

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 have been studied in detail, the former also by cytogenetic methods.

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Introduction

Now and then species are reported from the Mediterranean, that are not included in the Handbook of Mediterranean Amphipods. Such species are not always new to science; some clearly have been introduced from other areas. Since 1999, *Caprella scaura* has been recorded from the Venice lagoon (Danesi et al. 1999; Mizzan 1999). This species was described first from Mauritius in the Indian Ocean, and subsequently reported as distributed all over the world in several ‘forms’.

The present paper describes the Mediterranean material of *C. scaura* in detail and compares it with the various described ‘formae’. For the full set of data and illustrations, see the accompanying Organisms Diversity and Evolution Electronic Supplement (<http://www.senckenberg.de/odes/06-03.htm>).

Material and methods

In addition to classical procedures for dissection of the animals and drawing them from permanent mounts in Faure’s fluid, we studied some cytogenetical parameters (chromosome number, karyotype formula, size and base composition of the genome), made light-microscope photographs and drawings as well as SEM-pictures, and studied the ontogenetic development from juveniles to adults.

Results

Morphology

Summarizing the situation for the time being, we know five subspecies in which ventral spines are lacking: *Caprella scaura scaura* Templeton, 1836; loc. typ. Mauritius; length 14 mm (Guerra-García 2003a);

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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 morphology of the Mediterranean material (Figs. 2 and 3) matches that of the nominotypical subspecies.

Key to males of five 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 five dorsally in both sexes with two pairs of tubercles at rear part of back *C. s. diceros*
— Pereion four dorsally smooth 3
3. Pereion five dorsally in both sexes with pair of processes *C. s. typica*
— Pereion five 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; present work: Sicily, Greece.

Cytogenetics of the Venetian material

The karyotype (Fig. 1) is composed of $2n = 24$ chromosomes forming 12 pairs with a median centromere and gradually varying size. Flow-cytometric analyses assigned to *C. scaura* a haploid genome size (*C*-value) of 0.74 ± 0.008 picograms and an AT-DNA percentage in the whole genome of 77.09. The data on chromosome number, karyotype morphology and genome size agree with those published on Caprellidae earlier (Libertini et al. 2000, 2003; Libertini and Krapp-Schickel 2000; Libertini, A., unpublished data). Although genome size may vary significantly among caprellid species, the Caprellidae as a whole seem to be

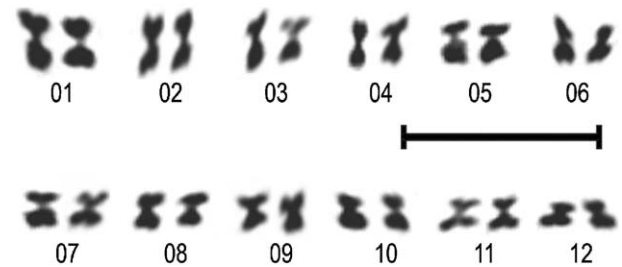


Fig. 1. *Caprella scaura* (Venice), karyotype with 12 pairs of metacentric chromosomes from a mitotic metaphase plate of an early embryo; scale bar = 10 μ m.

characterized by uniformity in karyotype morphology, along with the smallest genome sizes reported for Amphipoda. Moreover, among amphipods genome base composition is highly variable, with AT percentage ranging from 28.8 to 77.09 (Libertini et al. 2000; Electronic Supplement 06-03).

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. For the morphological habitus and

