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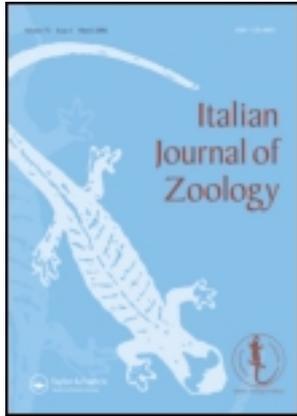
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Two new species of interstitial harpacticoids from southern Italy and proposal of a new *Parastenocaris* species-group

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Two new species of interstitial harpacticoids from southern Italy and proposal of a new *Parastenocaris* species-group

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INTRODUCTION

The genus *Ichnusella* represents an interesting Italian endemism and nowadays includes five species, all exclusive to estuarine interstitial habitats of some streams and rivers of Latium and Sardinia (Berera *et al.*, 2001). In the present study, we report the first record of the genus in southern Italy, where the discovery of *Ichnusella ionica* sp. nov. widens its distribution area.

Parastenocaris sibaritica sp. nov. belongs to a group of eight species all included, until now, in the *minuta*-group Lang (1948) *sensu lato* and characterized by morphological affinities and the same ecological preference for rivermouth habitats. On the basis of their particular ecology and morphology, these species may be distinguished from the others belonging to the *minuta*-group (Cottarelli & Bruno, 1997). We propose and define a new group of species, the "*bera*-group", and we also provide a key for identification purposes.

MATERIALS AND METHODS

Specimens were collected using the Karaman-Chappuis method (Delamare Deboutteville, 1960), fixed in 5% buffered formalin and mounted on permanent slides with Faure's medium. The drawings and measurements were made at 1250x, with an oil immersion lens, using a drawing tube mounted on a Zeiss Axioskop® phase contrast microscope.

For scanning electron microscopy, some specimens were fixed for 24 h in 10% formalin, washed twice in cacodylate buffer (pH 7.2), post-fixed in 1% osmium tetroxide in the same buffer, dehydrated in a graded ethanol series, critical-point-dried in a Balzers Union® CPD 020 apparatus, and coated with gold in a Balzers Union® MED 010 sputter coater. Observations were performed with a 1200 JEOL JEM® EX II scanning electron microscope.

The following abbreviations are used throughout the text and figures: A1, antennule; A2, antenna; Enp, endopod; Exp, exopod; Fu, caudal rami; Gsg, genital somite; Md, mandible; Mxl, maxillule; Mx, maxilla; Mxp, maxilliped; Op, anal operculum; P1-P6, legs 1 to 6; R, rostrum.

The nomenclature and descriptive terminology follow Huys *et al.* (1996).

The holotype, one male paratype and one female allotype will be deposited in the collection of the Museo Civico di Storia Naturale G. Doria, Genova (Italy); the remaining material of the type series is deposited at the Dipartimento di Scienze Ambientali, Università della Tuscia, Viterbo (Cottarelli's collection).

Latitude and longitude were determined using a Garmin GPS (Global Position System) 38™.

TAXONOMINC ACCOUNTS

Family PSAMMOPSYLLIDAE

Genus *Ichnusella* Cottarelli, 1971

Ichnusella ionica sp. nov.

Material – Holotype: one male, V. Cottarelli leg., 25.08.2001, mouth of Portigliola stream (Sant'Ilario dello Ionio, Calabria; 38°12.026' N, 16°13.946' E), 1 m from the right-hand river shoreline, 30 m from the sea; dis-

ABSTRACT

Two interstitial harpacticoids collected in subterranean freshwater in Calabria are described and discussed. *Ichnusella ionica* sp. nov. was collected in the interstitial habitat of the Portigliola stream, a record extending the distribution of the genus, which was previously recorded only from Latium and Sardinia. *Parastenocaris sibaritica* sp. nov. is described from a similar habitat of the Crati River. This new taxon belongs to a group of species living exclusively in estuarine interstitial habitats and all characterised by peculiar morphological and ecological features. The creation of a new group, the "*bera*-group", is proposed for these species.

KEY WORDS: Estuarine ecotone - *Ichnusella* - *Parastenocaris* - Species group.

ACKNOWLEDGEMENTS

This work was supported by grants from the Italian Ministero dell'Università e della Ricerca Scientifica e Tecnologica (M.U.R.S.T., 60% funds). We wish to thank the two anonymous referees, whose helpful comments improved the manuscript.

sected and mounted on a slide labelled: Calabria, Portigliola Stream - *Ichnusella ionica* holotype. Allotype: one female, V. Cottarelli leg., same date and place as holotype, mounted on a slide labelled: Calabria, Portigliola Stream - *Ichnusella ionica* allotype. Paratypes: eight males, eight females, and three ovigerous females, V. Cottarelli leg., same date and place as holotype, mounted on slides labelled: Calabria, Portigliola Stream - *Ichnusella ionica* paratype and numbered from 1 to 19. Three other males and four females were examined by scanning electron microscopy.

