Annls Limnol. 33 (4) 1997 : 255-262

Metacrangonyx ilvanus n. sp., the first Italian representative of the family Metacrangonyctidae (Crustacea : Amphipoda)

F. Stoch[1]

Keywords : Amphipods, *Metacrangonyx*, stygofauna, paleogeography.

Metacrangonyx ilvanus n.sp. is described from Elba Island; this is the first record of the family Metacrangonyctidae from Italy. The new species belongs to the *M. panousei* - group, and more exactly to the *M. gineti* - subgroup, previously known only from Morocco. This fact supports the idea of a multiple colonization process of continental groundwaters from the sea. It is hypothesized that the ancestor of *M. ilvanus* n. sp. colonized brackish waters along the coasts of the Tethys sea and survived the oligo-miocenic fragmentation of Thyrrhenis. A persistence of the species on a fragment of Thyrrhenis in the Tuscan archipelago or a more recent colonization of the older part of Elba Island from the Sardo-Corsican plate during the Messinian salinity crisis is suggested. More distributional data are needed to delineate the evolutionary scenario of the genus in the Mediterranean area.

Metacrangonyx ilvanus n. sp., premier représentant en Italie de la famille des Metacrangonyctidae (Crustacea : Amphipoda)

Mots clés : Amphipodes, *Metacrangonyx*, stygofaune, paléogéographie.

Metacrangonyx ilvanus n. sp., est décrit de l'île d'Elbe ; c'est la première citation de la famille des Metacrangonyctidae en Italie. La nouvelle espèce appartient au groupe *M. panousei* et plus précisément au sous-groupe *M. gineti*, qui n'était jusqu'alors connu que du Maroc. Ce fait soutient l'idée d'un processus de colonisation multiple des eaux souterraines à partir de la mer. Il est supposé que l'ancêtre de *M. ilvanus* n. sp. vivait dans les eaux saumâtres le long des côtes de la Tethys et a survécu à la fragmentation oligo-miocène du continent thyrrénien. La présence de l'espèce dans un fragment thyrrénien de l'archipel toscan ou la plus récente colonisation de la partie la plus ancienne de l'île d'Elbe à partir du socle Sardo-Corse pendant l'épisode Messinien sont suggérées. Davantage de données de répartition sont nécessaires pour décrire le scénario de l'évolution du genre dans la mer méditerranée.

1. Introduction

During recent stygobiological investigations in Elba Island, some amphipods of the family Metacrangonyctidae, previously unknown in Italy, were discovered in a phreatic well; they turned out to belong to a new species, *Metacrangonyx ilvanus* n.sp. Despite the fact that the well was sampled twice in two different seasons, only females were collected; the species seems very rare on Elba island, where over 50 wells and sources were explored.

The location of the new station enlarges the known areal of the genus towards North and is important to test the hypothesis on the evolutionary history of *Metacrangonyx* delineated by Boutin & Messouli (1988), Boutin et al. (1992) and Boutin (1994). The description of the new species is given herein, together with a short discussion of its biogeographic interest.

2. Materials and methods

The specimens were collected from a slightly brackish water well using a modified Cvetkov net; baited traps in the same well positioned in July 1995 gave no further specimens. Measurements of water temperature and some chemical parameters were obtained using portable testers of Hanna Instruments.

Specimens were stored in 70% ethanol with 10% glycerine added. One adult female was partly dissected

1. Museum of Natural History, Trieste, Italy.
Current address: v.le XXV Aprile, 24 I-34015 Muggia (Trieste), Italy.
e-mail: fabiocop@mbox.vol.it

in glycerine, and permanently mounted on slides in Faure's medium. A Zeiss Axioskop microscope fitted with a drawing tube was used to study the details at 400X and 1000X using an oil immersion lens.

3. Taxonomic account

Family Metacrangonyctidae Boutin & Messouli, 1988

Genus *Metacrangonyx* Chevreux, 1909

Metacrangonyx ilvanus n. sp.

Material examined

Phreatic well on the left side of the road Portoferraio - Porto Azzurro, between Campo ai Peri and the crossroad Nanni-Lacona, Elba Island, Italy; quote: m 25 a.s.l.; depth of the well: m 6.5. 1 April 1994, leg. F. Stoch, 2 ♀♀, 2 juv; water depth: m 2.5; water temperature: 15.4° C; pH: 7.6; conductivity: 1040 µS/cm; redox potential value: 268 mV; Na^+: 0.3 g/l. Same locality, 3 July 1995, leg. F. Stoch, 1 ♀ juv.; water depth: m 2.0; water temperature: 19.3° C; pH: 7.4; conductivity: >2000 µS/cm; Na^+: 0.2 g/l. Accompanying fauna: cyclopoid copepods (*Eucyclops serrulatus* - group, *Tropocyclops prasinus*, *Diacyclops languidoides* - group), ostracods (*Cypria ophthalmica, Candona* s.l. sp.), asellid isopods (*Proasellus* cf. *acutianus*), amphipods (*Niphargus sp.*), gastropods (*Islamia gaiteri*, det. M. Bodon)

Type material

Holotype ♀ mm 4.5, left appendages and telson dissected and mounted on two slides in Faure medium; remaining part of the body with appendages preserved in alcohol 70° with addition of 10% glycerine; paratypes, 1 ♀ 3.9 mm and 3 juvenile ♀♀ preserved in alcohol and glycerine. The type material is deposited in the Museum of Natural History in Verona.