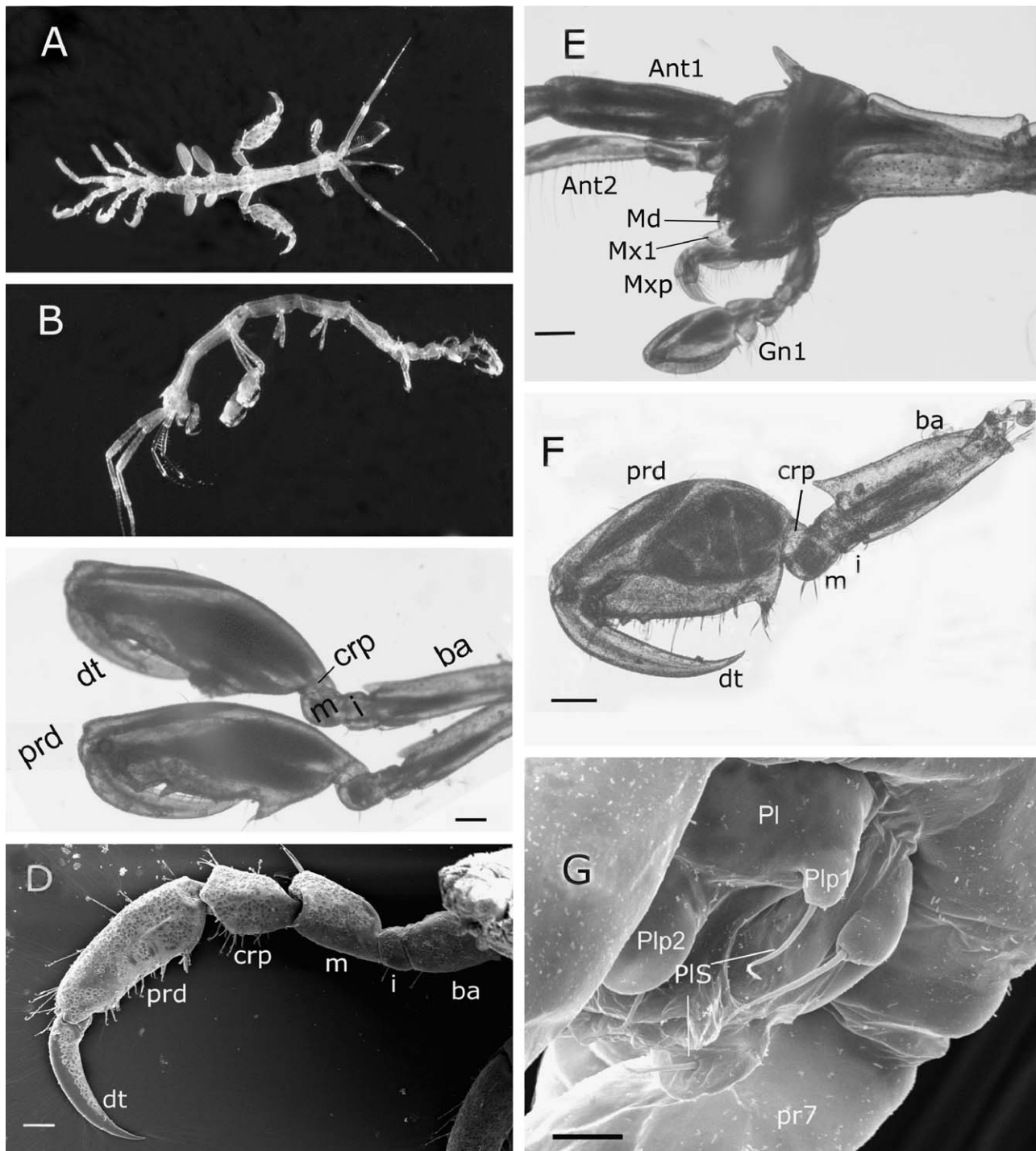


Fig. 2. *Caprella scaura* morphology (A and B: Messina, Sicily, photos by F. Costa; C–G: Venice). (A) Entire animal, dorsal view, 14.8 mm. (B) Lateral view, 15.7 mm. (C) Male gnathopod 2. (D) SEM image of male adult pereopod 5, lateral view. (E) Male adult head with mouthparts, maxilliped and gnathopod 1, lateral view. (F) Female gnathopod 2. (G) SEM of juvenile abdomen, ventral view. Abbreviations: Ant1, Ant2 = antenna 1, 2; ba = basis; crp = carpus; dt = dactylus; Gn1 = gnathopod 1; i = ischius; m = merus; Md = mandible; Mx1 = maxilla 1; Mxp = maxilliped; Pl = pleon; Plp 1, 2 = pleon palps; PIS = pleon setae; prd = propodus; Pr7 = pereion segment 7. Scale bars: C, E, F: 200 μ m; D, G: 100 μ m.