Description of the holotype – Body cylindrical and elongate, pitted, unpigmented, eyeless; length from rostrum to distal apex of caudal rami: 0.415 mm. Cephalothorax and anal somite respectively with one dorsal (Fig. 1B) and one ventral hyaline integumental window (Fig. 2A).

Anal operculum (Fig. 2A): distal margin smooth and straight, drawn out into paired curved and spinous processes bilaterally.

Caudal rami (Fig. 2A, B): longer than anal somite, of approximately cylindrical shape, with two apical curved spines; length to width ratio: 4.2. Armature consisting of: a long anterolateral seta, a posterolateral seta, an outer terminal seta, a long and strong inner terminal seta, a

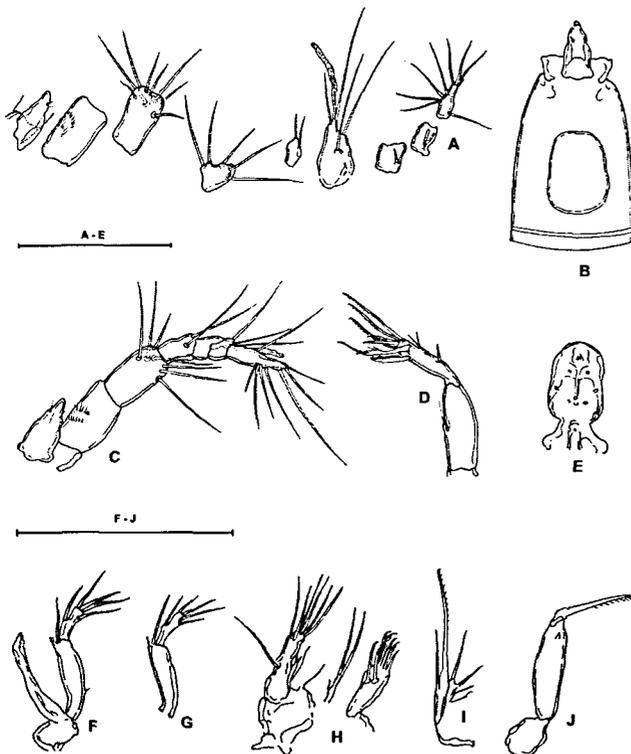


Fig. 1 - *Ichnusella ionica* sp. nov. Holotype male: A, antennule and rostrum, exploded view; B, cephalic shield with a dorsal hyaline integumental window; D, antenna; E, labrum; F, mandible; H, maxillule; I, maxilla; J, maxilliped. Allotype female: C, antennule and rostrum; G, mandibular palp. Scale bar, 0.025 mm.

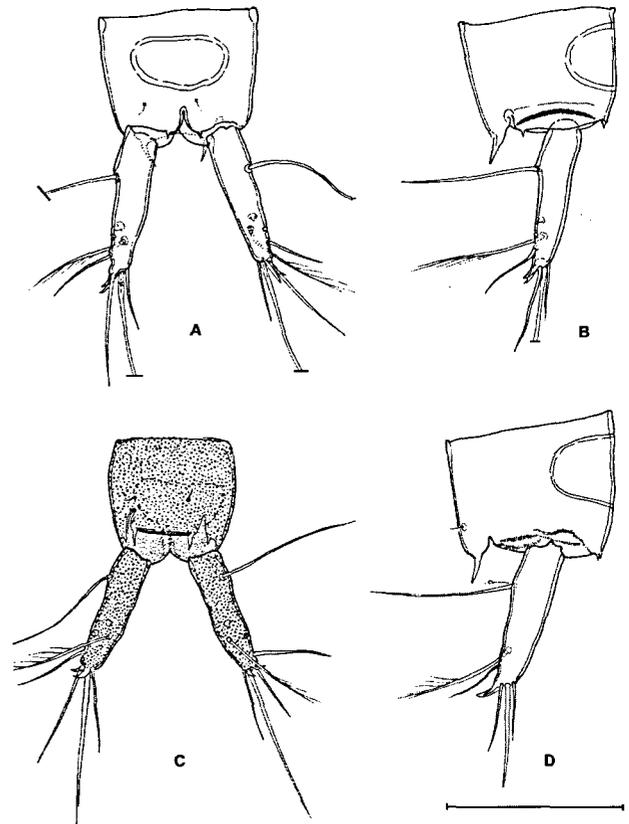


Fig. 2 - *Ichnusella ionica* sp. nov. Holotype: A, caudal rami and anal operculum, ventral view, and abdominal somite with ventral window; B, caudal rami and anal operculum, lateral view. Allotype female: C, caudal rami and anal operculum, dorsal view, and abdominal somite with ventral window; D, caudal rami and anal operculum, lateral view. Scale bar, 0.025 mm.

short terminal accessory seta near the inner terminal corner, a dorsal composite seta with a small spine close to it.

Rostrum (Fig. 1B): defined at the base by a distinct articulation, of triangular shape, with two sensilla.