Description

Holotype (female 4.5 mm): Body smooth, depigmented, eyes absent. Head with lateral cephalic lobes angular; postantennal sinus present.

Antenna 1 (Fig. 1a) with peduncle articles 1-3 progressively shorter, without spines, bearing respectively 12, 19 and 18 setae (left antenna of holotype). Primary flagellum 10-articulated, with articles 2-8 bearing 1 aesthetasc each; 8th aesthetasc exceeding length of penultimate article. Accessory flagellum (Fig. 1b) 3-articulated, slightly longer than article 1 of primary flagellum; articles 1 and 2 bearing 3 setae each; article 3 very small, with 3 distal setae.

Antenna 2 (Fig. 1c) with peduncle articles 4 and 5 subequal in length, bearing several setae but no spines; flagellum longer than last peduncle article, consisting of 6 articles bearing long setae.

Labrum as in Fig. 1e. Labium (Fig. 1d) without inner lobes, densely setose.

Left mandible as in Fig. 1h; incisor process with 5 teeth, lacinia mobilis with four teeth and bearing a small seta. Spine row consisting of 6 strong spines. Molar process accompanied by a group of three basal setae. Mandible palp 2-articulated, with distal article bearing two setae. Right mandible with spine row consisting of 3 spines; other details as in left mandible.

Maxilla 1 (Fig. 1f): inner lobe densely covered by hairs, bearing 15 plumose setae; outer lobe with 9 denticulated distal spines and a small seta. Palp of left maxilla 1 slender, longer than outer lobe; distal article of left palp bearing 4 distal spines and 1 seta. Palp of right maxilla 1 (Fig. 1f') as long as palp of left maxilla; distal article wider, bearing the same armature.

Maxilla 2 as in Fig. 1g, with lobes sparsely covered by hairs.

Maxilliped (Fig. 2a) typical of the genus *Metacrangonyx*; outer lobe not reaching the end of palp article 2, bearing a row of 7 smooth spines, accompanied by a row of 11 setae; palp 4-articulated, armed as in Fig. 2a.

Gnathopod 1 (Fig. 2b): coxal plate more than 2 times longer than wide; distal margin setose, posterobasal angle with a strong tooth. Basis bearing 5 long posterior setae; carpus less than 3 times as long as wide, with 6 groups of posterior setae; propodus typical of the genus *Metacrangonyx*, shorter than carpus, about 3 times longer than wide; palm short and transverse, bearing 3 setae at palmar angle.

Gnathopod 2 (Fig. 2c): coxal plate more than twice longer than wide, distal margin setose; posterobasal tooth smaller than in coxa 1; oostegite elongated, armed with 2 spines and 2 setae. Basis bearing 6 long posterior setae; carpus approximately 2 times as long as wide, bearing 5 groups of posterior setae; propodus (Fig. 2c,d) elongated (2.5 times as long as wide), bearing 5 (left) or 4 (right) groups of posterior setae; palm reaching nearly 2/5 of the posterior margin, bearing a double row of 5 strong teeth; palmar angle armed with 2 long spines and 1 seta; dactyl with 1 anterior seta.

Pereiopods 3 and 4 as in Fig. 3 a,b. Coxal plate 3 less wide than coxa 4, tapering distally, bearing 3 setae; coxal plate 4 with distal margin wide and setose. Oostegites elongated, armed with short spines. Basis of both pereiopods bearing 5 long setae.

Pereiopods 5-6 as in Fig. 3 c,e; coxal plates as in Fig. d,f; posterior lobes of basis present, not overreaching the length of ischium; dactyls short and stout.