details see Figs. 2 and 3. 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

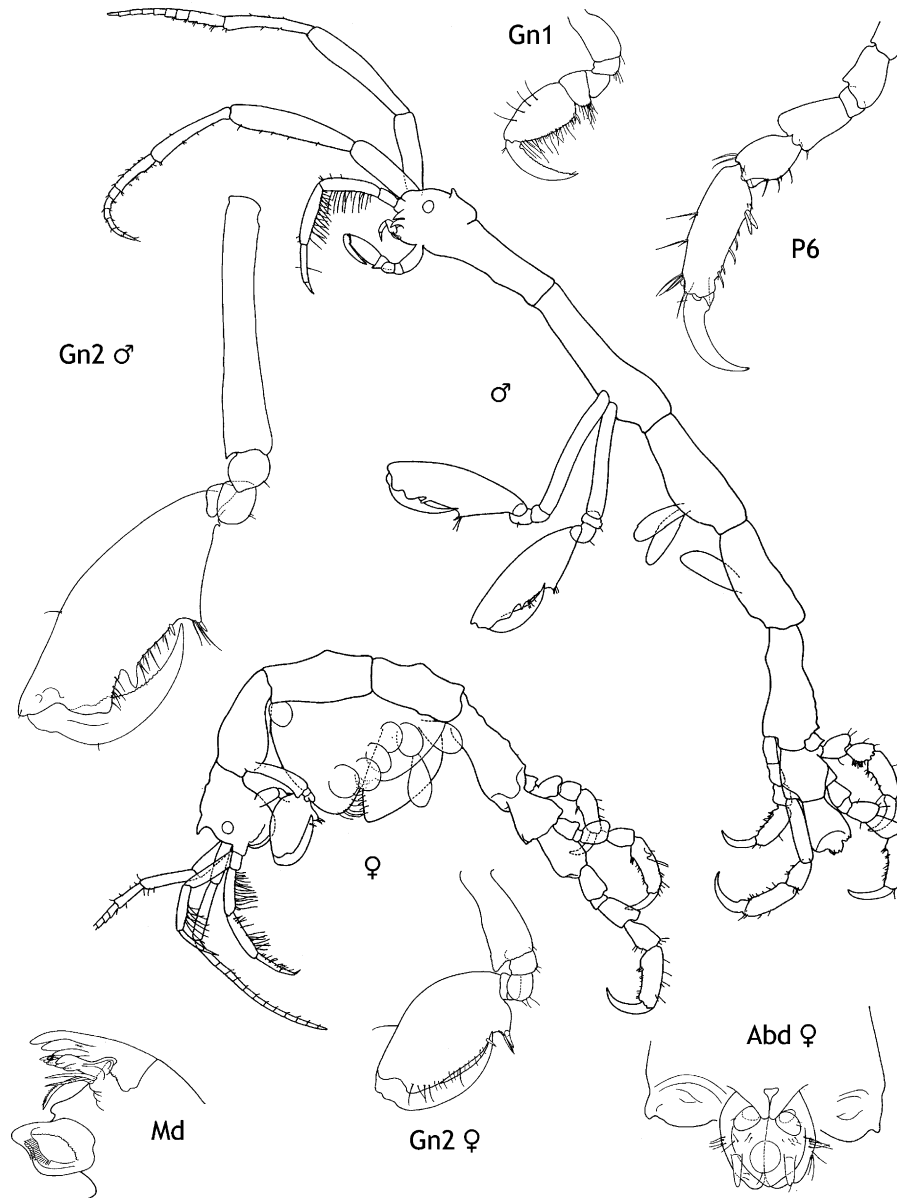


Fig. 3. *Caprella scaura* (Venice) habitus: male 14 mm; female 11 mm. Abbreviations: Abd = female abdomen; Gn 1, 2 = gnathopod 1, 2; Md = mandible, inner side; P6 = male peraeopod 6.

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 and 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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References

