachoi* sp.n. (23 to 25, and 28), *C. macrura* (26) and *C. martae* (27), nymphs: variability (23, 24) and bristles (25) in the row on the distal third of fore femora; maxillary palps (26 to 28). (Scale line 0.05 mm).

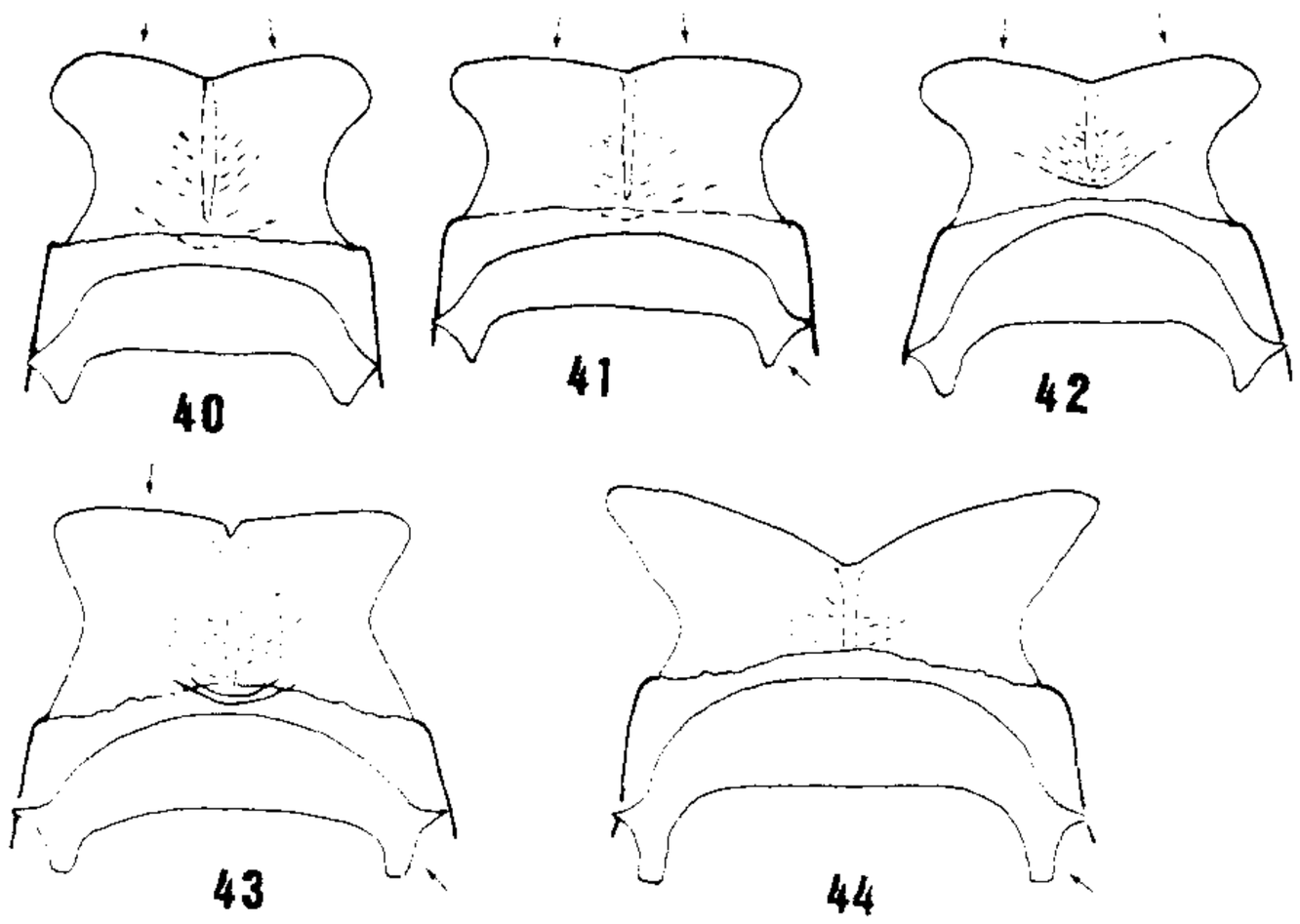
that we have examined 9 adults of *C.martae* from Sardinia (Italy), collected and identified by Dr. Carlo Belfiore, and only one specimen presented a projection on the 2nd abdominal segment. Moreover in *C.nachoi* sp.n. the tuft of spines at the tip of forceps is not bent inwards, and the postero-lateral projections of the 10th segment are longer and more slender than in *C.macrura* and *C.martae*; additional differences can be found in the hind margin of the 10th sternite, in the penis shape, and in the ventral pattern of the 10th sternite (Figs. 29-39 and 40-42; see also Malzacher, 1984: Taf. 3, Taf. 5: Figs. 1 and 2, and Taf. 9: Figs. 1-3).



Figs. 29-34. *C. nachoi* sp.n.: male genitalia (29, 30), forceps (31, 32), fleshy finger-like postero-median projection on the 2nd abdominal tergum (33), and antenna (34). (Scale line 0.05 mm). (Figs. 29-32 and 34, drawn after microscopic slides mounted in Hoyer's medium).



Figs. 35-39. Microtrichia on the nymphal body surface of: *C. macrura macrura* (35), *C. macrura helenica* (36), *C. macrura minoica* (37), and *C. luctuosa* (38). Outline of the fore femur of *C. luctuosa* (39). (Figs. 35 to 38 redrawn after Malzacher, 1984). (Scale line 0.005 mm.). Even though microtrichia have been outlined after SEM photographs, they can be clearly observed under a light microscope with oil immession at 1600 x). (Scale line 0.005 mm).



