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Caprella scaura Templeton, 1836 sensu lato (Amphipoda: Caprellidae) in the Mediterranean

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Abstract

Caprella scaura, first described from Mauritius and later reported in several 'forms' from all over the world, has now been found in the central and eastern Mediterranean. The morphology shows no significant difference to the topotypical material. Specimens from Venice and Sicily are studied in detail by light-microscope photographs, SEMs of adults and juveniles, and drawings of mouthparts and appendages; specimens from Venice are also analyzed cytogenetically.

Keywords: Amphipods; *Caprella scaura*; Mediterranean; Cytogenetics; Allochthones

Introduction

In 1999 a young student visited the Verona Museum (Italy) and discovered an unusual-looking caprellid from the Lagoon of Venice that did not fit any of the species included in the handbook of the Mediterranean fauna (Krapp-Schickel 1993). After some study, the specimen was identified by Sandro Ruffo as *Caprella scaura* Templeton, 1836, first described from Mauritius, and later reported from many places all over the world.

Together with other allochthones this discovery was published in Mizzan (1999), indicating that it has been a component of collections made during the period 1994–1995 in the Venice lagoon (Danesi et al. 1999; Occhipinti Ambrogi 2000).

Recently two of us (TK, AL) collected this species in quite large numbers around Venice. While TK studied the species morphologically, to understand to which 'form' this population belonged and from where it might have come, AL was interested in its cytogenetics. Before a joint paper was prepared, SEMs arrived from the remaining two present coauthors, who also wondered what species this could be. Shortly thereafter, additional photographs of live animals arrived from Sicily, and material in alcohol from Greece, indicating that the species had spread out of the Adriatic Sea.

Material and methods

From the Venice material growth stages, adults, cut-off mouthparts and other appendages were photographed on a Leica DM RBE microscope with a Visitron digital camera.

SEM: specimens were critical-point dried in a Bal-Tec CPD 030, sputtered with gold in a Polaron Sputter Coater, and examined in a Leo 1430VP at 10–20 kV.

Taxonomic studies: direct observation and drawings were made under a dissecting microscope (Wild M5, Reichert); animals were dissected in glycerine, mounted in Faure's medium, and studied or drawn under a light microscope Wild M20 with a camera lucida. Material from the Venice lagoon (Adriatic Sea) is stored at the Museo Civico di Storia Naturale, Verona (Italy).

Cytogenetics: About two dozen ovigerous females of *C. scaura* were used. Chromosome preparation was made according to the hot-dry method applied to early

embryos, following Libertini et al. (2000). Preparations were stained with Giemsa in phosphate buffer at pH 7.0. Chromosome classification is according to Levan et al. (1964).

By following the method reported in Libertini et al. (2000), genome size (GS) and nuclear AT-DNA content were evaluated through a flow-cytometric assay performed on late-embryo cell suspensions of *C. scaura*, by means of a xenon-mercury lamp cytometer (BRY-TE-HS, Bio-Rad Laboratories Inc.). Peripheral blood erythrocytes from a chicken (2C GS=2.50 pg, 2C AT-DNA=1.39 pg) (Tiersch et al. 1989; Ronchetti et al. 1995) were added to amphipod cell suspensions as internal standard. The nuclei were stained with propidium iodide (9 samples examined) and Hoechst 33258 (6 samples) for GS and AT-DNA evaluation, respectively. For each sample at least 3,000 cells were examined, and the DNA index (mean channel number of the G1/G0 peak of the caprellid cells over the mean channel number of the G1/G0 peak of the chicken cells) was evaluated after elaboration of the fluorescence data by means of Modfit software (Verity Software House). The average DNA indices among the analysed samples, multiplied by half of the DNA content of the standard, gave the haploid values (C-values) assigned to the investigated species (data are reported as mean ± standard deviation).

Caprella scaura Templeton, 1836

(Figs. 1–11)

Caprella scaura Templeton, 1836: 191–192, pl. XX fig. 6:– Bate (1862: 355, pl. LVI fig. 4); Mayer (1882: 65); Mayer (1890: 70–74, pl. IV 40–51, pl. VI fig. 41, pl. VII figs. 2, 35, 36); Mayer (1903: 117–120 pl. V, figs. 13–18, pl. X, fig. 11); McCain (1968: 40–44, figs. 17–18); Arimoto (1976: 146–147); Guerra-García (2003a: 4–5, fig. 2).

Caprella nodosa Templeton, 1836: 191–192, pl. XXI fig. 7.

Caprella cornuta Dana, 1853: 816–817.

Caprella attenuata Dana, 1853: 817–819.

More extensive synonymic listings for this species can be found in McCain (1968), McCain and Steinberg (1970), and Arimoto (1976).

Type locality: Mauritius: Rivière noire.

Type material: unknown, most probably not extant.

Diagnosis

Member of *Caprella scaura* sensu lato without ventral spine, with moderate spine on head; male pereion 1–5 dorsally smooth.

Morphological description

Colour: pale brown (Templeton 1836).

Male

Length: adult 10–16 mm. [Templeton (1836) wrote: "1 inch" – i.e. 2.54 cm – "from the tip of the antennae to the claw of the hind legs". Bate (1862: 355), perhaps dealing with Templeton's material, recorded half an inch. Guerra-García (2003a) figured a male from the type locality with about 14 mm. Length of specimens from Sicily up to 15.7 mm, from Greece no more than 12 mm.]

Antennae: second article of peduncle longest, distally widening; antenna 1 peduncle article 1 subequal to antenna 2 peduncular articles 2+3; antenna 1 peduncle article 1 slightly shorter than article 3; antenna 1 $\leq$ 2 antenna 2 [Templeton (1836): antenna 1 = 2 x antenna 2].

Cephalosoma: not swollen at back end [Templeton (1836): swollen at back end; Guerra-García (2003a): not swollen]. Occipital spine small, blunt [Templeton (1836): acute, well visible].

Gnathopods: gnathopod 2 basis shorter than pereion segment 2 [Templeton (1836): as long as segment; Guerra-García (2003a): much shorter than pereion segment 2].

Pereiopods: propodi proximally wider than distally, ratio l:b = 2.5 [Templeton (1836) and Guerra-García (2003a): propodi ratio l:b = 3, not much wider proximally].

Gills: equal to or less than half as long as segment 4 or 5 [Templeton (1836): about same length as segments]. Gill structure and salinity tolerance, see Takeuchi et al. (2003).

Female

No difference between the specimens from Venice and the figures of Mauritian material in Guerra-García (2003a). Length 13.0–13.5 mm.

Growth stages

(Figs. 4, 7, 8)

The description refers to ready-to-hatch juveniles removed from the marsupium. They differ from adults in numerous features.

Length: 1.8–2.2 mm.

Antennae: antennae 1 and 2 of almost the same length. A1 peduncle articles 1, 2 of almost the same length; A1 peduncle article 1 = A2 peduncular articles 2+3; A1 article 1 > article 3.

Cephalosoma: roundish, not higher than long; length 1/3–1/4 of cephalosoma and pereion length (about 1/8–1/10 in adults); occipital spine absent.

Mouthparts: mandible to Mx 2 very similar to adult features.

Gnathopods: Gn1 of the same length as Gn2 (adult: Gn1 < Gn2); basis, ischium, merus, carpus of appro-

ximately the same relative size in Gn1 and Gn2; basal spine of propodus of Gn2 less prominent than in adults; only a few setae at inner side of propodus; coxae of Gn1 and Gn2 closely together.

Pereion segments and pereiopods: segments roundish, not longer than high; pereion segments 2–4 not longer than pereion segments 5–7 (in adults 2–4 have double length of 5–7). Dorsal spines absent. Pereiopod dactyli of same length as or longer than propodi (in adults: dactylus < propodus).

Gills: roundish, shorter than in adults.

Remarks

Templeton (1836) described this species from Mauritius. His figure shows a strong spine on the head, a long basis of Gn2 (subequal to length of segment 2), very long oval branchiae on pereionites 3–4, and narrow propodi on the pereiopods. Furthermore, he writes that A1 is about twice as long as A2, and that the length from tip of A1 to top of dactylus P7 is an inch. In addition, he described *Caprella nodosa* Templeton, 1836 (1/8 of an inch!) which could easily be a juvenile of *C. scaura*, in spite of a longer and more forwardly bent spine on the head. Mayer (1882: 65) was absolutely sure about this synonymy ("unzweifelhaft"), and in 1890 (p. 70) he added that Stebbing was of his opinion as well.

Mayer (1890) recognized 3 "varieties", and added 3 more in 1903. According to recent rules of nomenclature these are now treated as subspecies.

1) *C. scaura typica* Mayer, 1890

Type locality: Brazil: Rio de Janeiro.