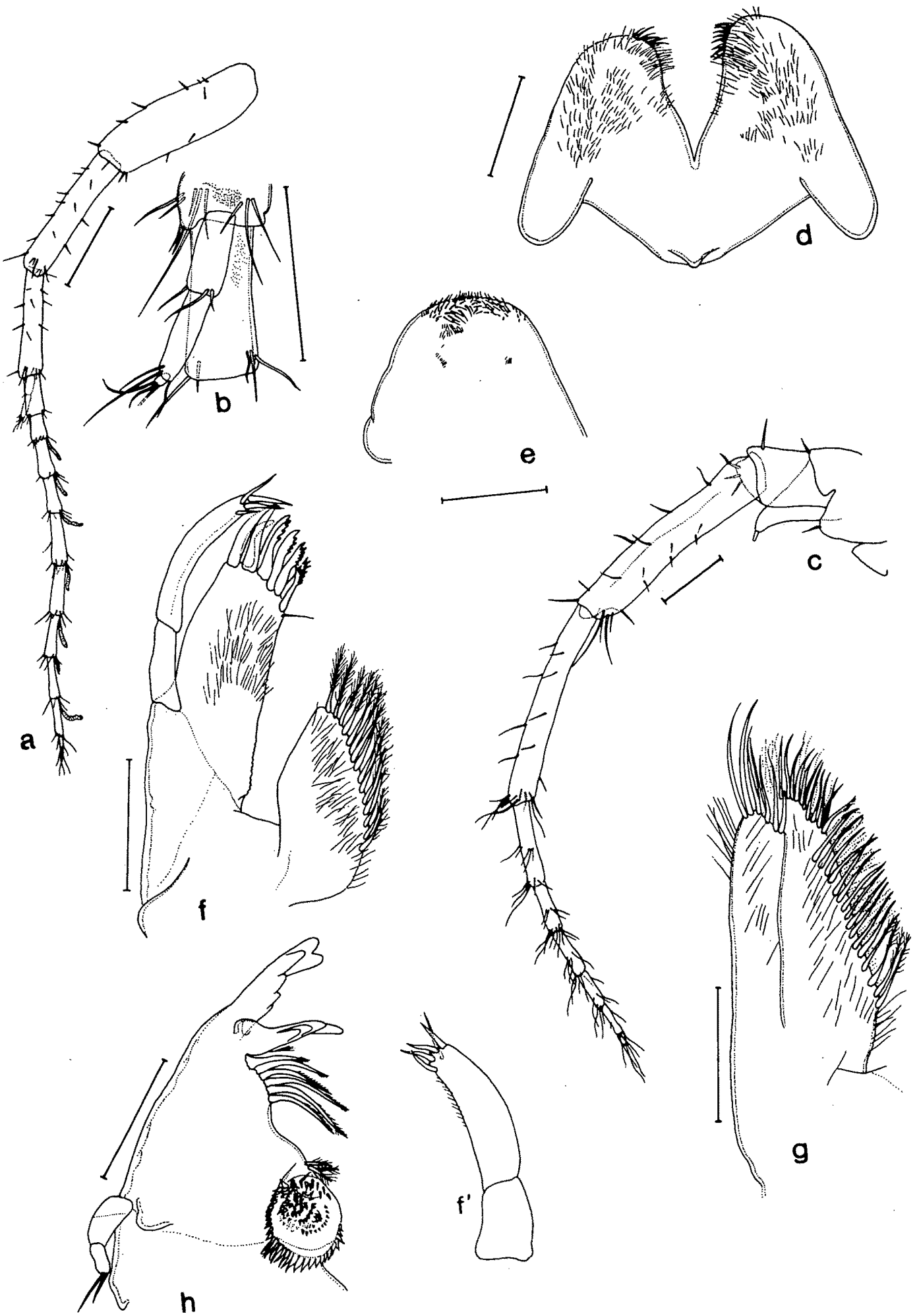
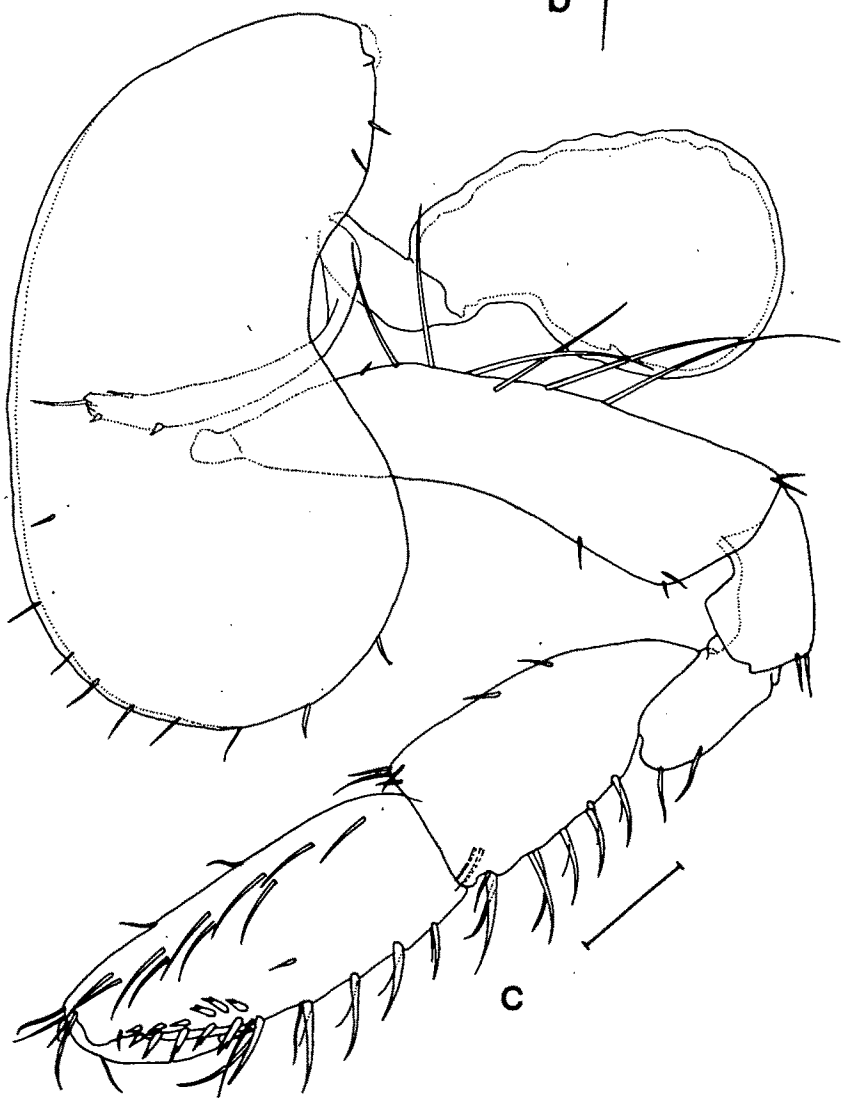


