

The decapod fauna (Axiidea, Anomura, Brachyura) from the Late Pleistocene of Trumbacà, Reggio Calabria (Calabria, southern Italy)

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Abstract - We report a rich faunal assemblage from the Tyrrhenian (Late Pleistocene) of Trumbacà, located in the southern area of Reggio Calabria (Calabria, southern Italy). The only brachyuran reported to date from this locality is *Ranilia constricta* (A. Milne Edwards, 1880) by Vazzana (2008). The studied specimens have been assigned, as follows: *?Corallianassa* sp., *Dardanus arrosor* (Herbst, 1796), *Dardanus substriatus* (A. Milne Edwards, 1861), *Paguristes* cf. *P. syrtensis* de Saint Laurent 1970, *Anapagurus* sp., *Ranilia constricta* (A. Milne Edwards, 1880), *Ranina propinqua* Ristori, 1891, *Ebalia* cf. *E. deshayesi* Lucas, 1846, *Ilia nucleus* (Linnaeus, 1758), *Medorippe lanata* (Linnaeus, 1767), *Calappa granulata* (Linnaeus, 1758), *Pisa armata* (Latreille, 1803), *Derilambrus* cf. *D. angulifrons* (Latreille, 1825), *Atelecyclus undecimdentatus* (Herbst, 1783), *Carcinus* sp., *Pilumnus hirtellus* (Linnaeus, 1761), and *Xantho* cf. *X. incisus* (Leach, 1814). The studied assemblage enlarges our knowledge on the evolution of the Mediterranean decapod faunas.

Key-words: Decapoda, Axiidea, Anomura, Brachyura, Late Pleistocene, Calabria, southern Italy.

Riassunto - La fauna a crostacei decapodi (Axiidea, Anomura, Brachyura) del Pleistocene superiore di Trumbacà, Reggio Calabria (Calabria, Italia meridionale).

Viene descritta una ricca associazione a crostacei decapodi del Tirreniano (Pleistocene superiore) di Trumbacà, località ubicata a sud di Reggio Calabria (Calabria, Italia meridionale). L'unico crostaceo decapode descritto da questa località è *Ranilia constricta* (A. Milne

Edwards, 1880), segnalata da Vazzana (2008). Gli esemplari oggetto di questo studio sono stati così assegnati: *?Corallianassa* sp., *Dardanus arrosor* (Herbst, 1796), *Dardanus substriatus* (A. Milne Edwards, 1861), *Paguristes* cf. *P. syrtensis* de Saint Laurent 1970, *Anapagurus* sp., *Ranilia constricta* (A. Milne Edwards, 1880), *Ranina propinqua* Ristori, 1891, *Ebalia* cf. *E. deshayesi* Lucas, 1846, *Ilia nucleus* (Linnaeus, 1758), *Medorippe lanata* (Linnaeus, 1767), *Calappa granulata* (Linnaeus, 1758), *Pisa armata* (Latreille, 1803), *Derilambrus* cf. *D. angulifrons* (Latreille, 1825), *Atelecyclus undecimdentatus* (Herbst, 1783), *Carcinus* sp., *Pilumnus hirtellus* (Linnaeus, 1761), and *Xantho* cf. *X. incisus* (Leach, 1814). L'associazione descritta incrementa le nostre conoscenze sull'evoluzione delle faune a crostacei decapodi del Mediterraneo.

Parole chiave: Decapoda, Axiidea, Anomura, Brachyura, Pleistocene superiore, Calabria, Italia meridionale.