Male: Spine on the head short, acute, bent forward. In adult males A1 flagellum with 8–9 incompletely defined arts., and 11 well defined ones. Gn2 dactylus without tooth on inner margin. Body hairless. Length 16 mm (Mayer 1890), 21 mm (Mayer 1903). In males on segment 1 and 3 one distal unpaired spine, and dorsally on segment 2 in the region of insertion of gnathopods a pair of spines. Females are extremely spinous, but "seem to live together with totally smooth ones".

2) *C. scaura diceros* Mayer, 1890

Type locality: Japan: Kobe (Stebbing 1888: 1257).

With thick protuberance distally on segment 4 in both sexes, sometimes also distally on segments 2 and 3; rarely on segment 1. No ventral spines. 30–35 mm. Females very spinous. Body hairless.

3) *C. scaura cornuta* Mayer, 1890

Type locality: Brazil: Rio de Janeiro.

Spine on the head short and stout, in adult males bent not forward, but upward, in females directed forward. Female body without protuberances, but hairy. 18 mm.

4) *C. scaura spinirostris* Mayer, 1903

Type locality: North Pacific Ocean.

Very long and acute tooth on head. Gn2 male palm with acute tooth. 18 mm. With ventral spine, but otherwise similar to *cornuta*.

5) *C. scaura scauroides* Mayer, 1903

Type locality: North Pacific Ocean.

20 mm. Female spinous. Ventral spine already present in young specimens.

6) *C. scaura californica* Mayer, 1903

Type locality: USA: California.

Female spinous. Male 20 mm. With ventral spine.

Mayer (1903) gave a short key in which the first three subspecies (from Japan or Rio de Janeiro, respectively) lack ventral spines, whereas subspecies 4 to 6 (from Hong Kong, Tokyo, Chile and California, respectively) show a ventral spine near the insertion of Gn1,2.

A seventh subspecies was described by Utinomi (1947): *Caprella scaura hamata*, in which the males also have acute dorsal processes on segments 1–4, and also lateral ones, but no ventral spines. Type locality: Japan.

Dougherty and Steinberg (1953) revived Stimpson's (1857) *Caprella californica* as a valid species.

McCain (1968: 40–44) described *Caprella scaura* from the western North Atlantic and found his material to agree well with the descriptions from Mauritius.

Arimoto (1976: 120) created a subgenus *Spinicephala* which includes the present species. However, later authors did not use this subgenus.

Guerra-García (2003a: 4–5, fig. 2) figured topotypical material.

When Mayer (1890) created his "Varietät *Caprella scaura typica*", he most probably meant that the Brazilian material was matching the type material from Mauritius. However, Arimoto (1976: 146) noted quite a number of differences and referred to Mayer's treatments as "*Caprella scaura* in part". According to the rules of today, the nominal subspecies from Mauritius has to be "*Caprella scaura scaura* Templeton", and there are several indications, also thanks to the paper of Guerra-García (2003a), that it is not the same as the material from Brazil.

Summarizing the situation for the time being, we know 5 subspecies in which ventral spines are lacking:

Caprella scaura scaura Templeton, 1836; loc. typ. Mauritius; length 14 mm (Guerra-García 2003a);

Caprella scaura typica Mayer, 1890; loc. typ. Brazil; length (male) 16–21 mm;

Caprella scaura cornuta Mayer, 1890; loc. typ. Brazil; length (male) 18 mm;

Caprella scaura diceros Mayer, 1890; loc. typ. Japan; length (male) 22.5 mm;

Caprella scaura hamata Utinomi, 1947; loc. typ. Japan; length (male) 24 mm.

The following two 'forms' have ventral spines and should be kept separate:

Caprella scaura spinirostris Mayer, 1903; loc. typ. Chile; with ventral spines;

Caprella scaura scauroides Mayer, 1903; loc. typ. Japan.

Laubitz (1970) synonymized these with *Caprella californica* Stimpson, 1857.

Key to males of 5 subspecies of *Caprella scaura* without a ventral spine

1. Pereion 1–3 dorsally with a pair of processes ..... *C. s. hamata*
– Pereion 1–3 dorsally smooth 2
2. Pereion 4 distally with acute; backward-directed prolongation. Pereion 5 dorsally in both sexes with two pairs of tubercles at rear part of back ..... *C. s. diceros*
– Pereion 4 dorsally smooth 3
3. Pereion 5 dorsally in both sexes with pair of processes ..... *C. s. typica*
– Pereion 5 dorsally smooth 4
4. Head with short and blunt spine dorsally ..... *C. s. cornuta*
– Head with long and acute spine ..... *C. s. scaura*

Distribution of *Caprella scaura* sensu lato

Indian Ocean: Templeton (1836); Arimoto (1976); Ren and Zhang (1996); Laubitz (1995), Guerra-García (2004).

Pacific Ocean: Mayer (1890); Dougherty and Steinberg (1953): California, Guerra-García (2003b): Australia, New Zealand; Guerra-García and Takeuchi (2003, 2004): Hongkong, Tasmania; Guerra-García and Thiel (2001), Guerra-García and Takeuchi (2003), Thiel et al. (2003): Chile, Laubitz (1991): New Caledonia, Indonesia and the Philippines.

Atlantic Ocean: Stimpson (1857), McCain (1968): N-Atlantic, Mayer (1890), Serejo (1998): Brazil.

Mediterranean: Mizzan (1999), Danesi et al. (1999), Occhipinti Ambrogi (2000): Adriatic Sea. Here added: Sicily, Greece.

Ecology

Guerra-García (2003a) reported no specific habitat selection: specimens were collected on bryozoans, seaweeds, brown algae (Lim and Alexander 1986; Takeuchi and Hino 1997; Guerra-García and Thiel 2001) or sponges (Serejo 1998). The behaviour is well studied, including observations of parental care (Lim and Alexander 1986; Aoki 1999; Schultz and Alexander 2001).

Most of the Venice material comes from red, sometimes also brown, algae growing on buoys in about 0.2–1.0m depth of the lagoon.

The Sicilian material (collected and photographed by F. Costa, Messina; see Fig. 1) was found in brown algae (*Cystoseira stricta, Cystoseira abrotanifolia)* on buoys about 10m off the coast, at about 0.5m depth, where Caprella was living in high population density together with many other microorganisms.

The Greek material was collected by Cédric d'Udekem d'Acoz (Tromsø Museum, Norway) in the Amvrakikos gulf (38°44'N, 20°55'E, 1m depth, seagrass with many epiphytes, 31.vii. and 16.viii.2002). The latter is almost completely closed, being connected to the sea by a narrow channel only, but has a marine, not a brackish-water fauna and can be considered as a kind of seawater lake. There is a big yacht harbour at the entrance of the gulf (at Preveza), *C. scaura* could have arrived there with the yachts. On the other hand, for a few years there has been some aquaculture (fish cages) in the gulf that also represents a possible means of introduction.

Cytogenetics

(Table 1, Fig. 12)

Chromosomes were counted in 55 mitotic metaphase plates from early embryos (Table 1) of *C. scaura* from the Venice lagoon. The diploid chromosome number 2n=24 was more frequently scored and is assumed as typical for the species.

The karyotype (Fig. 12) was built by using the five best mitotic metaphase plates; it is composed of 12 pairs of chromosomes with a median centromere which were all classified as metacentric. Chromosome lengths gradually varied from 2.18 to 1.09 µm.

In flow-cytometric GS evaluation, the average DNA index between the cells of *C. scaura* and the chicken resulted as 0.59±0.007. Therefore, *C. scaura* diploid nuclear DNA content was evaluated as 1.48±0.016 pg, corresponding to a haploid GS (C-value) of 0.74±0.008 pg. For AT-DNA content, the average index was 0.82±0.015, corresponding to a haploid value of 0.57±0.011 pg. Calculated percentage of AT-DNA in the whole genome of *C. scaura* therefore is 77.09.

Data on chromosome number, karyotype morphology and genome size in the Venetian population of *C. scaura* agree with those published on Caprellidae earlier. The same chromosome number and a similar karyotype formula were found in *C. macho* Platvoet et al., 1995 (= *C. mutica* Schurin) by Libertini and Krapp-Schickel (2003). A slightly smaller genome size (0.68 pg) has been reported for *C. equilibra* Say, 1818

by Libertini et al. (2003). Although genome size may vary significantly among caprellid species, the Caprellidae as a whole seem to be characterized by uniformity in karyotype morphology, along with the smallest genome sizes reported for Amphipoda. (Libertini et al. 2000, 2003; Libertini and Krapp-Schickel 2000; A. Libertini unpubl. data). Moreover, base composition in the genome is expected to be highly variable among amphipod taxa, since the two species so far analyzed, *Jassa marmorata* Holmes, 1903 and *C. scaura*, are characterized by widely different AT-DNA percentages of 28.85 and 77.09, respectively (Libertini et al. 2000; present paper).