Antennule (Fig. 1A): eight-segmented. First segment with two rows of transverse spinules; second segment with eight distal setae. Third segment with three apical setae and two subapical ones; fourth segment with two short setae. Fifth segment enlarged with a strong apical tubercle bearing two long setae and an aesthetasc not reaching the last segment of A1 and two subapical setae; sixth segment with one spiniform seta. Seventh segment bare, with a tooth-like expansion on the proximal part; last segment long and narrow, with eight setae.

Antenna (Fig. 1D): one-segmented exopod fused to the basis with an apical seta, allobasis bare. Endopod bearing distally three geniculate, two unipinnate, and two transformed setae. Remaining ornamentation as in figure.

Labrum (Fig. 1E): bare.

Mandible (Fig. 1F): two-segmented palp; basis with one seta on the distal margin, endopod with a seta inserted at about midlength of the segment, three apical and one subapical setae.

Maxillule (Fig. 1H): praecoxal arthrite with five apical and curved spines of the same length, two curved setae inserted at about midlength of arthrite. Coxal endite with two distal setae; basis with six apical setae; exopod reduced to a long seta.

Maxilla (Fig. 1I): syncoxa with one endite bearing two setae. Basis prolonged in a long apical curved tip; endopod represented by a long seta.

Maxilliped (Fig. 1J): slim and elongate; syncoxa and basis unarmed, endopod represented by a long, pinnate, apical claw.

P1-P4 bases each with a pore and a seta near the exopod insertion.

P1 (Fig. 3A): an inner seta near the endopod insertion. Exopod one-segmented and small, with an apical seta. Endopod two-segmented, Enp-1 about five times as long as Enp-2, with a transformed proximal inner seta. Enp-2 bearing two geniculate apical setae of different lengths, one vestigial inner subapical seta, and one subapical spinule.

P2 (Fig. 3B): exopod three-segmented, armature as shown in figure. Endopod one-segmented, shorter than Exp-1, with two normal apical setae of different lengths and one transformed subapical one.

P3 (Fig. 3C): transformed; exopod three-segmented, enlarged and curved inwards; Exp-1 very enlarged with one strong outer distal seta; Exp-2 with one outer seta. Last segment very small, with one long subapical transformed seta and two apical spines, inner margin with a row of spinules. Endopod represented by a short cylindrical segment, with two apical spinules of different lengths and a shorter subapical one.

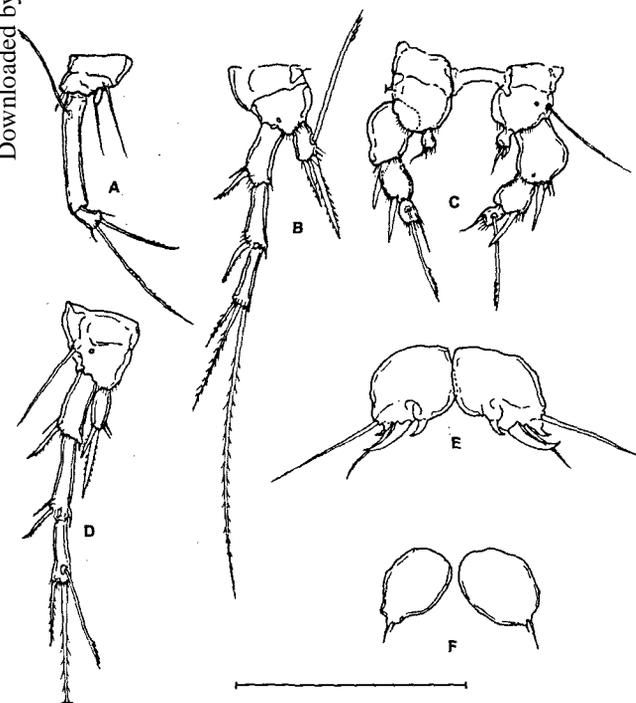


Fig. 3 - *Ichnusella ionica* sp. nov.: Holotype: A, P1; B, P2; C, P3; D, P4; E, P5; F, P6. Scale bar, 0.025 mm.