INTRODUCTION

The studied specimens were collected from a grey, micaceous, thin sandy deposits from the Tyrrhenian (Late Pleistocene) of Trumbacà district, located at southeast of Reggio Calabria (Calabria, southern Italy, 38°6'52.66"N 15°39'0.73"E). Trumbacà is nearby (about two hundred meters) the coeval Bovetto district, from which Garassino & De Angeli (2008) previously reported *Ranilia constricta* (A. Milne Edwards, 1880). Moreover, Garassino *et al.* (2010b) also reported *Homola barbata* (Fabricius, 1793), from the Cafari district (Reggio Calabria), one of the several fossiliferous localities (close each other) collected from the Late Pleistocene arenaceous series cropping out in the southern area of Reggio Calabria (Bovetto, Trumbacà, Cafari, Ravagnese, among others). A natural exposure (about 5 m thick) and 100 meters above sea level, crosses and exposes the Late Pleistocene fossiliferous sandy bench series in Trumbacà district. This locality was previously known for its rich and well-preserved typical Tyrrhenian malacofauna (Bonfiglio, 1972). The only brachyuran reported to date from this locality is *Ranilia constricta* (Vazzana, 2008). A rich sample of axiideans, anomurans, and brachyurans enlarge the knowledge of decapod communities from the Late Pleistocene (Tyrrhenian) of the Mediterranean area.

MATERIALS

The studied sample includes 46 specimens of axiideans, anomurans and brachyurans. The infraorder Axiiidea de Saint Laurent, 1979, includes *?Corallianassa* sp.

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(2 specimens) (Callianassidae Dana, 1852); the infraorder Anomura H. Milne Edwards, 1832, includes *Dardanus arrosor* (Herbst, 1796) (2 specimens), *D. substriatus* (A. Milne Edwards, 1861) (3 specimens), *Paguristes* cf. *P. syrtensis* de Saint Laurent, 1970 (1 specimen) (Diogenidae Ortmann, 1892), and *Anapagurus* sp. (3 specimens) (Paguridae Latreille, 1802); the infraorder Brachyura Latreille, 1802, includes *Ranilia constricta* (A. Milne Edwards, 1880) (6 specimens), *Ranina propinqua* Ristori, 1891 (1 specimen) (Raninidae De Haan, 1839), *Ebalia* cf. *E. deshayesi* Lucas, 1846 (1 specimen), *Ilia nucleus* (Linnaeus, 1758) (1 specimen) (Leucosiidae Samouelle, 1819), *Medorippe lanata* (Linnaeus, 1767) (1 specimen) (Dorippidae MacLeay, 1838), *Calappa granulata* (Linnaeus, 1758) (9 specimens), *Pisa armata* (Latreille, 1803) (3 specimens) (Pisidae Dana, 1851), *Derilambrus* cf. *D. angulifrons* (Latreille, 1825) (2 specimens) (Parthenopidae MacLeay, 1838), *Atelecyclus undecimdentatus* (Herbst, 1783) (1 specimen) (Atelecyclidae Ortmann, 1893), *Carcinus* sp. (2 specimens) (Portunidae Rafinesque, 1815), *Pilumnus hirtellus* (Linnaeus, 1761) (5 specimens) (Pilumnidae Samouelle, 1819), and *Xantho* cf. *X. incisus* (Leach, 1814) (3 specimens) (Xanthidae MacLeay, 1839). Due to the very delicate nature of the fossils and the loose matrix, all specimens were fixed with a film of polyvinyl acetate for study and preservation. The specimens are housed in the palaeontological collections of the Museo di Storia Naturale di Milano (MSNM).

For the higher-level classification, we follow the recent arrangement proposed by Ng *et al.* (2008), De Grave *et al.* (2009), and Van Bakel *et al.* (2012).

Abbreviations

hc: height of the carpus; hpa: height of the palm; lc: length of the carpus; lcxp: length of the carapace (excluding rostrum); ld: length of the dactylus; li: length of the index; lpa: length of the palm; wcxp: width of the carapace.

SYSTEMATIC PALAEOLOGY

Order Decapoda Latreille, 1803
 Infraorder Axiidea de Saint Laurent, 1979
 Family Callianassidae Dana, 1852
 Subfamily Callichirinae Manning & Felder, 1991
 Genus *Corallianassa* Manning, 1987

Type species: *Callianassa longiventris* A. Milne Edwards, 1870 by original designation.

Included fossil species: *Corallianassa acucurvata* Swen, Fraaije & van der Zwaan, 2001.