Conclusions

An undoubtedly closely related clade of *Caprella* species with an occipital spine is distributed in warm waters all over the world. Its members are divided in those with and those without ventral spines. The species collected in the Mediterranean shows no ventral processes, therefore is close to *Caprella scaura scaura*, described from Mauritius by Templeton (1836) as well as Guerra-García (2003a). In addition, it matches quite well the description given by McCain (1968) from the northern Atlantic. The species may have been dispersed by ships – some authors implying ballast water – but a more likely explanation seems that it travelled living among fouling on the hulls of the ships. At this time we exclude the subspecies lacking ventral spines – *typica* Mayer, 1890, *diceros* Mayer, 1890, and *hamata* Utinomi, 1947 – as well as those with ventral spines currently subsumed under *Caprella californica* Stimpson.

The morphology of the Mediterranean material (from Venice, now also from the coast of Messina, Sicily, as well as from Greece; see Figs. 2, 3) matches the descriptions of the type material from the Indian Ocean as well as specimens from California. However, from Aoki and Kikuchi (1990) we know that in some caprellid species both smooth and spiny specimens can be raised from the same brood; therefore, the length and shape of dorsal spination should be used for differentiation with caution. In the growth stages studied here, dorsal protrusions, especially the occipital spine, are as yet not developed, and on the body and its appendages we found differences in shape and relative sizes between juveniles and adults. This is most obvious when the antennae of both stages are compared. However, the mandibles and maxillae have their adult-specific characters fully developed already in the young animals. Due to the morphogenetic reconstruction involving some of the specific features of *C. scaura*, a more detailed observation of the growth stages in juveniles, adults and hyperadults is necessary. Only the integration of morphology, cytogenetics, DNA studies, and may be cultivation, will reveal whether the described morphs really belong to the same species. A first step in this direction has been taken here.

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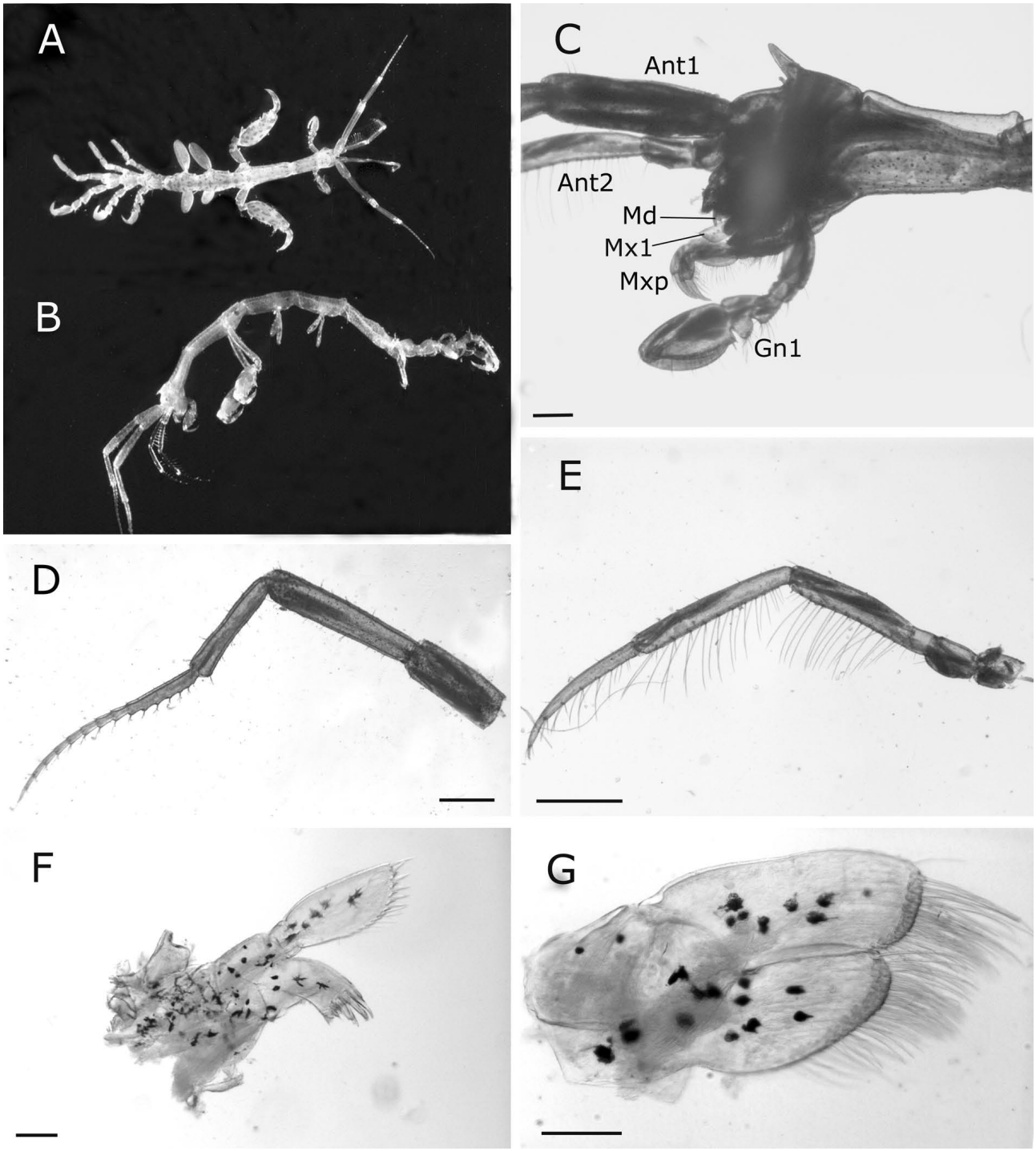

Fig. 1: Light microscopy of male adults. (A) Entire animal, dorsal view: 14.8 mm. (B) lateral view, 15.7 mm; both photos by Francesco Costa after material from Messina, Sicily. All other specimens from Venice. (C) Head with mouthparts, maxilliped and gnathopod 1, lateral view; scale bar 200 µm. (D) Antenna 1; bar 500 µm. (E) antenna 2; bar 500 µm. (F) Maxilla 1; bar 100 µm. (G) Maxilla 2; bar 100 µm. *Ant1*, *Ant2* = antenna 1,2, *Md* = mandible, *Mx1* = maxilla, *Mxp* = maxilliped, *Gn1* = gnathopod 1.