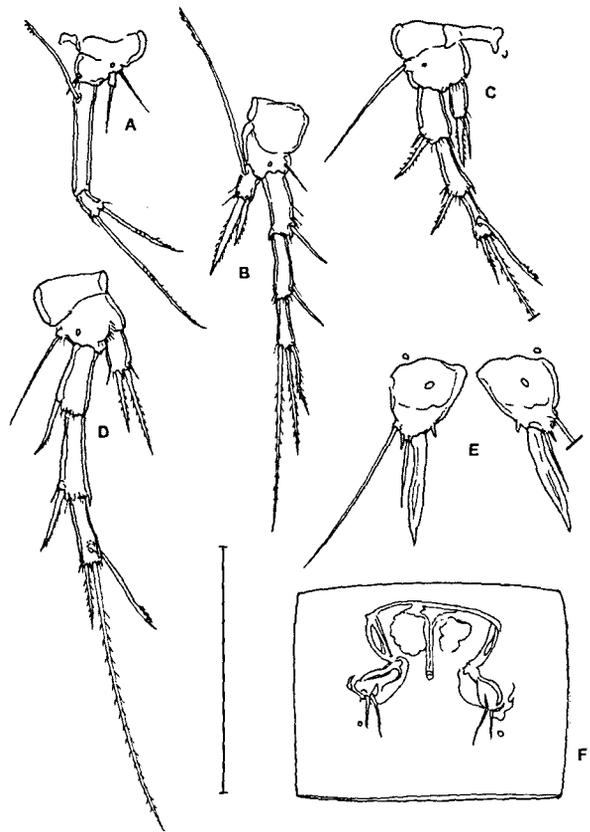


Fig. 4 - *Ichnusella ionica* sp. nov.: Allotype female: A, P1; B, P2; C, P3; D, P4; E, P5; F, P6 and genital field. Scale bar, 0.025 mm.

P4 (Fig. 3D): exopod three-segmented, last segment with a subapical transformed seta and two apical normal ones of different lengths. Endopod as long as half of Exp-1, with two apical setae of different lengths.

P5 (Fig. 3E): an almost rectangular plate, with two distal lobes; the inner lobe with a sinuous inner margin and a curved spine. On the outer lobe, from the inner to the outer corner, a strong curved spine, one seta, a shorter curved spine, one long seta.

P6 (Fig. 3F): two asymmetrical oval plates, each with a short spinule and a seta on the distal margin.

Description of the female allotype - Length: 0.412 mm. R (Fig. 1C), A2, Mx1, Mx, Mxp, P1 (Fig. 4A), P2 (Fig. 4B), P4 (Fig. 4D), cephalic and abdominal (Fig. 2C) hyaline windows as in the male.

Caudal rami (Fig. 2C, D): resembling those of the male but a little shorter, longer than the last abdominal somite. Length to width ratio: 4.15.

Antennule (Fig. 1C): six-segmented, first segment with two transverse rows of spinules, second segment with seven distal setae. Third segment with two setae; fourth segment with a tubercle bearing two setae and an aesthetasc, larger than the corresponding aesthetasc of the male. Fifth segment with a distal seta, last segment with eight setae.

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Mandibular palp (Fig. 1G): endopod with a seta inserted at about midlength of the segment, two apical and two subapical setae.

P3 (Fig. 4C): basis with outer seta and pore. Exopod three-segmented, Exp-3 with two apical setae and a subapical transformed one; remaining ornamentation as in figure. Endopod represented by a cylindrical segment, shorter than Exp-1, with two apical setae, the outer seta stronger.

P5 (Fig. 4E): two plates of almost triangular shape bearing, along the distal margin from the inner to the outer corner: a short spine, a very strong and long spiniform seta, a seta, a short spine, a very long seta.

Genital field and P6: as in Figure 4F. P6 vestigial, represented by two tiny setae of same length.

Supplementary description of male – Some of the features described for the holotype have been checked in three males with SEM.

P5 (Fig. 5B): with two distal lobes and the inner one ending with a curved strong spine. Caudal rami and integumental windows: as in Figure 5D.



Fig. 5 - *Ichnusella ionica* sp. nov.: Allotype female: A, Habitus (scale bar, 100 µm); C, P5 and genital field (scale bar, 10 µm); B, P5 (scale bar, 10 µm); D, caudal rami (scale bar, 10 µm).

Supplementary description of female – Some of the features described for the holotype have been checked in four females with SEM.

Habitus (Fig. 5A): body pitted and somites with wavy distal margins. Gsg: as in Figure 5C, inner corner of P5 with a short spine.

Derivatio nominis – The species name comes from the Latin adjective “ionica” which derives from the name of the Ionian Sea.

Family PARASTENOCARIDIDAE
Genus *Parastenocaris* Kessler, 1913

Parastenocaris sibiritica sp. nov.

Material – Holotype: one male, V. Cottarelli leg., 22.08.2001, mouth of the Crati River (Sibari, Calabria; 39°49.428' N, 16°31.805' E), 1.5 m from the right-hand river shoreline, 200 m from the sea; dissected and mounted on a slide labelled: Calabria, Crati River - *Parastenocaris sibiritica* holotype. Allotype: one female V. Cottarelli leg., same date and place as holotype, mounted on a slide labelled: Calabria, Crati River - *Parastenocaris sibiritica* allotype. Paratypes: one male and three females, V. Cottarelli leg., same date and place as holotype, mounted on slides labelled: Calabria, Crati River - *Parastenocaris sibiritica* paratype and numbered from one to four.

Description of the holotype – Body cylindrical and elongate, unpigmented, eyeless; length from rostrum to distal apex of anal operculum: 0.374 mm. Cephalosome and first four abdominal somites with dorsal hyaline integumental windows.