Discussion. In *Corallianassa* major merus is ovoid, with armed lower margin, either with denticles (e.g. in *C. articulata* Rathbun, 1906; see Rathbun, 1906: fig. 47b and Sakai, 1999: fig. 15d, e) or large spines (e.g. in *C. longiventris* (A. Milne Edwards, 1870); see Borradaile, 1904: fig. 2b). In this respect, it is similar to *Glypturus* Stimpson, 1866 (Hyžný & Müller, 2012). With the exception of one species, *Corallianassa intesi* (de Saint Laurent & Le Lo-

euff, 1979), the lower margin of carpus does not possess spines which is typical for *Glypturus*. Numerous extant species of *Corallianassa* possess major propodus that are highest around the midpoint, thus having a convex upper margin (see e.g. Rathbun, 1906: fig. 47b; Poore & Griffin, 1979: fig. 26c; Dworschak, 1992: fig. 14a; Sakai, 1999: fig. 16d, 18c). This is not usual for other callianassid genera, although one can observe variation in this character. *Corallianassa* usually has a rather long dactylus both in major and minor chela. In the major one, it may be nearly as long as the propodus (e.g. Sakai, 1967: fig. 3C; Sakai, 1999: fig. 16d). Many species possess large setal pores at both fingers, sometimes extending on the palm. Major dactylus is robust, curved and without prominent teeth.

Corallianassa acucurvata described by Swen *et al.* (2001) from the Maastrichtian of the Netherlands is based on specimens without merus (which is considered taxonomically important, see Manning & Felder, 1991); other characters, however, conforms with the concept of *Corallianassa* as presented above.

Corallianassa rigoi described by De Angeli & Garassino (2006b) from the Cretaceous of Italy exhibits a long major propodus with upper and lower margins parallel to each other, and with short fingers. This character combination is not typical for *Corallianassa*. Moreover, *C. rigoi* possesses an elongate carpus, triangular in outline, which is quite untypical for the genus. No convincing arguments for generic assignment were presented by De Angeli & Garassino (2006b), and we remove the species from *Corallianassa*. Re-examination of the type material is needed to resolve the generic status of *C. rigoi*.

?*Corallianassa* sp.
 Fig. 1A

Material and measurements: One right major propodus (MSNM i27900 – hpa: 8 mm; li: 5 mm; lpa: 9 mm); one left major dactylus (MSNM i27910 – ld: 9 mm).

Description: Major propodus slightly longer than high, highest around the midpoint, upper margin convex, lower margin rimmed; index relatively long, slightly shorter than palm; a faint ridge extends along the index and continues onto palm; outer lateral surface of palm covered with large setal pores at the base of the index; index stout, with blunt tip and a blunt tooth at the middle of the occlusal margin. Major dactylus massive and stout, upper margin forms distinct keel, occlusal margin unarmed, tip hooked; large setal pores forming rows extend along outer lateral surface close to the occlusal margin and along inner lateral surface close to the upper margin.

Discussion. The studied specimens show a suite of characters pointing to their generic identity. The propodus has a convex upper margin, its lower margin is rimmed, fingers possess large setal pores, the index is robust, relatively long and has a blunt tooth at its occlusal margin, dactylus is massive and its tip is hooked. Although none of these characters alone can be treated as diagnostic, their combination is quite typical for *Corallianassa*. In this respect, the studied material shows striking similarities to *C. longiventris* (see Borradaile, 1904: fig. 2b) and *C. martensi* (see Sakai, 1984: fig. 3B). The presence of

the faint ridge on the dactylus, however, is unusual for the genus. Therefore, we treat the studied material with question mark.

Another possible candidate for the studied material would be *Pestarella* Ngoc-Ho, 2003. This taxon has not such prominent setal pores on the lateral surface of propodus like *Corallianassa*. Finally we point out that, if this studied material represents *Corallianassa*, it would be the first record for this genus in the fossil and extant record from the Mediterranean basin.