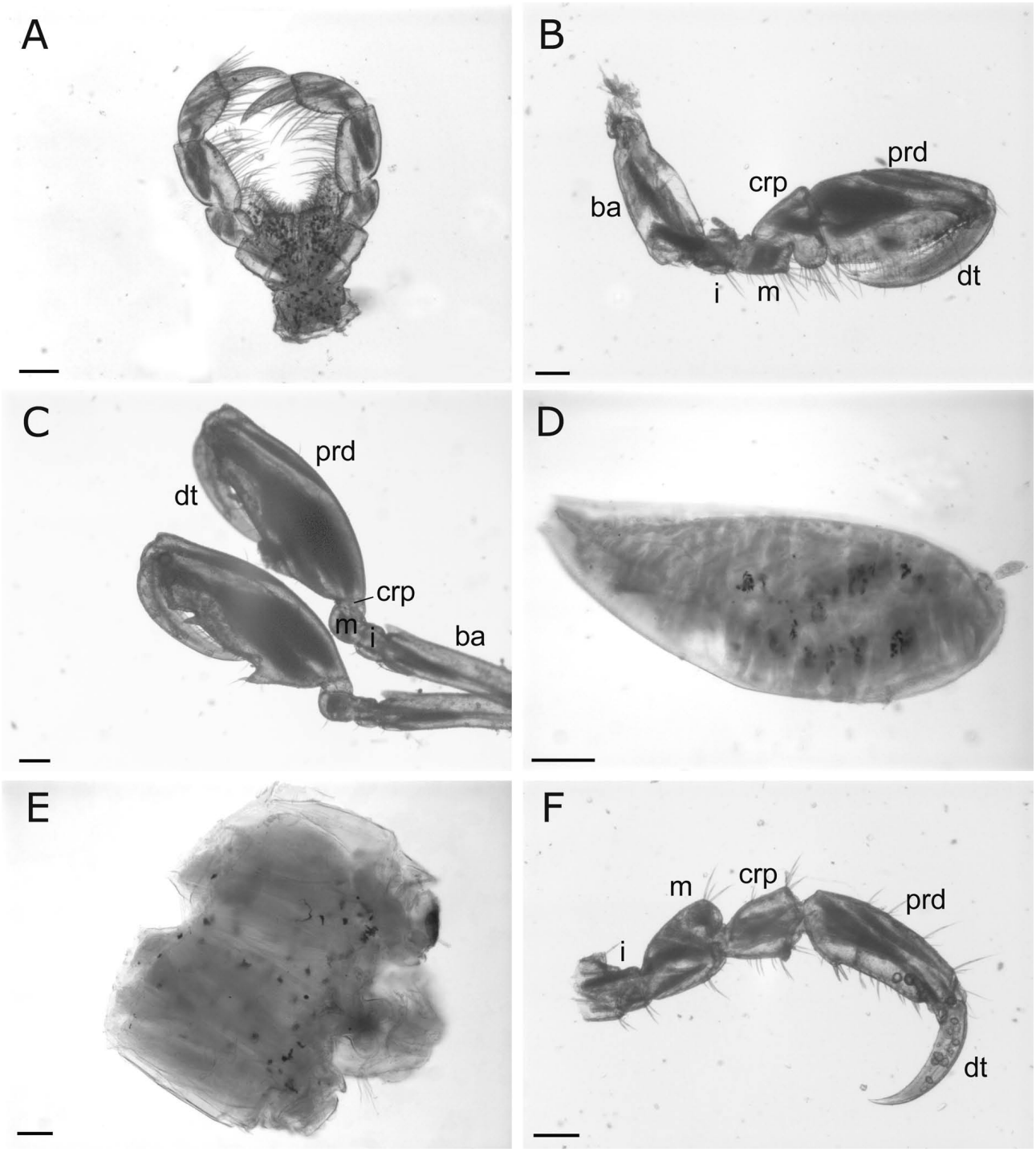

Fig. 2: Light microscopy of male adults. (A) Maxilliped; bar 100 µm. (B) Gnathopod 1; bar 100 :m. (C) Gnathopod 2; bar 200 µm. (D) Gill; bar 100 µm. (E) Abdomen, ventral view, bar 40 µm. (F) Pereiopod 5; bar 100 µm. *i* = ischius, *m* = merus, *crp* = carpus, *prd* = propodus, *dt* = dactylus.

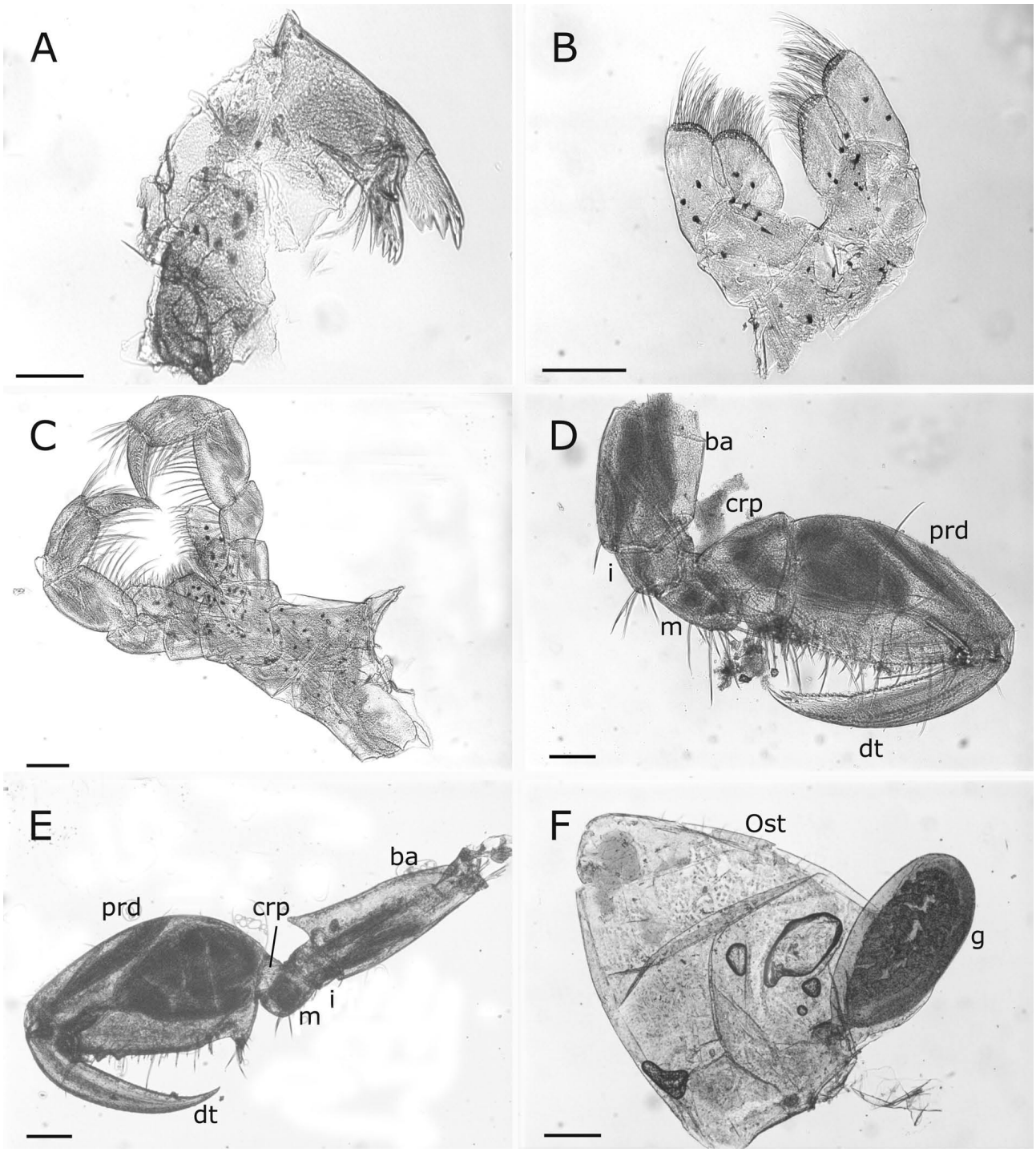

Fig. 3: Light microscopy of female adults. (A) Mandible; bar 100 µm. (B)M maxilla 2; bar 100 µm. (C) Maxilliped; bar 100 µm. (D) Gnathopod 1; bar 100 µm. (E) Gnathopod 2; 200 µm. (F) Oostegite and gill; bar 100 µm. *ba* = basis, *i* = ischius, *m* = merus, *crp* =carpus, *prd* = propodus, *dt* = dactylus, *Ost* = oostegite, *g* = gill.