Fig. 1. *Metacrangonyx ilvanus* n. sp. (holotype female). a) antenna 1; b) accessory flagellum of antenna 1; c) antenna 2; d) labium; e) labrum; f) left maxilla 1; f') palp of right maxilla 1; g) maxilla 2; h) left mandible. Scale bars: 0.1 mm.

Fig. 1. *Metacrangonyx ilvanus* n. sp. (holotype femelle). a) antenne 1; b) flagelle accessoire de antenne 1; c) antenne 2; d) lèvre inférieure; e) lèvre supérieure; f) maxille 1 gauche; f') palpe de maxille 1 droit; g) maxille 2; h) mandibule gauche. Echelle: 0.1 mm.



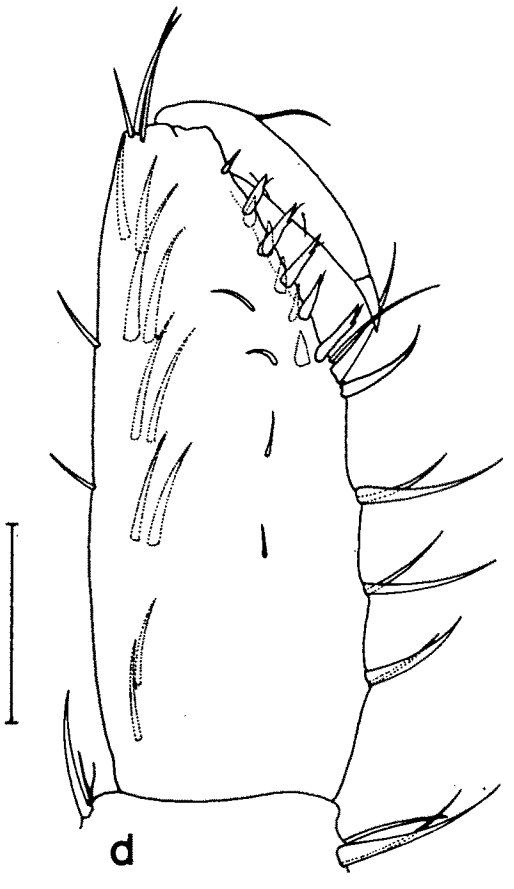


Fig. 2. *Metacrangonyx ilvanus* n. sp. (holotype female). a) maxilliped; b) gnathopod 1; c) gnathopod 2 with oostegite; d) propodus of gnathopod 2. Scale bars: 0.1 mm.

Fig. 2. *Metacrangonyx ilvanus* n. sp. (holotype femelle). a) maxillipède; b) gnathopode 1; c) gnathopode 2 avec oostégite; d) propode de gnathopode 2. Echelle: 0.1 mm.