Infraorder Anomura MacLeay, 1838
Superfamily Paguroidea Latreille, 1802
Family Diogenidae Ortmann, 1892
Genus *Dardanus* Paul'son, 1875

Type species: *Dardanus hellerii* Paul'son, 1875, by monotypy.

Included fossil species: see Schweitzer *et al.* (2010: 53, 54).

Dardanus arrosor (Herbst, 1796)
Fig. 1B

Material and measurements: 2 right propodi (MSNM i27885 – hpa: 11 mm; li: 4 mm; lpa: 16 mm; MSNM i27887 – hpa: 9 mm; li: 3 mm; lpa: 14 mm).

Description: Palm longer than high, with upper and lower margin almost parallel; palm covered with sinuous transverse crests, dentate anteriorly; triangular index, relatively long, with dentate transverse crests; occlusal margin with some weak teeth.

Discussion. The studied propodi show the typical morphological characters of the extant *Dardanus arrosor* (Herbst, 1796), widespread along the Atlantic coastlines (Portugal and Africa) and in the Mediterranean area where this species lives at a depth of 20–50 m. Ristori (1891b) reported some incomplete dactyli from the Pliocene sands of Monte Mario (Rome) (now assigned to the Early Pleistocene by Cosentino *et al.*, 2009) ascribed to *Pagurus striatus* (Latreille, 1803), juvenile synonym of *Dardanus arrosor* (Herbst, 1796).

Dardanus substriatus (A. Milne Edwards, 1861)
Fig. 1C

Material and measurements: 3 left propodi (MSNM i27886 – hpa: 11 mm; ld: 7 mm; li: 3 mm; lpa: 11 mm; MSNM i27888 – hpa: 7 mm; ld: 5 mm; li: 2 mm; lpa: 7 mm; MSNM i27889 – ld: 5 mm; li: 2 mm).

Description: Palm as long as high, with upper and lower margins converging anteriorly; palm covered with sinuous transverse crests, dentate anteriorly; short subtriangular index, very wide at the base and covered with dentate crests; occlusal margin weakly dentate; subtriangular dactylus longer than index.

Discussion. The studied propodi differ from those of *Dardanus arrosor* in having a shorter palm with upper and lower margins converging anteriorly and more numerous and raised crests, interlaced with each other like “scale

fish”. Based upon these characters the studied propodi are assigned to *D. substriatus*, reported from the Pliocene of Piedmont (Sismonda, 1846; A. Milne Edwards *in* Sismonda, 1861), Tuscany (Ristori, 1886; De Angeli *et al.*, 2009), and from the Early Pliocene (now Early Pleistocene, see Baldanza *et al.*, 2014) of Umbria (Pasini & Garassino, 2010).

Genus *Paguristes* Dana, 1851

Type species: *Paguristes hirtus* Dana, 1853, by subsequent designation of Stimpson (1859).

Included fossil species: see Schweitzer *et al.* (2010: 54).

Paguristes cf. *P. syrtensis* de Saint Laurent 1970
Fig. 1D

Material and measurements: One incomplete dorsal shield (MSNM i27901).

Description: Sub-ovoid shield longer than broad, with anterior lateral margins sloping, sub-parallel, slightly convex medially; posterior region not preserved; pointed post antennal projection, concave ocular incision bordered by a marked elevate rim; rostrum partially preserved, with parallel carinate margins; narrow anterior region slightly inflated centrally; anterior lateral region with sparse irregular pits more coarse anteriorly; subelliptical central part of the shield marked by transverse striae and pits, divided by a smooth and short medial gastric groove; medial section of central part of the shield nearly flat; cervical groove partially preserved on the left side of the posterolateral region, *linea transversalis* not preserved.

Discussion. The general morphology of the shield is characteristic of Paguridae. Indeed, many morphological affinities with the extant *Paguristes syrtensis* de Saint Laurent 1970, widespread in the Mediterranean area, in having the same carapace shape, ridged supraorbital margins, and an elongate nostrum restricted axially (Falciai & Minervini, 1992). *Paguristes eremita* (Linnaeus, 1767), also present in the Mediterranean area, has shorter rostrum. This is the first record for the species from the Pleistocene of southern Italy and from the Mediterranean basin.