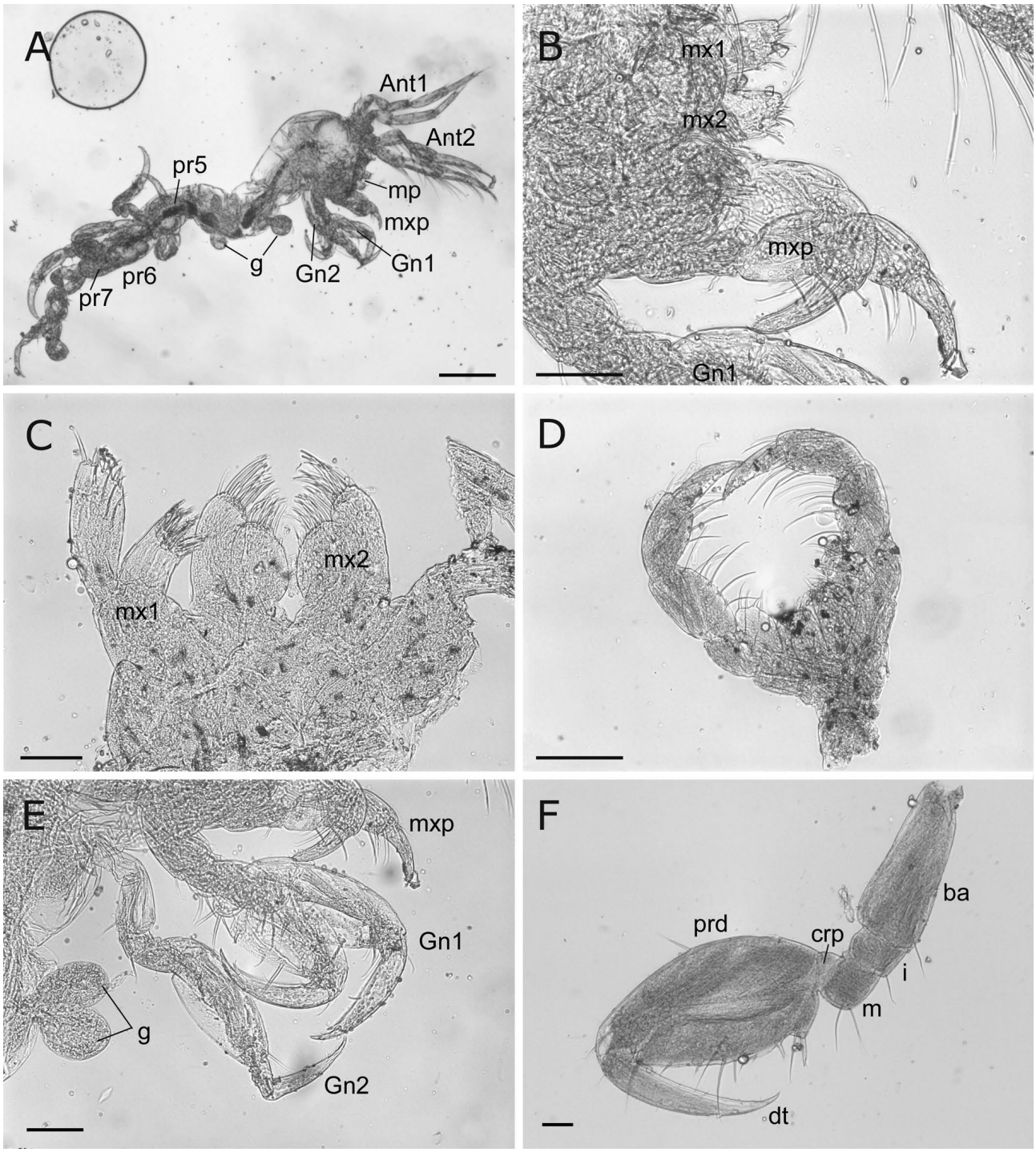

Fig. 4: Light microscopy of juveniles. (A) Survey of entire animal, lateral view; bar 200 µm. (B) Mouth parts, maxilliped and gnathopod 1, lateral view; bar 50 µm. (C) Maxilla 1,2; bar 50 µm. (D) maxilliped; bar 100 µm. (E) Maxilliped, gnathopod 1, 2 and gills, lateral view; bar 40 µm. (F) gnathopod 2; bar 20 µm. *Ant1*, *Ant2* = antenna 1, 2, *mp* = mouthparts, *Mx1,2* = maxilla 1, 2, *Mxp* maxilliped, *Gn1,2* = gnathopod 1, 2, *g* = gills, *pr5-7* = pereion segment 5-7, *ba* = basis, *i* = ischius, *m* = merus, *crp*= carpus, *prd* = propodus, *dt* = dactylus.

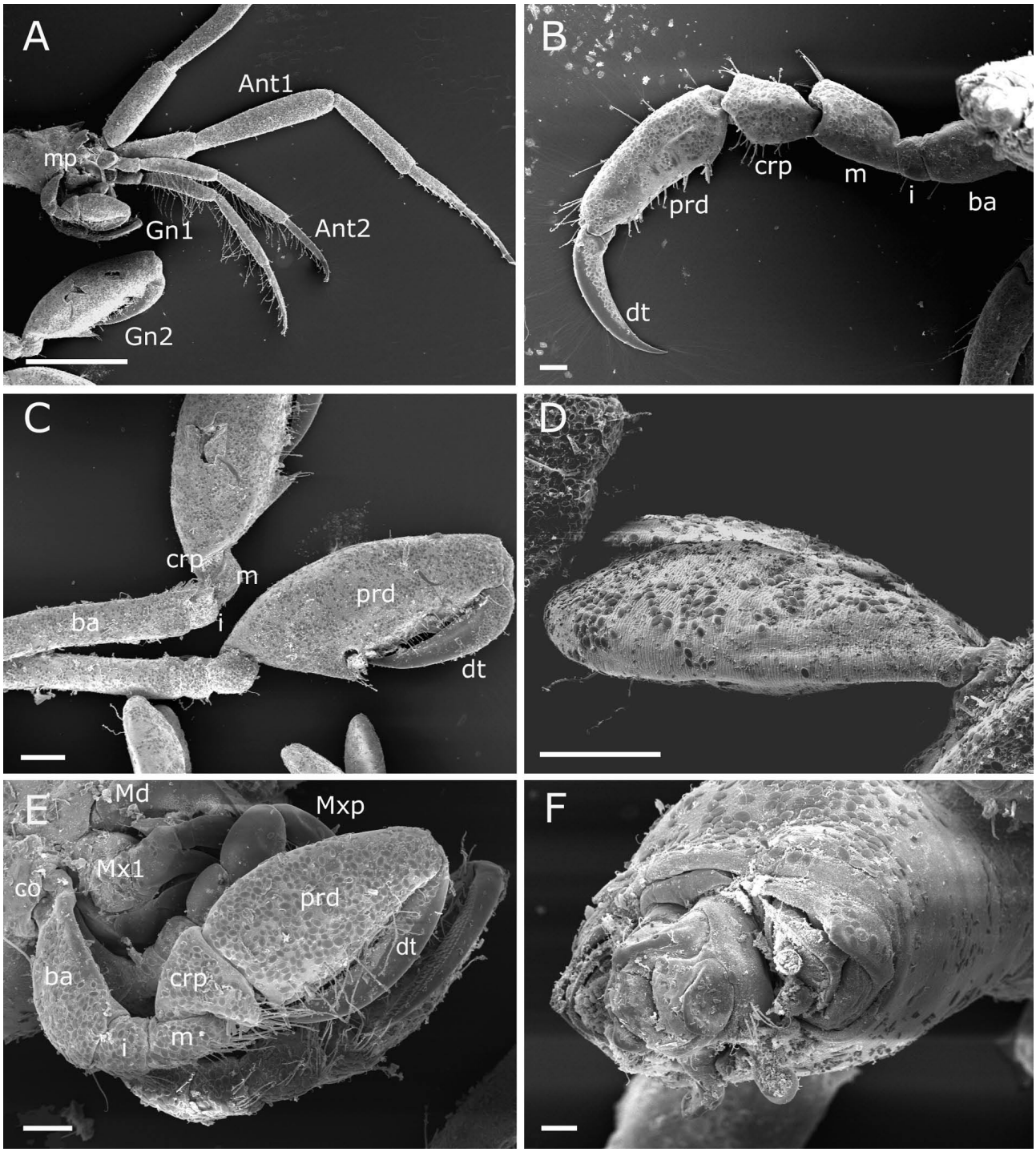

Fig. 5: Scanning electron microscopy (SEM) of male adults. (A) Head region with antennae, mouth parts, maxilliped and gnathopods, lateral view; bar 1 mm. (B) Pereiopod 5, lateral view; bar 100 µm. (C) Gnathopods 2, lateral view; bar 200 µm. (D) Gill; bar 200 µm. (E) Mouthparts, maxilliped and gnathopod 1, lateral view; bar 100 µm. (F) abdomen, viewed from ventrally and posteriorly; bar 20 µm. *Ant1*, *Ant2* = antenna 1, 2, *mp* = mouthparts, *Md* = mandible, *Mx1* = maxilla 1, *Mxp* = maxilliped, *Gn1,2* = gnathopods 1, 2, *ba* = basis, *i* = ischius, *m* =merus, *crp* = carpus, *prd* =propodus, *dt*= dactylus.