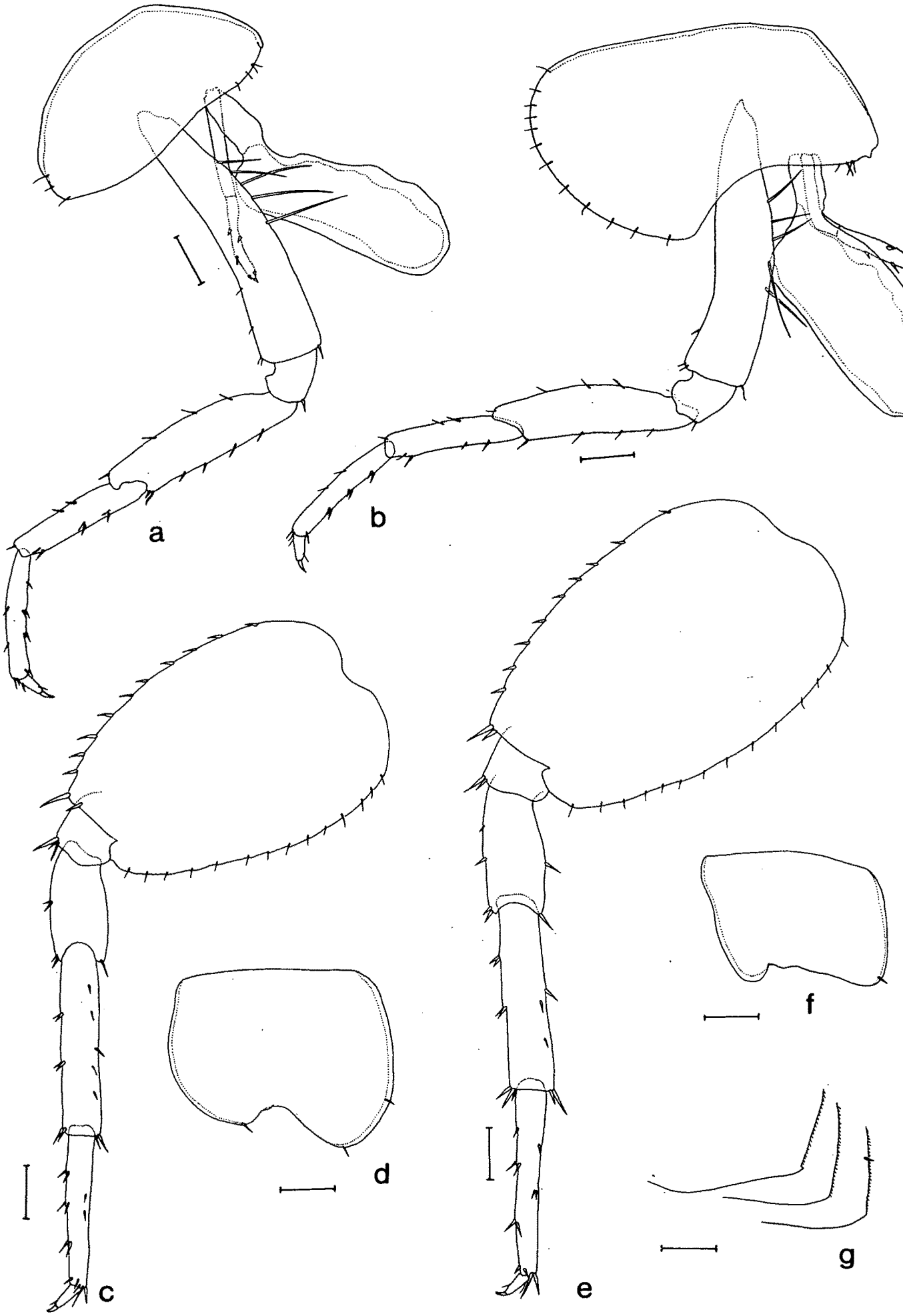


Fig. 3. *Metacrangonyx ilvanus* n. sp. (holotype female). a) pereiopod 3 with oostegite; b) pereiopod 4 with oostegite; c) pereiopod 5; d) coxal plate of pereiopod 5; e) pereiopod 6; f) coxal plate of pereiopod 6; g) epimeral plates 1-3. Scale bars: 0.1 mm.

Fig. 3. *Metacrangonyx ilvanus* n. sp. (holotype femelle). a) péréiopode 3 avec oostégite; b) péréiopode 4 avec oostégite; c) péréiopode 5; d) plaque coxale du péréiopode 5; e) péréiopode 6; f) plaque coxale du péréiopode 6; g) plaques épimérales 1-3. Echelle: 0.1 mm.

Pereiopod 7 (Fig. 4a) shorter than pereiopod 6; coxal plate as in Fig. 4b; basis large, ovoid, wider in the distal part, with wide posterior lobe overreaching the length of ischium; propodus less than 6 times as long as wide, bearing 4 couples of short anterior spines and two posterodistal spines. Dactyl short and stout (Fig. 4c), with 1 seta on posterior margin; anterior margin with a spine and a subungual seta; unguis about 1/4 as long as dactyl.

Epimeral plates 1-3 as in Fig. 3g, without spines.

Pleopods 1-3 (Fig. 4 d-g) with 3 retinacula each (Fig. 4e); peduncle of pleopod 1 with a row on 7 marginal setae, peduncle of pleopod 2 and 3 respectively with 1 and 2 outer marginal setae; exopodites of pleopods 1-3 respectively 9-, 9-, 8-articulated, endopodites 6-, 6-, 5-articulated; article 1 of endopodites longer than the others.

Uropod 1 (Fig. 4h) with peduncle bearing a basoventral spine; rami subequal in length, with a row of 4 marginal spines and 1 distal spine accompanied by other 2 short and stout spines near its basis. Uropod 2 (Fig. 4i) shorter and stouter than uropod 1; both rami subequal in length, with distal spines as in uropod 1. Uropod 3 (Fig. 4j) short, with peduncle rounded, bearing 2 spines and 2 setae; outer ramus short, as long as 1/2 of peduncle, bearing a distal spine; inner ramus very small, scale-like.