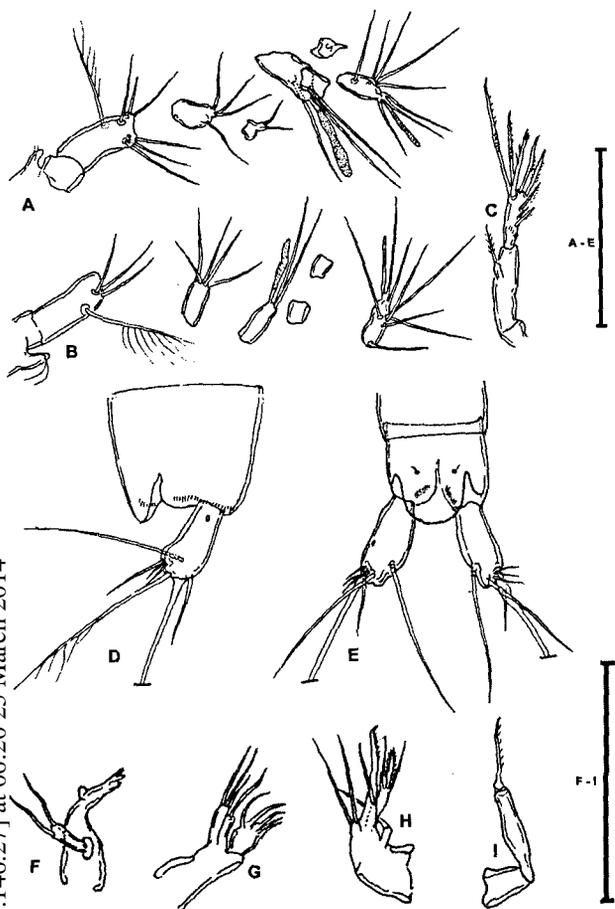
Anal operculum (Fig. 6D): posterior border smooth and rounded and extending beyond posterior end of anal somite.

Caudal rami (Fig. 6D): shorter than anal somite, of approximately cylindrical shape; length to width ratio: 2.6. Armature consisting of: a posterolateral seta with two short accessory setae, an outer terminal composite seta, a long inner terminal seta, a terminal accessory seta near the inner terminal corner, a dorsal composite seta.

Rostrum (Fig. 6A): small and triangular, with two sensilla.

Antennule (Fig. 6A): eight-segmented. First segment bare; second segment with six normal and one plumose setae. Third segment with four apical setae; fourth segment with two small setae. Fifth segment with a strong apical tubercle bearing two long setae and an aesthetasc and one seta inserted at about midlength of the segment; sixth segment unarmed as seventh segment which is lengthened in a curved tip; last segment with eight setae and an aesthetasc.

Antenna (Fig. 6C): one-segmented exopodite with a slender apical seta. Endopod bearing two geniculate, one transformed and two barbed apical setae and two subapical barbed setae.



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Fig. 6 - *Parastenocaris sibiritica* sp. nov. Holotype: A, antennule and rostrum, exploded view; C, antenna; D, caudal rami and anal operculum, lateral view; F, mandible; G, maxillule; H, maxilla; I, maxilliped. Allotype female: B, antennule and rostrum, exploded view; E, caudal rami and anal operculum, dorsal view. Scale bar, 0.025 mm.

Mandible (Fig. 6F): one-segmented palp bearing two apical setae.

Maxillule (Fig. 6G): praecoxal arthrite with four apical and one subapical curved spines. Coxal endite with one distal seta; basis with three apical setae.

Maxilla (Fig. 6H): syncoxa with two endites, one bears two normal and one leaf-like setae, the other bears one normal seta. Basis prolonged in an apical curved and distally spinulose tip, with a lateral seta; endopod represented by a small tubercle with two setae.

Maxilliped (Fig. 6I): slim and elongated, as in figure.

P1 (Fig. 7A): basis with a hook and a seta near the endopod insertion. Exopod three-segmented, almost as long as the endopod. Third segment with three apical setae, two geniculate and one normal, and one subapical seta. Endopod two-segmented, second segment with two geniculate setae of different lengths.

P2 (Fig. 7C): exopod three-segmented, armature as shown in figure. Endopod one-segmented, shorter than Exp-1, represented by a cylindrical segment with some apical spinules and one seta.

P3 (Fig. 7D): relatively elongated; basis with a long seta and two rows of spinules on the outer margin. Endopod represented by a seta. First segment of the exopod with an acute tubercle on the proximal side of the inner margin; another tubercle on the inner margin at about mid-length of the segment. Two strong distal spines inserted at about 2/3 of the length on the outer margin. The segment ends in a leaf-like apophysis with an acute tip. Second segment longer than the end of the apophysis, represented by a narrow and elongated appendix.

P4 (Fig. 7F): exopod three-segmented, ornamentation as shown in figure. Endopod reaches the length of the second segment of the corresponding exopod and has, on the proximal margin, a lengthened tip; the segment continues with a leaf-like lamina with undulating margin. Near the insertion of the endopod are inserted three curved spines, the innermost being the longest.