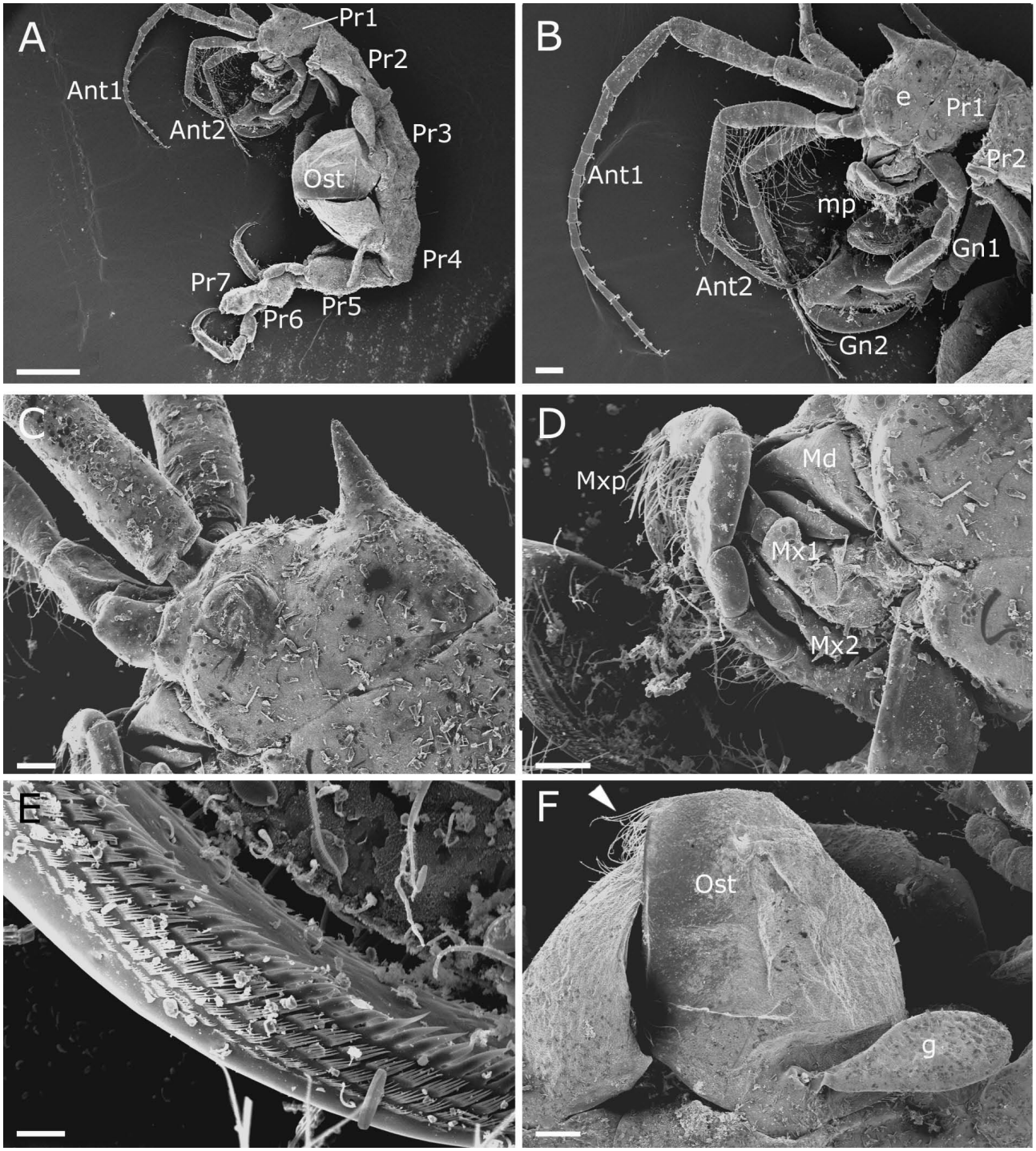

Fig. 6: SEM of female adults. (A) Survey of entire animal, lateral view; bar 1 mm. (B) Head region with antennae, mouth parts, gnathopod 1, 2, eye and pereion segment 1-2, lateral view; bar 200 µm. (C) head, lateral view; bar 100 µm. (D) mouthparts with maxilliped, lateral view; bar 100 µm. (E) setae on dactylus of gnathopod 1; bar 20 µm. (F) oostegite and gill; *arrowheads* setae at the oostegite edge; lateral view; bar 200 µm. *Ant1,2* = antenna 1, 2, *Gn1,2* = gnathopod 1, 2, *Pr1-7* = pereion segment 1-7, *Ost* = Oostegite, *mp* = mouthparts, *Md* = mandible, *Mx1,2* = maxillae 1, 2, *Mxp* = maxilliped, *g* = gill.

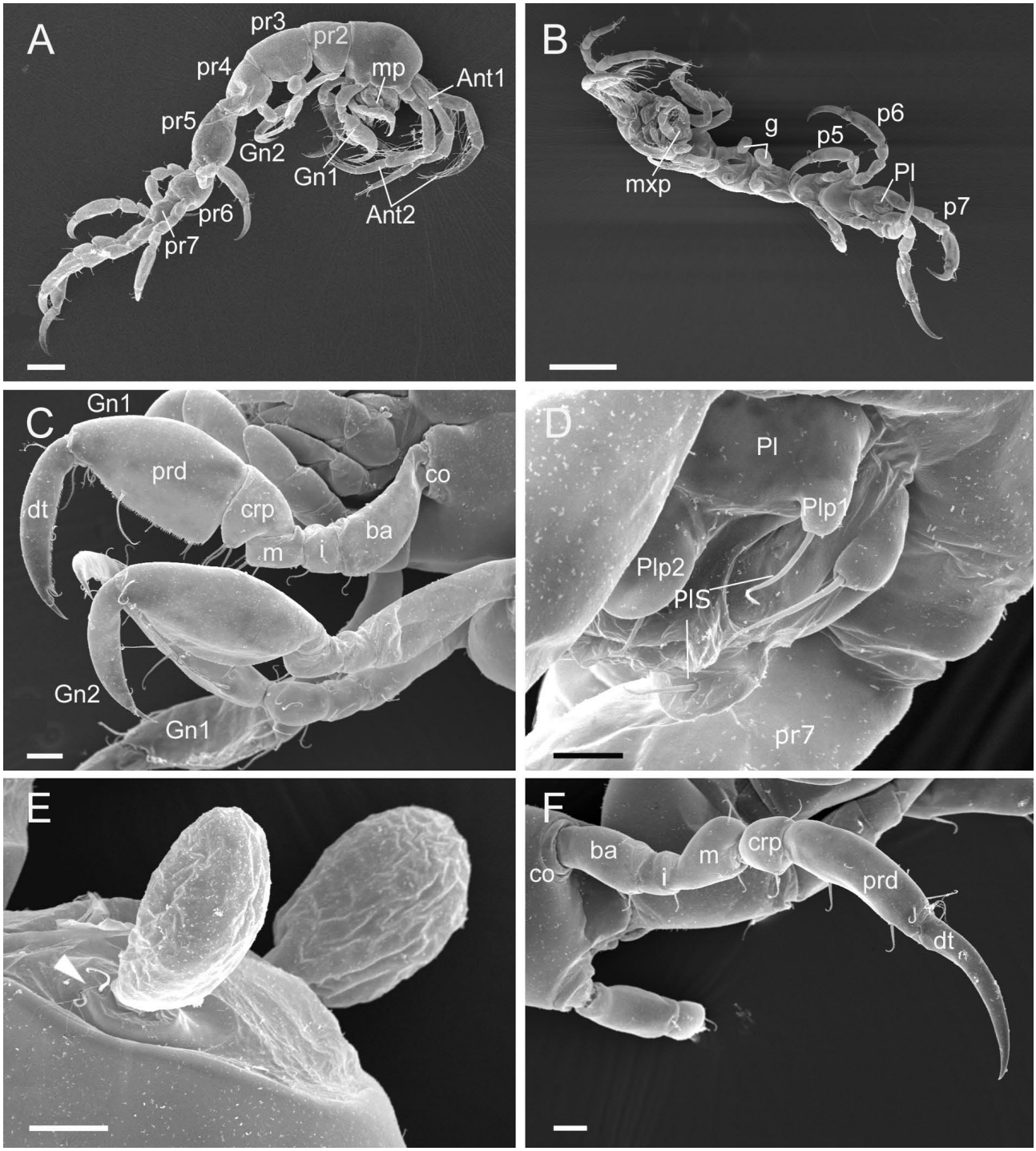

Fig. 7: SEM of juveniles. (A) Survey of entire animal, lateral view; bar 100 µm. (B) Survey of entire animal, ventral view; bar 200 µm. (C) gnathopod 1, 2, lateral view; bar 20 µm. (D) abdomen, ventral view; bar 100 µm. (E) gills, lateral view; *arrowheads* sensory hairs at the base of the gills; bar 20 µm. (F) pereiopod 5, lateral view; bar 20 µm. *Ant1,2* = antenna 1, 2, *mp* = mouthparts, *Gn1,2* = gnathopod 1, 2, *Pr1-7* = pereion segment 1-7, *mp* = mouthparts, *P5-7* = pereiopod 5-7, *Pl* = pleon, *Plp 1,2* = pleon palps, *PlS* = pleon setae, *g* = gills, *co* = coxa, *ba* = basis, *i*= ischius, *m*= merus, *crp*= carpus, *prd*= propodus, *dt*= dactylus.