Telson (Fig. 4k) as long as wide, subquadrangular, bearing 2 groups of 4 setae, 3 of them being plumose and 1 simple; distance between the two simple setae approximately 1/3 of telson width.

The paratype female of 3.9 mm is younger and shows no remarkable differences in the above mentioned characters.

Male unknown.

Etymology

The specific name *ilvanus* refers to Elba island, named *Ilva* by the Romans.

Remarks

Following Messouli et al. (1991), Boutin et al. (1992) and Boutin (1994) *Metacrangonyx ilvanus* should be considered as a member of the *M. panousei* - group, and more exactly of the *M. gineti* - subgroup, which includes *M. gineti, M. ruffoi* and *M. aroundanensis*. It shares with the member of this subgroup the low number of articles of primary flagellum of antenna 1 and the shape and ornamentation of uropod 3. Nevertheless, it can be easily differentiated from the above mentioned species, as well as from the other species of *M. panousei* - group, by the following characters:

- structure and ornamentation of peduncle articles of antenna I and II ;

- mandible palp two-articulated (always 1-articulated in the other species) ;

- more elongated propodus of gnathopod 2 ;

- shorter and stouter pereiopods 5-7 with shorter dactyls ;

- shape of basis of pereiopod 7, rounded and wider in its distal part ;

- distal armature of both rami of uropods 2 and 3 ;

- shape of telson.

4. Discussion

Boutin (1994), as well as Boutin & Messouli (1988) and Boutin et al. (1992) discussed the origin and evolution of the family Metacrangonyctidae in North Africa. Metacrangonyctid amphipods are supposed to be thalassoid stygobionts which colonized continental groundwaters following the «regression model» (Stock 1977). Following Boutin (1994), different monophyletic groups of species colonized independently and successively the groundwaters of Morocco during the marine regressions of the Turonian (*M. spinicaudatus* - group and also *M. remyi* - group), the Senonian (*M. panousei* - group) and the Eocene (genus *Longipodacrangonyx*). Moreover, Boutin (1994) suggested to explain in the same way the colonization of Balearic islands by *M. longipes* Chevreux, 1909 (a member of the *M. remyi* - group) and of Fuerteventura, Egyptian Sinai and Israel by members of the *M. panousei* - group (see Stock & Rondé-Broekhuizen 1986, Ruffo 1982 and Karaman 1989), even if this hypothesis is not ever supported by geological evidence. A more recent origin was considered by Boutin (1994) as incompatible with the distribution of the genus in Moroccan mainlands.

Some data suggest an ancient marine origin of the new species. *M. ilvanus* n. sp. belongs to the *M. gineti* - subgroup, known only from Morocco, and shows no close phylogenetic relationship with the species inhabiting the Balearic islands; this fact is in agreement with Boutin's hypothesis of multiple colonizations of inland waters from the sea at different periods. Nevertheless, there is a strong geological evidence for a miocenic origin of the older part of Elba island (Lipparini 1976). If a pre-miocenic origin for the whole *M. panousei* - group of species is accepted, it must be postulated that the ancestor of *M. ilvanus* n. sp. colonized the brackish coastal waters of the Tethys sea and survived in the western Paleomediterranean basin the oligomiocenic fragmentation of Thyrrhenis. There are two ways to explain this evolutionary history. The first scenario postulates the persistence of a pre-miocenic, palaeothyrrenian stock of species in the area of the Tuscan Archipelago; this hypothesis cannot be rejected (Sarà 1976), because of the inaccuracy of the geologi-