Family Paguridae Latreille, 1802
Genus *Anapagurus* Henderson, 1886

Type species: *Pagurus laevis* Bell, 1846, by subsequent designation of Holthuis (1962).

Included fossil species: see Schweitzer *et al.* (2010: 55); Pasini & Garassino (2011: 59).

Anapagurus sp.
Fig. 1E

Material and measurements: 3 left propodi, lacking dactyli (MSNM i27890 – hpa: 9 mm; li: 5 mm; lpa: 7 mm; MSNM i27891 – hpa: 5 mm; li: 2 mm; lpa: 4 mm; MSNM i27892 – hpa: 4 mm; li: 1 mm; lpa: 2 mm).

Description: Propodus with convex transverse section and granulate outer surfaces; palm with oblique carpo-propodus articulation; palm with convex lower margin and short straight dorsal margin; stout triangular index with transverse occlusal margin bearing a rim of small short tubercles.

Discussion. The studied propodi show the typical characters of Paguridae Latreille, 1802 and mainly of *Anapagurus* Henderson, 1886. Moreover, the studied specimens show some morphological affinities with the extant *A. hyndmanni* (Bell, 1846).

The fossil record of *Anapagurus* from Italy and Mediterranean basin is very scarce to date and limited to a single specimen of *Anapagurus* sp, from the Pleistocene of Arda River (Emilia Romagna, northern Italy) (Garassino & De Angeli, 2004a), and to *A. mamertinus* Pasini & Garassino, 2011, from the Pliocene of Capo Milazzo (Sicily) (Pasini & Garassino, 2011).

Infraorder Brachyura Latreille, 1802
Section Podotremata Guinot, 1977
Subsection Raninoidia De Haan, 1839
Superfamily Raninoidea De Haan, 1839
Family Raninidae De Haan, 1839
Subfamily Notopodinae Serène & Umali, 1972
Genus *Ranilia* H. Milne Edwards, 1837

Type species: *Ranilia muricata* H. Milne Edwards, 1837, by monotypy.

Included fossil species: see Schweitzer *et al.* (2010: 73).

Ranilia constricta (A. Milne Edwards, 1880)

Material and measurements: Two carapaces nearly complete (MSNM i27877 – lcxp: 18 mm; wcxp: 12 mm; MSNM i27878 – lcxp: 20 mm; wcxp: 15 mm); two loose palms, one dactylus, and one merus (MSNM i27915).

Description: Sub-oval carapace, strongly convex in transverse section, almost straight in midline; slightly raised front with prominent pointed spines; maximum width of the carapace between the prominent elongate lateral spines; lateral margins convergent posteriorly towards the short and gently convex posterior margin; stout chelipeds with tubercles and ciliate lines; elongate, pointed dactylus downward directed distally; palms longer than high with a ventral distal distinct spine; merus granulate dorsally, smooth ventrally with sparse pits; blunt distal dorsal spine.

Discussion. Garassino & De Angeli (2008) reported *Ranilia constricta* from the Late Pleistocene of Bovetto district (Reggio Calabria), with an additional updated emended diagnosis of the species, whereas Vazzana (2008) reported the same species from Trumbacà district, strictly close to Bovetto. The studied specimens show the main morphological characters of *Ranilia constricta* to which they are assigned. Recent *R. constricta* is widespread from Western to Central and Western Atlantic.

Subfamily Ranininae De Haan, 1839
Genus *Ranina* Lamarck, 1801

Type species: *Cancer raninus* Linnaeus, 1758, by subsequent designation of Latreille (1810).

Included fossil species: see Schweitzer *et al.* (2010: 74).

Ranina propinqua Ristori, 1891
Fig. 1F

Material and measurements: One incomplete carapace (MSNM i27876 – lcxp: 47 mm).

Description: Carapace convex dorsally, covered by subtriangular granular tubercles, uniformly arranged along the antero- and posterolateral margins, more scarce on gastric regions; anterolateral spines incomplete.