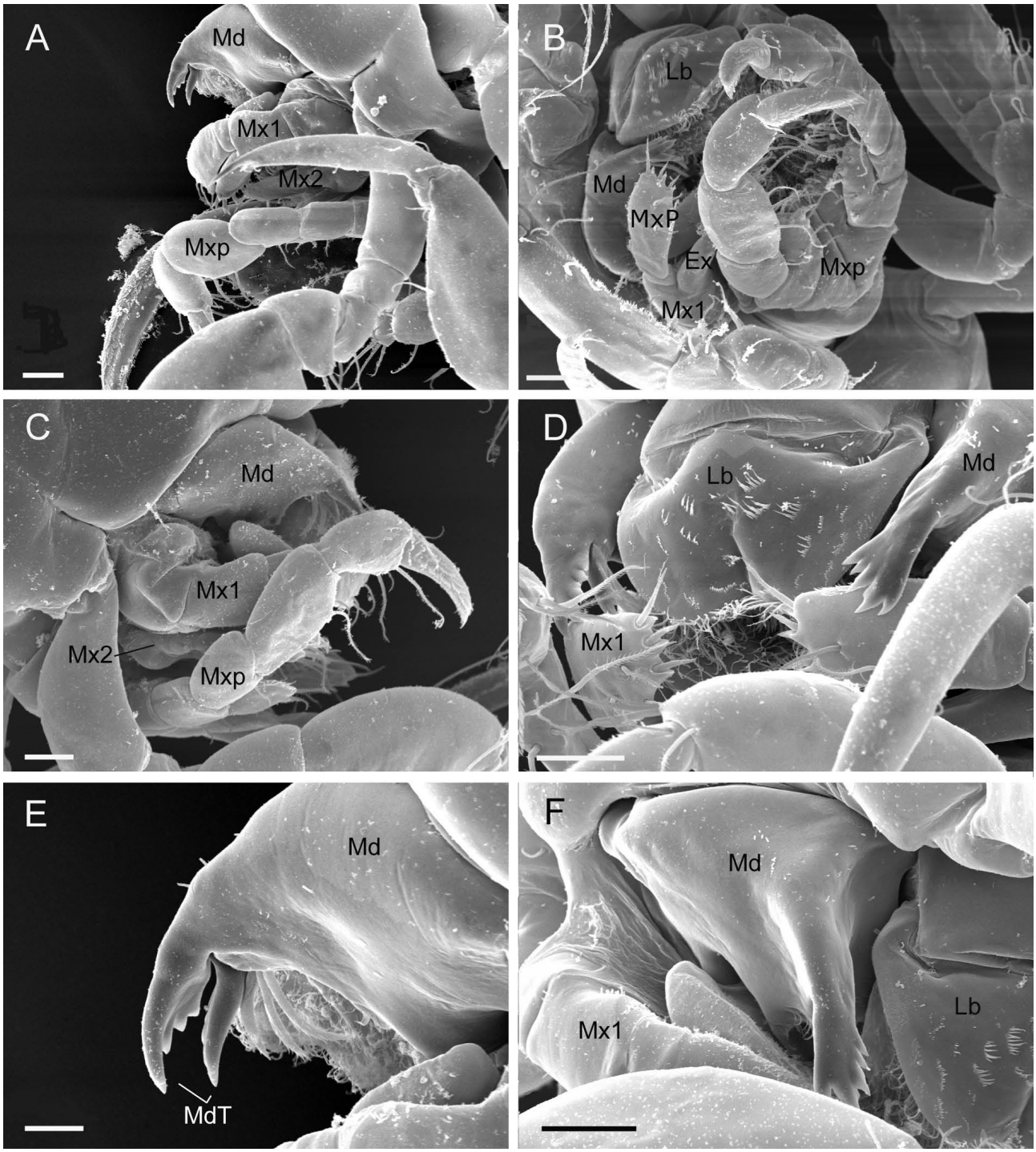

Fig. 8: SEM of juveniles. (A) Mouthparts and maxilliped, lateral view; bar 20 µm. (B) labrum, mouthparts, maxilliped, ventroposterior view; bar 20 µm.. (C) Mouthparts, lateral view; bar 20 µm. (D) Labrum, mandible and maxilla 1, ventral view; bar 20 µm. (E) Mandible, lateral view; bar 10 µm. (F) Labrum, mandible and maxilla 1, lateral view; bar 20 µm. *Md* = mandible, *Mx1,2* = maxilla 1, 2, *Mxp* = maxilliped, *Lb* = labrum, *Ex* = exopodite or outer plate of maxilla 1, *MxP* = palpus of maxilla 1, *MdT* = incisor-teeth of mandible.

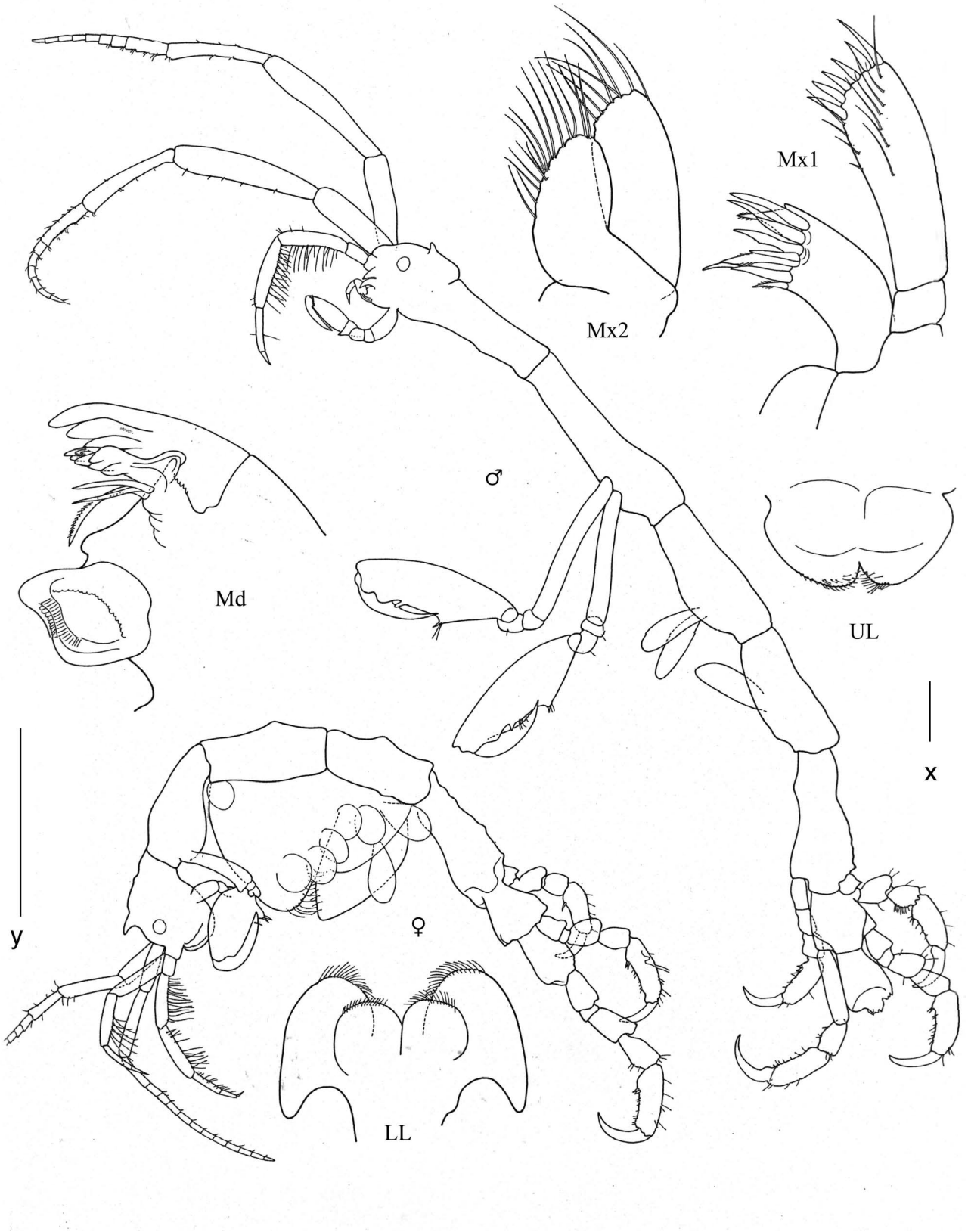

Fig. 9: Caprella scaura (Venice): male habitus 14mm, female habitus 11 mm; mouthparts: Mx1,2, UL, LL, Md inner side. Habitus drawings in scale x = 1mm; LL in scale y = 0.5mm; all other mouthparts in scale y = 0,25mm.