P5 (Fig. 7H): an almost rectangular plate, prolonged in an inner distal tip. Three setae of different lengths along the distal margin and another seta on the outer distal corner.

Spermatophore (Fig. 7J): reniform.

Description of the female allotype – Length: 0.380 mm. R (Fig. 6B), A2, Mdb, Mxl, Mx, Mxp, P2, cephalic and dorsal windows as in the male.

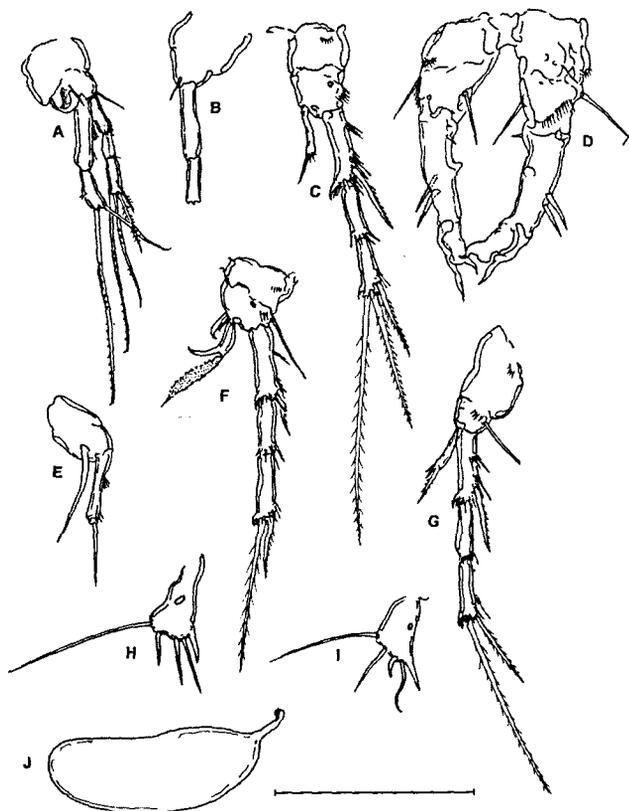


Fig. 7 - *Parastenocaris sibiritica* sp. nov. Holotype: A, P1; C, P2; D, P3; F, P4; H, P5; J, Spermatophore. Allotype female: B, P1 endopod; E, P3 endopod; G, P4; I, P5. Scale bar, 0.025 mm.

Caudal rami (Fig. 6E): morphology and ornamentation as in the male.

Antennule (Fig. 6B): seven-segmented. First segment bare, second segment with four setae, the longest one pinnate. Third segment with five distal setae; fourth segment with two apical setae and an aesthetasc. Fifth and sixth segments short and without ornamentation, seventh segment with seven setae and an aesthetasc.

P1 (Fig. 7B): basis with a seta near the endopod insertion.

P3 endopod (Fig. 7E): transformed in a strong spine a little longer than the first segment of the corresponding exopod.

P4 (Fig. 7G): endopod one-segmented, longer than the first segment of the corresponding exopod, bearing a spinulose seta on the distal margin. The exopod is three-segmented and armed as in figure.

P5 (Fig. 7I): an almost rectangular plate smaller than that of the male, with a long slender seta on the outer distal corner, two setae and a spine on the distal margin, a tip on the inner distal corner.

Derivatio nominis – The species name comes from the ancient Greek town of Sibari near the Crati River.

Remarks on systematics

Ichnusella ionica sp. nov. is particularly reminiscent of *I. eione* Cottarelli, 1971 in the morphology and the ornamentation of the caudal rami in both sexes, since in both species they are provided with two curved distal spines. The caudal rami are longer than the anal somite and the length to width ratio is 4.2, very similar to those of *I. longifurca* Cottarelli, Bruno & Berera, 1999. The ornamentation of the endopod of mandibular palp in *I. ionica* sp. nov. has five setae as *I. improvisa* Berera, Cottarelli & Bruno, 2001 and *I. tertia* Cottarelli, Bruno & Berera, 1999, while *I. eione* and *I. pasquinii* (Cottarelli, 1969) and only the female of *I. longifurca* have four setae. The male P3 are squat and strong, more similar to the corresponding legs of *I. eione*, but they can be distinguished by the transformed seta inserted at about midlength of Exp-3, while in the same position *I. eione* shows a normal seta.

The ornamentation of the male P4 is similar to that of the other species of the genus, the only exception being *I. eione*. In this species, in fact, the P4 Exp-3 bears a long but not transformed subapical seta.