Discussion. Pasini, Garassino & De Angeli *in* Baldanza *et al.* (2014: 274) discussed the specimens of *Ranina* known to date in the fossil record of Italy, re-describing the main characters of *Ranina propinqua*. The studied specimen preserves just the left side of the carapace, including the pre-orbital and the incomplete extraorbital spines, showing the main characters of *Ranina* Lamarck, 1801. Moreover, the above-mentioned characters of the studied specimen are typical of *R. propinqua*, to which it is assigned. *Ranina propinqua* was previously described from Pliocene sandy deposits of Via della Madonna degli Angeli in Città della Pieve (Perugia, Umbria, central Italy) by Ristori (1891a) [these deposits are now referred to the Gelasian-Calabrian interval (Early Pleistocene) see Baldanza *et al.*, 2014)]; and recently from the Early Pleistocene of Fabro Scalo (Terni, Umbria, central Italy) by Baldanza *et al.* (2014) and from the Early Pleistocene of Orzalume Cottano area (Orvieto, Umbria, central Italy) (Famiani *et al.*, in press). The discovery of *R. propinqua* from Trumbacà, attests the presence of *Ranina* in the southern Mediterranean area still during the Tyrrhenian (Late Pleistocene).

Section Eubrachyura de Saint Laurent, 1980
Subsection Heterotremata Guinot, 1977
Superfamily Leucosioidea Samouelle, 1819
Family Leucosiididae Samouelle, 1819
Subfamily Ebalinae Stimpson, 1871
Genus *Ebalia* Leach, 1817

Type species: *Ebalia bryerii* Leach, 1817, by subsequent designation of Rathbun (1922).

Included fossil species: see Schweitzer *et al.* (2010: 87).

Ebalia cf. *E. deshayesi* Lucas, 1846
Fig. 2A

Material and measurements: One complete carapace (MSNM i27902 – lcxp: 4 mm; wcxp: 7 mm).

Description: Octagonal carapace, slightly wider than long, convex dorsally and with small tubercles on gastric and branchial regions; wide developed bugle on the cardiac region; lateral and posterolateral margins slightly concave.