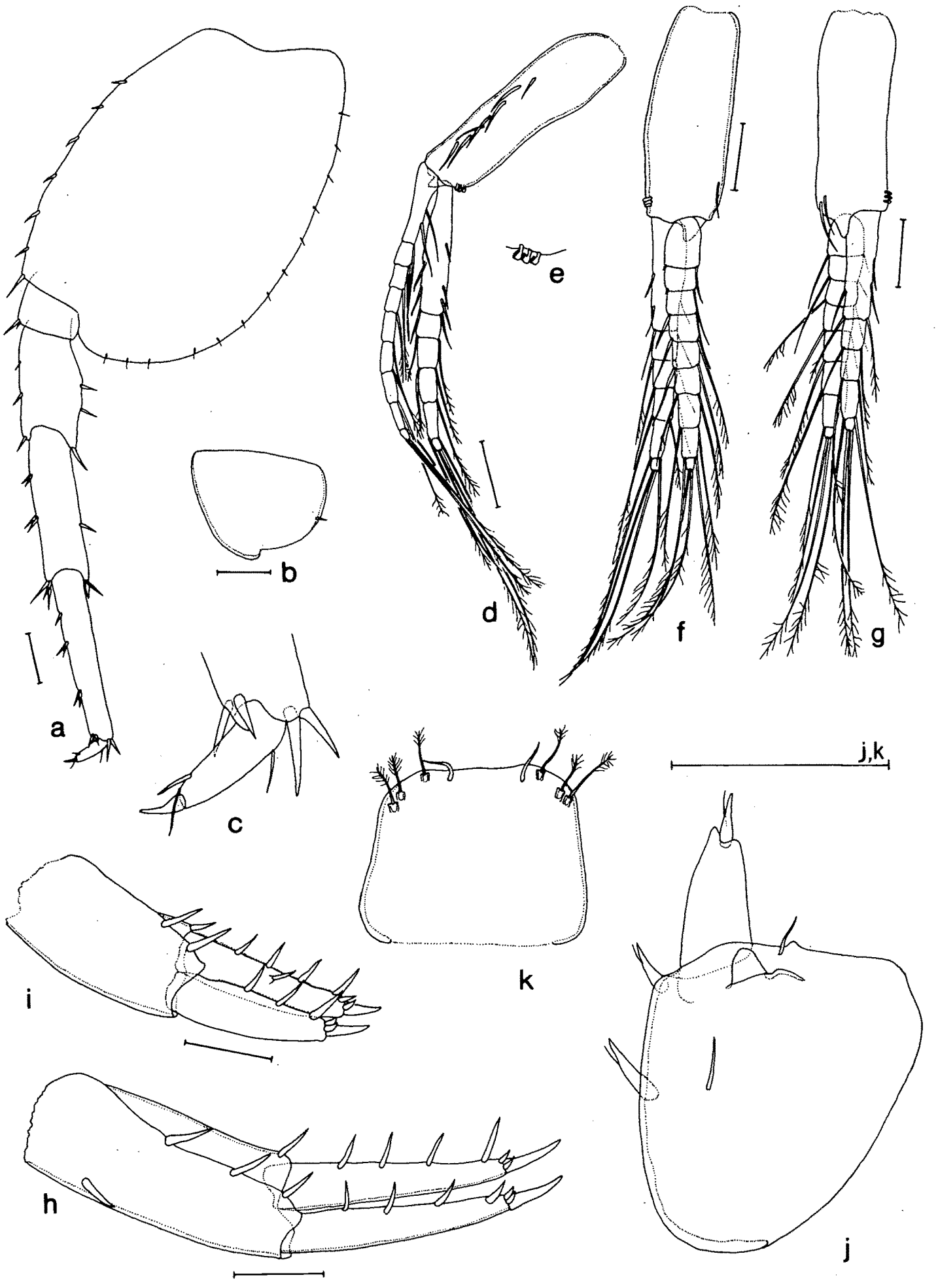


Fig. 4 . *Metacrangonyx ilvanus* n. sp. (holotype female). a) pereiopod 7; b) coxal plate of pereiopod 7; c) dactyl of pereiopod 7; d) pleopod 1; e) retinacula of pleopod 1; f) pleopod 2; g) pleopod 3; h) uropod 1; i) uropod 2; j) uropod 3; k) telson, dorsal side. Scale bars: 0.1 mm.

Fig. *Metacrangonyx ilvanus* n. sp. (holotype femelle). a) péréiopode 7; b) plaque coxale du péréiopode 7; c) dactyle du péréiopode 7; d) pléopode 1; e) rétinacles de pléopode 1; f) pléopode 2; g) pléopode 3; h) uropode 1; i) uropode 2; j) uropode 3; k) telson, face dorsale. Echelle: 0.1 mm.

cal data (see also La Greca 1996). Another scenario was suggested by Giusti (1976), who splitted the fauna of the Tuscan Archipelago into two groups of colonizers. The first group derived from the Sardo-Corsican plate, a residual of Thyrrhenis, and colonized the older volcanic parts of Elba during the Messinian salinity crisis, when the two lands were located close together. According to this scenario, a dispersal of *M. ilvanus* n. sp. through brackish waters (possibly correlated with the important shifting of marine shores during the different phases of the Messinian events) instead of a direct immigration from the sea must be postulated. The second group of species defined by Giusti (1976) colonized Elba island during Pleistocenic connections with the Italian peninsula. This group includes the other amphipod species known from Elba island (*Ilvanella inexpectata* Vigna Taglianti, 1972, and *Niphargus* sp. pl.); they are all limnicoid stygobionts (Vigna Taglianti 1975) reported also from Tuscany groundwaters and their evolutionary history is probably completely different from that of *M. ilvanus* n. sp. (see Ruffo 1982a).

Unfortunately, the distributional data in hand are too scarce to accept or reject the hypotheses mentioned above, since up to now no *Metacrangonyx* species are reported from Corsica or Sardinia. Nevertheless, the rarity of *Metacrangonyx ilvanus* n. sp. on Elba island suggests that more intensive researches could lead to its discovery in those islands, as well as in other areas around the Mediterranean basin, allowing a better understanding of the evolutionary scenario of the genus.

Acknowledgements

I wish to thank C. Boutin (University of Toulouse, France) and S. Ruffo (Museum of Natural History, Verona) for the helpful and invaluable comments on an early draft of the manuscript and the stimulating discussions on the origin of the genus *Metacrangonyx*.