Figs. 40-44. Penis and hind part of styliger: *C. macrura macrura* (40 to 42), *C. macrura minoica* (43), and *C. macrura helenica* (44). (Redrawn after Malzacher, 1984).

Biology: Nymphs of *C.nachoi* sp.n. were collected on sandy river banks where there was a thin layer of vegetal detritus and some pebbles (coexisting with *C. pusilla* Navás, 1913), in clean as well as in organically polluted waters, of which the abiotic parameters were in the following ranges: temperature: 15.8-16.3°C, pH: 7.3-7.9; flow: 113-242 l/sec.; PO_4: 1.09-2.02 mg/l; NH_4^+: 2.06-5.97 mg/l; Cl^-: 67-121 mg/l; conductivity: 1000-1314 µs/cm.

The presence of mature nymphs with black wing pads could suggest a univoltine life cycle with a flight period during spring (May-June).

KEYS FOR THE IDENTIFICATION OF THE EUROPEAN SPECIES OF THE *CAENIS MACRURA*-GROUP

Nymphs:

Nymphs of the *Caenis macrura* group can easily be separated from other European species of the genus *Caenis* by the deep notch of the 9th abdominal sternite (Figs. 12-14).

1. – Row of bristles on anterior half of the fore femur forming a regular straight line across femur; these bristles are pressed together and most are wider distally than basally (see Malzacher, 1984: Taf. 16). Femur usually with a slight concavity on the outer edge (Fig. 39 and Elliott *et al.*, 1988: Fig. 40d). Dorsal body surface with brush shaped microtrichia (Fig. 38) .... *C. luctuosa* (Burmeister, 1839).
   – Row of bristles on the fore femora sparse and most bristles wider basally than distally (similar to Figs. 23 to 25). Microtrichia on dorsal surface of body dish-shaped (or similar to a fan, or a parasol) (Figs. 35-37) 2
2. – Anterior margins of genae forming a conspicuous protuberance; distance between each eye and lateral margin of pronotum wider than eye width; flanges of pronotum well developed (Figs. 1-7 and 19-20). Second segment of maxillary palpus slightly longer than 3rd (Fig. 28). Dorsal projection on 2nd abdominal tergite, long, narrow and rounded at the end (Fig. 21); margins of abdominal segments 7-9 not uniformly convex, with the postero-lateral projections directed somewhat outwards (Figs. 12 and 13) ..... *C. nachoi* sp.n.
   – Anterior margins of genae without protuberances, distance between eye and margin of pronotum narrower than an eye width; lateral plates of pronotum not developed as above (Figs. 8-10 and 15-18). Second segment of the maxillary palpus shorter than 3rd (Figs. 26 and 27). Dorsal projection of 2nd abdominal tergite either long and rounded or else short and somewhat sharp at the end (similar to Figs. 21 or 22); margins of abdominal segments 7-9 uniformly convex (Fig. 14, and Malzacher, 1984: Taf. 24, Figs. 1 and 2) 3
3. – Dorsal projection on 2nd abdominal tergite long, narrow and rounded at the end (similar to Fig. 21, and Belfiore, 1984: Fig. 3) ..... *C. martae* Belfiore, 1984
   – Dorsal projection on 2nd abdominal tergite comparatively shorter, wider, and somewhat pointed at the end (Fig. 22, and Belfiore, 1984: Fig. 4). *C. macrura* Stephens, 1835 (Includes three described taxa: *C. macrura macrura* Stephens, 1835, *C. macrura helenica* Malzacher, 1984 and *C. macrura minoica* Malzacher, 1984, which can be only roughly differenciated by the shape of the microtrichiae on the body surface, see figs. 35-38).

Male Adults:

Male adults of the *Caenis macrura* group can easily be distinguished from the other European species of the genus *Caenis* by the presence of a bunch of long spines (length similar to width of forceps at the tip) on the forceps tip (cf. Figs. 29, 31 and 32).

1. – Base of the antennal flagellum very dilated (more than three times wider at base than in middle of flagellum). Central sclerite of styliger generally triangular, its rear pointed. Penis lobes long, V-shaped (see Malzacher, 1984: Taf. 4) ..... *C. luctuosa* (Burmeister, 1839)
   – Base of the antennal flagellum not, or only slightly, dilated (less than three times wider at base than in middle of flagellum) (similar to Fig. 34, and Malzacher, 1984: Taf. 10, Fig. 5). Central sclerite of styliger generally rounded 2
2. – Lateral projections of abdominal segments 7-9 shorter than 1/3 of total length of each segment..... .....*C. macrura* Stephens, 1835 (Includes three described taxa: *C. macrura macrura* Stephens, 1835, *C. macrura helenica* Malzacher, 1984 and *C. macrura minoica* Malzacher, 1984; differentiation difficult due to variability of characters, some common morphs shown in Figs. 40-44).
   – Lateral projections of abdominal segments 7-9 either similar to, or longer than, 1/3 of total length of each segment 3
3. – Hind corner of styliger rounded, its pattern as in Figs. 29 and 30 ..... *C. nachoi* sp.n.
   – Hind corner of styliger angular, its pattern different ..... *C. martae* Belfiore, 1984

ACKNOWLEDGEMENTS

We are most indebted to Dr. Peter Malzacher (Ludwigsburg, Germany) for valuable advice, to Dr. Carlo Belfiore (Naples, Italy) and Dr. Tomas Soldán (Ceske Budejovice, Czechoslovakia) for providing specimens of *C.martae* and *C. macrura*, respectively; also to Dr. García de Jalón (Madrid) for kindly sending material. We are similarly grateful to Mr. David Nesbitt for checking the English.

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