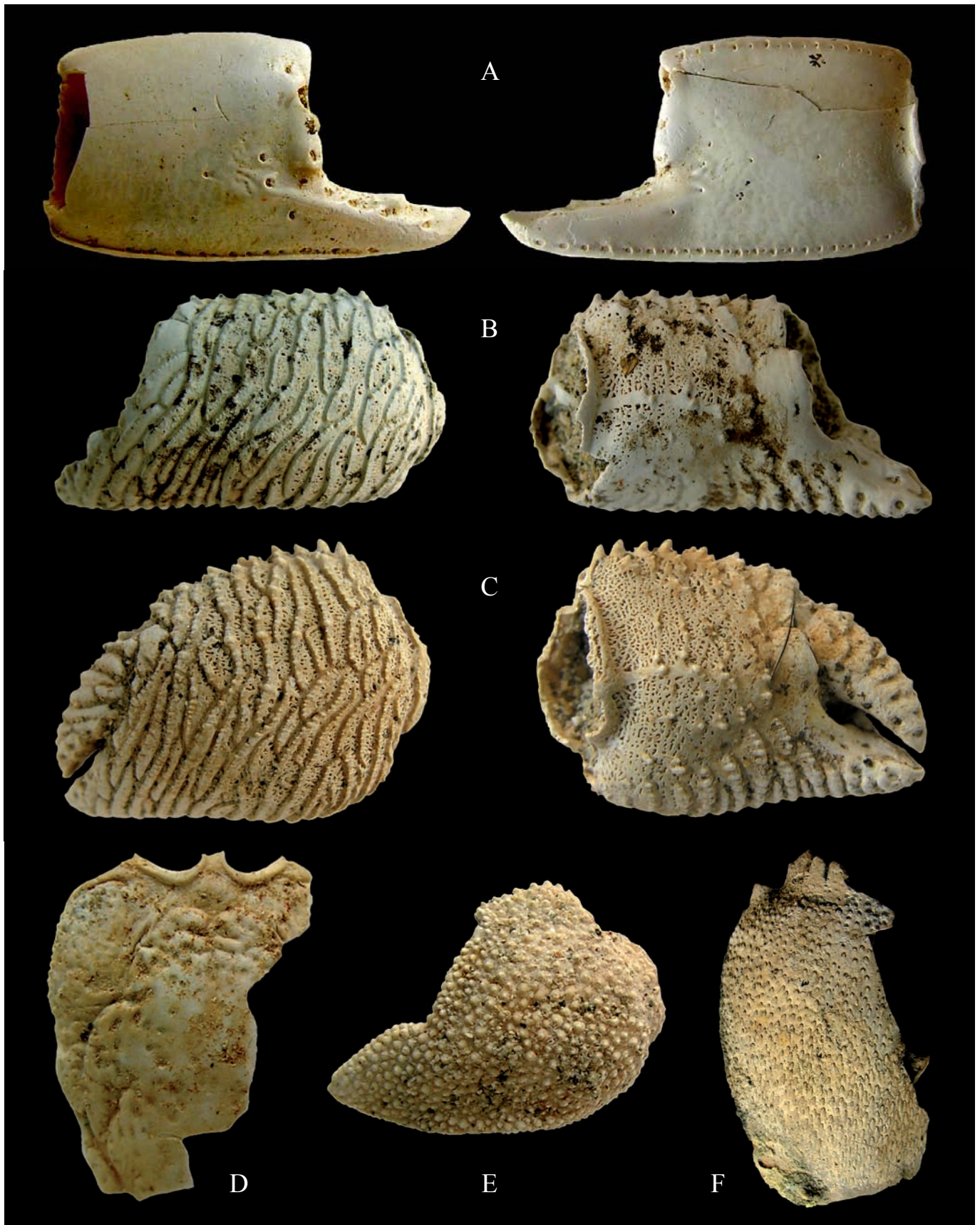


Fig. 1 - A) *?Corallianassa* sp., MSNM i27900, right chela, outer and inner views (x 6.1). B) *Dardanus arrosor* (Herbst, 1796), MSNM i27885, right chela, outer and inner views (x 3.7). C) *Dardanus substriatus* (A. Milne Edwards, 1861), MSNM i27886, left chela, outer and inner views (x 3.8). D) *Paguristes* cf. *P. syrtensis* de Saint Laurent 1970, MSNM i27901, dorsal shield (x 6). E) *Anapagurus* sp., MSNM i27890, left chela, outer view (x 4.6). F) *Ranina propinqua* Ristori, 1891, MSNM i27876, incomplete carapace in dorsal view (x 1.3).

Discussion. As pointed out by De Angeli *et al.* (2009: 178), “the high degree of sexual dimorphism among adults, the remarkable morphological differences between adults and juvenile stages, and the extremely variable morphology of carapace in the same species, makes the right classification of the species ascribed to this genus difficult”. The studied specimen, however, shows morphological affinities with extant *Ebalia deshayesi* Lucas, 1846, in having an octagonal carapace, slightly wider than long, with small tubercles on gastric and branchial regions, wide developed bugle on the cardiac region, and having lateral and posterolateral margins slightly concave. Based upon these main characters, the studied specimen is tentatively assigned to *Ebalia* cf. *E. deshayesi* Lucas, 1846.

This fossil species was previously reported by De Angeli *et al.* (2009), from the Early Pliocene of Poggio alla Staffa, Siena (Tuscany, central Italy). Therefore, it represents the first record from the Pleistocene of southern Italy and from the Mediterranean basin. Extant *E. deshayesi* is widespread in Eastern Atlantic (Balearic Islands) and Mediterranean Sea, living in sandy and muddy bottoms (Zariquiey Álvarez, 1968).

Genus *Ilia* Leach, 1817

Type species: *Cancer nucleus* Linnaeus, 1758, by monotypy.

Included fossil species: see Schweitzer *et al.* (2010: 87, 88).