References

Balazuc J. & Ruffo S. 1953. — Due nuove specie del genere *Metacrangonyx* Chevreux (Amphipoda. Gammaridae) delle acque interne del Nord Africa francese. *Mem. Mus. civ. St. Nat. Verona*, 4: 25-33.

Boutin C. 1994. — Phylogeny and biogeography of metacrangonyctid amphipods in North Africa. *Hydrobiologia,* 287: 49-64.

Boutin C. 1994. — Stygobiology and historical geology: the age of Fuerteventura (Canary Island), as inferred from its present stygofauna. *Bull. Soc. géol. France*, 165 (3): 273-285.

Boutin C. & Messouli M. 1988. — *Metacrangonyx gineti* n. sp. d'une source du Haut-Atlas Marocain et la famille des Metacrangonyctidae n. fam. (Crustacés Amphipodes stygobies). *Vie Milieu*, 38 (1): 67-84.

Boutin C., Messouli M. & Coineau N. 1992. — Phylogénie et biogéographie évolutive d'un groupe de Metacrangonyctidae, crustacés amphipodes stygobies du Maroc. II. — Cladistique et paléogéographie. Avec l'examen comparatif de plusieurs logiciels de parcimonie. *Stygologia*, 7 (3): 159-177.

Chevreux E. 1909. — Amphipodes (première série). *Arch. Zool. expér. gén.*, 5 sér., 2 (*Biospeologica* XII): 27-42, 2 tavv.

Giusti F. 1976. — I Molluschi terrestri, salmastri e di acqua dolce dell'Elba, Giannutri e scogli minori dell'Arcipelago Toscano. *Lav. Soc. It. Biogeogr.*, 5: 99-346.

Karaman G.S. 1981. — Revision of the genus *Metacrangonyx* Chevr. 1909. *Glas. Republ. zavoda zast prirode Prirodn. Muz. Titograd*, 14: 31-46.

Karaman G.S. 1989. — *Metacrangonyx ortali* n. sp., a new subterranean member of the family Crangonyctidae, from Dead Sea region. *Studia Marina*, 20: 33-49.

Karaman G.S. & Pesce G.L. 1980. — Researches in Africa by the Zoological Institute of L'Aquila, Italy. V. On three subterranean amphipods from North Africa (Amphipoda: Gammaridea). *Bull. Zool. Mus. Univ. Amsterdam*, 7 (20): 197-202.

La Greca M. 1996. — Storia biogeografica degli ortotteri d'Italia: origine e distribuzione (Insecta, Orthoptera). *Boll. Mus. Civ. St. nat. Verona*, 20: 1-46.

Lipparini T. 1976. — Per la storia del popolamento delle isole dell'Arcipelago Toscano (contributo geo-palentologico). *Lav. Soc. It. Biogeogr.*, N.S., 5: 13-25.

Messouli M., Boutin C. & Coineau N. 1991. — Phylogénie et biogéographie évolutive d'un groupe de Metacrangonyctidae, crustacés amphipodes stygobies du Maroc. I. — Les espèces du groupe *panousei*. *Mém. Biospéol.*, 18: 247-262.

Ruffo S. 1954. — *Metacrangonyx longicaudus* n. sp. (Amphipoda Gammaridae) delle acque sotterranee del Sahara marocchino. *Mem. Mus. civ. St. Nat. Verona*, 4: 127-130.

Ruffo S. 1982. — Une nouvelle espèce de *Metacrangonyx* Chevreux (Amphipoda: Gammaridae) du désert du Sinaï. *Israel J. Zool.*, 31: 151-156.

Ruffo S. 1982a. — Gli anfipodi delle acque sotterranee italiane. *Lav. Soc. It. Biogeogr.*, N.S., 7: 139-169.

Ruffo S. 1986. — Amphipoda: groupe *Metacrangonyx*. In: Botosaneanu L. (ed.), *Stygofauna mundi*. E.J. Brill/Dr. W. Backhuys, Leiden: 550-552.

Sarà M. 1976. — Note conclusive sul XX Congresso S.I.B. «Il popolamento animale e vegetale dell'Arcipelago toscano». *Lav. Soc. It. Biogeogr.*, N.S., 5: 917-926.

Stock J.H. 1977a. — The taxonomy and zoogeography of the Hadziid Amphipoda, with emphasis on the West Indian taxa. Studies Fauna Curaçao, 177: 1-81.

Stock J.H. & Rondé-Broekhuizen B. 1986. — Stygofauna of the Canary Islands, 1. A new species of *Pygocrangonyx*, an amphipod genus with African affinities, from Fuerteventura. *Bijdr. Dierk.*, 56 (2): 247-266.

Vigna Taglianti A. 1975. — Gli anfipodi sotterranei dell'Arcipelago Toscano. *Lav. Soc. It. Biogeogr.*, N.S., 5: 3-11.