Parastenocaris sibiritica sp. nov. shares many affinities with some species previously ascribed to the *minuta*-group Lang, 1948 as reported by Cottarelli & Bruno (1997). All of these taxa show a similar morphology evinced in the male P3, in P4 endopod, in caudal rami, in endopodite P2 and P5 in both sexes. The new species is recognizable by the peculiar anal operculum and by the ornamentation of P5 in both sexes. In particular, the anal operculum shows a posterior border longer than the end of the anal somite. This peculiar

feature appears in some *Parastenocaris* species, even geographically distant, as for example in *P. sardoa* Cottarelli and Torrasi, 1977, and *P. savita* Ranga Reddy, 2001; however this is a new character for the group of species living in the estuarine ecotone. In spite of the fact that the morphology and ornamentation of P5 is more or less constant in all the *Parastenocaris* of this group, this leg in *P. sibiritica* sp. nov. has in the male four marginal setae and an inner tip on the distal inner corner, while in the female one of the marginal setae is replaced by a spine.

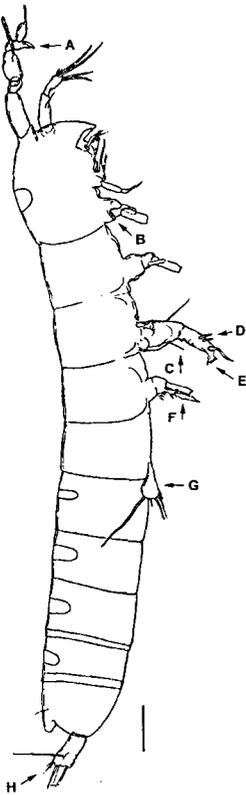
Parastenocaris sibiritica shares with *P. etrusca* Cottarelli, Bruno & Venanzetti, 1995, *P. aphroditis* Cottarelli & Bruno, 1997 and *P. andalusica* Enckell, 1965 the morphology of the P4 endopod.

Parastenocaris etrusca is easily distinguishable by the presence of three spines on the P4 basis; *P. aphroditis* and *P. andalusica* are recognizable by the different shape of the terminal part of the endopodite. The morphology of the male P3 is similar to that of *P. etrusca*, but *P. sibiritica* shows a longer second segment of the exopod. The female P4 endopod is similar to those of *P. etrusca* and *P. hera* Cottarelli, 1969.

Parastenocaris sibiritica sp. nov. belongs to a group of species that share not only peculiar morphological features but also a very similar ecological preference. These species show a Perimediterranean distribution and live typically in estuarine habitats where the environmental parameters have wide variability (Cottarelli & Bruno, 1997). These *Parastenocaris* seem to be the only Mediterranean species adapted to this ecological variability. For these taxa, we propose a new group of species named “*hera*-group nov.” because *P. hera* was the first species described by one of us. Although the “species group” is an “unofficial” systematic category which is placed halfway between the genus (or subgenus) and the species, this category allows relationships to be established and makes identification easier. The species group is, therefore, defined using three different features: morphology, distribution, and autecology.

Diagnosis for the “*hera*-group”

P5 (Fig. 8G) with a rectangular or triangular shape and prolonged distally in an inner tip or a spine, always longer in the female than in the male; caudal rami cylindrical and markedly shorter than the anal somite bearing the three anterolateral setae (Fig. 8H) on the distal part; this character was used by Schminke to define the “Parastenocaridinae” (see Martinez Arbizu, 1997). Dorsal integumental windows on cephalothorax and urosomites. Male A1 8-segmented and the 7th segment lengthened in a curved tip (Fig. 8A); male P1 basis (Fig. 8B) with a hook and a seta near the endopod insertion; male P3 Exp-1 bearing one (Fig. 8D) or two groups of spines on the outer margin and ending in a leaf-like apophysis (Fig. 8E) slightly shorter than the Exp-2; male P3 endopod represented by a seta (Fig. 8C); male P4



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Fig. 8 - Schematic representation of a male of *Parastenocaris heragroup*. A, the arrows show the peculiar features of the "heragroup". A, 4th article of antennule; B, ornamentation of P1 basis; C, P3 endopod; D, spines on the outer margin of P3 Exp-1; E, P3 apophysis; F, P4 endopod; G, P5; H, anterolateral setae of the caudal ramus. Scale bar, 0.025 mm.

endopod ending in a narrow lamina with acute tip (Fig. 8F). The new group includes, as well as *P. sibiritica* sp. nov., the following species: *P. andalusica*; *P. hera*; *P. stellae* Cottarelli, Saporito & Puccetti, 1981; *P. rivi* Cottarelli & Bruno, 1994; *P. oligoalina* Cottarelli, Bruno & Venanzetti, 1995; *P. etrusca*; *P. aphroditis*.

With the aim of identifying all the Perimediterranean species of the *hera*-group so far known, we provide a key. It should be emphasized, however, that, for certain identification, both male and female must be examined.