- Aoki, M., Kikuchi, T., 1990. *Caprella bidentata* Utinomi, 1947 (Amphipoda Caprellidea), a synonym of *Caprella monoceros* Mayer, 1890, supported by experimental evidence. *J. Crustacean Biol.* 10, 537–543.
- Arimoto, I., 1976. Taxonomic studies of Caprellids (Crustacea, Amphipoda, Caprellidea) found in the Japanese and adjacent waters. Special Publication of the Seto Marine Biology Laboratory Series 3.
- Danesi, P., Gola, G., Tagnin, L., 1999. Strutture e dinamiche del macrobenthos ai confini dei partiacque nel bacino centrale della laguna di Venezia. In: Bon, M., Sburlino, G., Zuccarello, V. (Eds.), *Aspetti Ecologici e Naturalistici dei Sistemi Lagunari e Costieri*, Atti 13° Conv. Gruppo Ecologia di Base “G. Gadio”, Venezia, pp. 267–269.
- Dougherty, C., Steinberg, J.E., 1953. Notes on the skeleton shrimps (Crustacea, Caprellidea) of California. *Proc. Biol. Soc. Wash.* 66, 39–50.
- Guerra-García, J., 2003a. The Caprellidea (Crustacea: Amphipoda) from Mauritius Island, western Indian Ocean. *Zootaxa* 232, 1–24.
- Guerra-García, J., 2003b. The caprellidean Amphipoda from the subantarctic islands of New Zealand and Australia with the description of a new genus and two new species. *Sci. Mar.* 67, 177–194.
- Guerra-García, J.M., 2004. The Caprellidea (Crustacea, Amphipoda) from western Australia and Northern Territory, Australia. *Hydrobiologia* 522, 1–74.
- Guerra-García, J.M., Takeuchi, I., 2003. The Caprellidea from Mirs Bay, Hong Kong, with the description of a new genus and two new species. *J. Crustacean Biol.* 23, 154–168.
- Guerra-García, J.M., Takeuchi, I., 2004. The Caprellidea (Crustacea: Amphipoda) from Tasmania. *J. Nat. Hist.* 38, 967–1044.
- Guerra-García, J.M., Thiel, M., 2001. The caprellid fauna (Crustacea: Amphipoda: Caprellidea) from Coquimbo, northern-central Chile with a taxonomic key for species identification. *Rev. Chil. Hist. Nat.* 74, 873–883.
- Laubitz, D.R., 1991. Crustacea Amphipoda Caprellidea: caprellids from the western Pacific (New Caledonia, Indonesia and the Philippines). In: Crosnier, A. (Ed.), *Résultats des Campagnes MUSORSTOM*. Mém. Mus. Natn. Hist. Nat., Paris (Ser. A) Zool. 9, 101–123.
- Laubitz, D.R., 1995. Caprellidea (Crustacea: Amphipoda) from the southern and western Indian Ocean. *Mésogée* 54, 81–100.
- Libertini, A., Krapp-Schickel, T., 2000. Chromosome number and karyotype analysis in eight marine amphipod (Crustacea) species. *Pol. Arch. Hydrobiol.* 47, 465–471.
- Libertini, A., Colomba, M.S., Vitturi, R., 2000. Cytogenetics of the amphipod *Jassa marmorata* Holmes, 1903 (Corophioidea: Ischyroceridae): karyotype morphology, chromosome banding, fluorescent in situ hybridization and nuclear DNA content. *J. Crustacean Biol.* 20, 350–356.
- Libertini, A., Trisolini, R., Eriksson-Wiklund, A.K., 2003. A preliminary survey on genome size in Amphipoda. *Abstr. XI Colloq. Amphipoda*, Tunis, 25–30 March, 2003, p. 17.
- Mayer, P., 1890. Die Caprelliden des Golfes von Neapel und der angrenzenden Meeresabschnitte. *Fauna Flora Golf. Neapel* 17, 1–55.
- McCain, J.C., 1968. The Caprellidea (Crustacea, Amphipoda) of the western North Atlantic. *US Natl. Mus. Bull.* 278, 1–116.
- Mizzan, L., 1999. Le specie alloctone del macrozoobenthos della Laguna di Venezia: il punto della situazione. *Boll. Mus. Civ. St. Nat. Venezia* 49, 145–177.
- Occhipinti Ambrogio, A., 2000. Biotic invasions in a Mediterranean lagoon. *Biol. Invasions* 2, 165–176.
- Ren, X., Zhang, C.H., 1996. Fouling Amphipoda (Crustacea) from Dayawan, Guangdong province, China (South China sea). *Inst. Oceanol. China Acad. Sci.* 1, 58–78.
- Serejo, C.S., 1998. Gammaridean and caprellidean fauna (Crustacea) associated with the sponge *Dysidea fragilis* Johnston at Arraial de Cabo, Rio de Janeiro, Brazil. *Bull. Mar. Sci.* 63, 363–385.
- Stimpson, W., 1857. The Crustacea and Echinodermata of the Pacific shores of North America. *Boston J. Nat. Hist.* 6, 503–513.
- Templeton, R., 1836. Descriptions of some undescribed exotic Crustacea. *Trans. Entomol. Soc. London* 1, 185–198.
- Thiel, M., Guerra-García, J.M., Lancellotti, D.A., Vásquez, N., 2003. The distribution of littoral caprellids (Crustacea: Amphipoda: Caprellidea) along the Pacific coast of continental Chile. *Rev. Chil. Hist. Nat.* 76, 297–312.
- Utinomi, H., 1947. Caprellidea of Japan and adjacent waters. *Seibutu Suppl.* 1, 68–82.