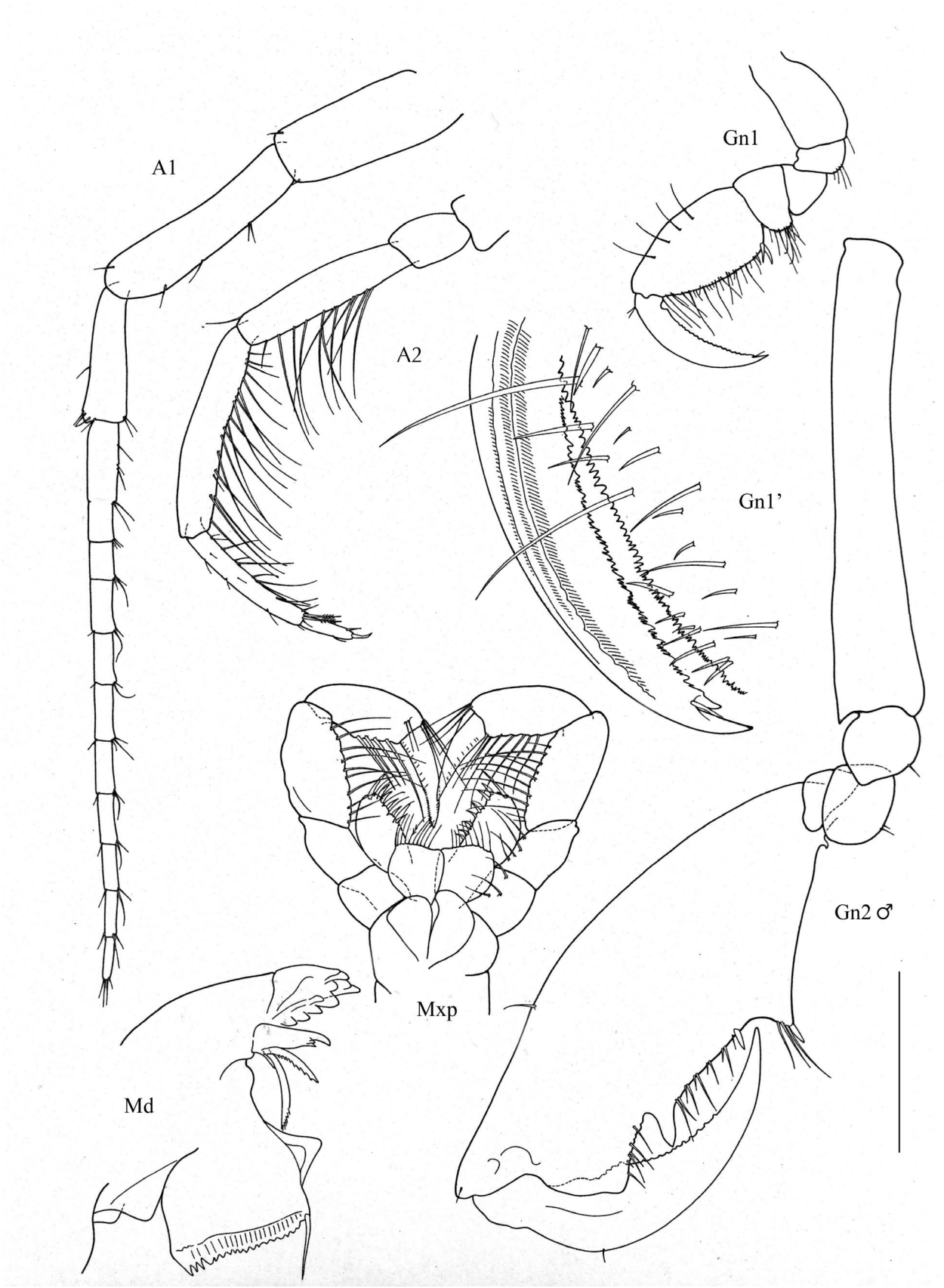

Fig. 10: Caprella scaura (Venice): A1,2 female,
Gn1,2 male, dactylus Gn1 enlarged, Mxp, Md outer side.
A1,2, Gn1,2 in scale = 1mm; Mxp in scale = 0.5mm; Gn1', Md in scale = 0.25mm.

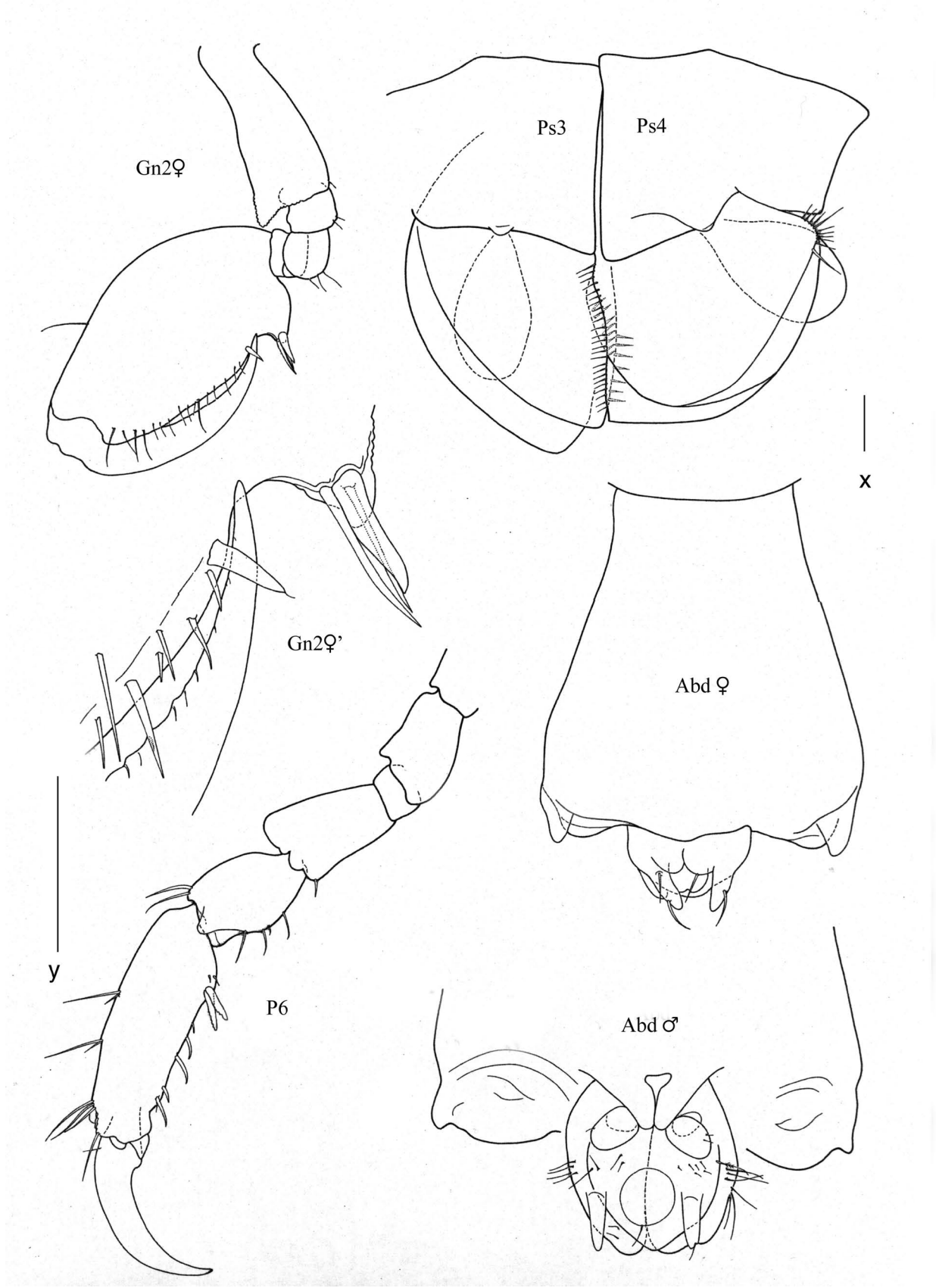

Fig. 11: Caprella scaura (Venice): female Gn2 entire, below Gn2 palm and palmar corner enlarged; pereion 3,4; P6; abdomina: above female, below male. Gn2, P6 in scale y = 1mm;
Ps3,4 in scale x = 0.5mm; Abd in scale y = 0.5mm; Gn2‘ in scale y = 0.25mm.

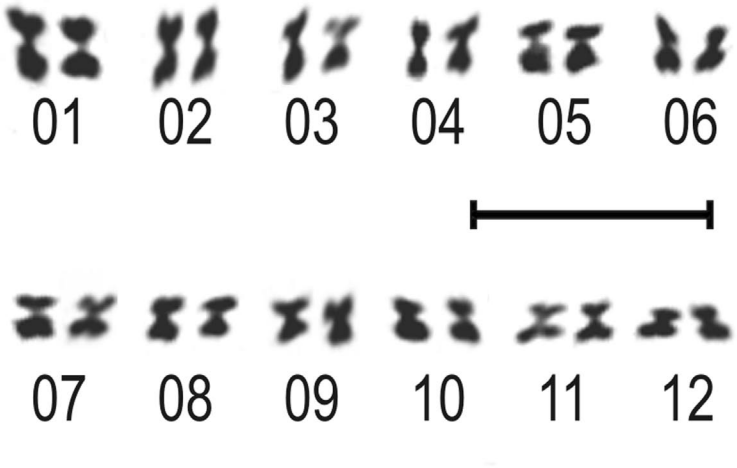

Fig. 12: *Caprella scaura* (Venice): karyotype with 12 pairs of metacentric chromosomes from a mitotic metaphase plate of an early embryo, bar 10 µm.

2n chromosome number	20	21	22	23	24	25	26	27	Total scored cells
Frequencies	1	0	2	5	46	0	0	1	55

Table 1: Chromosome counts in early embryo metaphase plates of *Caprella scaura* from the Venice Lagoon.