Key for the males

- 1. P4 endopod bearing on the proximal part one sharpened process 2
- 1'. P4 endopod bearing on the proximal part two sharpened opposing processes 4
- 2. P4 basis with 3 spines 3
- 2'. P4 basis with 2 spines 3
- 3. P3 Exp-1 with two groups of 1 and 4 spines on the outer margin 3
- P. aphroditis*

- 3'. P3 Exp-1 with one group of 2 spines on the outer margin 3
- P. sibiritica* sp. nov.
- 3". P3 Exp-1 with 1 spine on the outer margin 5
- P. andalusica*
- 4. P3 Exp-1 with one group of 2 spines on the outer margin 5
- P. hera*
- 4'. P3 Exp-1 with one group of 3 spines on the outer margin 5
- 4". P3 Exp-1 with two groups of spines, respectively of 2 and 4 spines, on the outer margin 5
- P. stellae*
- 5. P5 prolonged distally in an inner tip 5
- P. oligoalina*
- 5'. P5 with a spine instead of the inner tip 5
- P. rivi*

Key for the females

- 1. P4 endopod represented by a strong pointed appendix 2
- 1'. P4 endopod represented by a segment bearing an apical seta 5
- 2. P4 endopod longer than the Exp-1 and bearing two spines at about 2/3 of its length 3
- P. oligoalina*
- 2'. P4 endopod slightly longer than the Exp-1 with some distal spinules 4
- 3. P5 prolonged distally in an inner tip with four marginal setae 4
- 3'. P5 with a spine instead of the inner tip 4
- P. rivi*
- 4. P3 endopod longer than the first segment of the exopod 4
- P. aphroditis*
- 4'. P3 endopod shorter than the first segment of the exopod 4
- P. stellae*
- 5. P3 endopod longer than the first segment of Exp-1, P5 with approximately rectangular shape and bearing from inner to outer margin 1 seta, 1 curved spine, 2 setae 4
- P. sibiritica* sp. nov.
- 5'. P3 endopod as long as the first segment of Exp-1, P5 with approximately rectangular shape, prolonged in an inner distal tip and bearing from inner to outer margin: 2 setae of the same length, 1 spine and 1 long seta; Mx with 1 endite bearing two normal setae 4
- P. hera*
- 5". P3 endopod slightly longer than the first segment of Exp-1, P5 with approximately rectangular shape, prolonged in an inner distal tip and bearing from inner to outer margin: 2 setae of the same length, 1 spine and 1 long seta; Mx with two endites: endite 1 with 1 normal seta and 1 leaf-shaped seta, endite 2 with 1 normal seta 4
- P. etrusca*
- 5". P3 endopod slightly longer than the first segment of Exp-1, P5 triangular and bearing 2 setae 4
- P. andalusica*

CONCLUSIVE REMARKS

The discovery of *I. ionica* sp. nov. confirms, once again, the earlier conclusion (Cottarelli, 1971) that the members of the genus *Ichnusella* are characteristic of the estuarine interstitial habitat. As was the case for the other species, the new taxon was collected in the subterranean freshwaters near the mouth of a stream. The new collecting site, the Portigliola stream, is a small intermittent watercourse very similar to Rio Ciuchesu (type-locality of *I. improvisa*) in its ecological characteristics. At this site, *I. ionica* sp. nov. was collected together with many specimens of *Halectinosoma* sp.; it appears to be a new community combination since up to now all the *Ichnusella* species were found in association with *Psammopsyllus maricae* and with the *Parastenocaris* of the *hera*-group.

The present record broadens the distribution of the genus, until now limited to the northern and eastern coasts of Sardinia and the coast of Latium. The new record from southern Italy corroborates the opinion that the present geonemy is not the real distribution area of the genus, since the low density of the populations and the high ecological variability of the estuarine ecotone increase the possibility of patchy distribution (Dole Olivier & Marmonier, 1992). We suppose that the "spoty distribution" (*sensu* Galassi, 2001) of the genus may be due to the sparse collections and the distribution, which could be Perimediterranean.

As regards *P. sibiratica* sp. nov., the present data point to the existence of a group of species that shares the same ecological preference, as these taxa are found only in rivermouth ecotones, and shows a Perimediterranean geonemy, with a large part of the species recorded in Italy. At the moment the boundaries of the distribution area reach westward to Spain, with the presence of *P. andalusica* (Enckell, 1965), and eastward to Greece, with the record of *P. aphroditis* (Cottarelli & Bruno, 1997). The morphological similarities between the species of the *hera*-group could strengthen the hypothesis of a common origin for these taxa from one ancestor living in the mouths of a Mediterranean river (Cottarelli *et al.*, 1995). This ancestor should have already shown those morphological features that are still shared by this group of *Parastenocaris* (Cottarelli & Bruno, 1997).

In conclusion, the interstitial estuarine ecotone presents several interesting environmental peculiarities which are reflected in the particular aspects of the ecology and biology of the biocenosis. From a biogeographical point of view, these habitats appear, on the one hand, a "preferential" way to observe actual examples of freshwater colonization by marine meiofauna, as in the case of *Ichnusella* species, and, on the other, the final point of the "way back" from subterranean freshwaters to the sea for taxa of ancient marine origin, now defined as freshwater fauna, as regards the *Parastenocaris* of the *hera*-group.

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