Ilia nucleus (Linnaeus, 1758)
Fig. 2B

Material and measurements: One complete carapace (MSNM i27903 – lcxp: 10 mm; wcxp: 7 mm).

Discussion. Zariquiey Álvarez (1968) pointed out the main diagnostic characters of *Ilia nucleus*, as follows: typical globular carapace, slightly longer than wide; very narrow subacutely bidentate front; posterior margin with well-developed, rounded two median lobes, and one strong spine upward-directed on either lateral margins. We ascribe the studied specimens to the extant *I. nucleus*, because it shares the same above-mentioned morphological characters. A review of the morphological characters of this species carried on by Garassino and Pasini (2012), pointed out that all the specimens previously reported from the Pliocene of Italy and erroneously ascribed to *I. pliocaenica* Ristori, 1891, should be instead ascribed to *I. nucleus* (for discussion see Garassino *et al.*, 2010a, 2012, 27-30; Garassino & Pasini, 2012, 43-46). Moreover *I. nucleus*, was recently reported from the Early Pleistocene (Emilian) of Pomezia (Roma, Lazio, central Italy) (Garassino *et al.*, 2010a; Garassino & Pasini, 2012), and from the Zanclean (Early Pliocene) of “La Serra” quarry (Pisa, Tuscany, central Italy) by Garassino *et al.* (2012). Extant *I. nucleus* is widespread in the Mediterranean Sea, living imbedded in sandy bottoms from 5 to 160 meters deep.

Note. The studied specimen shows direct evidence of a predation consisting of an ovoid submillimetric drilled

hole into the dorsal gastric region. This kind of holes (ichnotaxon *Oichnos ovalis*) has been attributed to possibly octopods with some figured examples (Klompemaker *et al.*, 2013: 606, 605, fig. 3). Similar boreholes of comparable size and form, were previously reported also from the fossil decapod leucosiid *Ristoria pliocaenica* (Ristori, 1891) from the Early Pliocene of the “La Serra” quarry by Pasini & Garassino (2012: 263, 261, Fig. 3 A, B). This report expands the scarce record on fossil decapod crab predation found in the worldwide Cenozoic (for discussion see Klompemaker *et al.*, 2013).

Superfamily Dorippoidea MacLeay, 1838

Family Dorippidae MacLeay, 1838

Genus *Medorippe* Manning & Holthuis, 1981

Type species: *Cancer lanatus* Linnaeus, 1767, by original designation.

Included fossil species: see Schweitzer *et al.* (2010: 79).

Medorippe lanata (Linnaeus, 1767)
Fig. 2C

Material and measurements: One carapace, including pleon (MSNM i27884 – lcxp: 21 mm; wcxp: 27 mm).

Description: Flat subhexagonal carapace, wider than long, with deep groves and distinct tubercles; lateral margins converging anteriorly, larger posteriorly; short front; long anterolateral margins with a strong branchial spine; two tubercles present behind the triangular frontal teeth; anterolateral and outer orbital pointed teeth; regions well marked dorsally; smooth hepatic, branchial, and supraorbital regions separated by deep groves; sinuous posterior margin, with s1-s3 exposed dorsally.

Discussion. The main characters of the carapace and pleon allow to ascribe the studied specimen to a male individual of *Medorippe lanata*. Gemmellaro (1914) reported some specimens from the Sicilian (Late Pleistocene) of Sicily (southern Italy), housed in Marquis of Monterosato’s private collection (repository and catalogue number unknown), probably today lost (De Angeli & Garassino, 2006a). This is the second fossil record for the species in the Mediterranean area. Extant *M. lanata* is widespread in the Eastern Atlantic, Mediterranean Sea and South-West Africa coasts (Holthuis & Manning, 1990). *Medorippe lanata* specially inhabits muddy and muddy-sandy bottoms, ranging from a few metres to 75 meters deep in the Mediterranean area (Falciai & Minervini, 1992).

Superfamily Calappoidea De Haan, 1833

Family Calappidae De Haan, 1833

Genus *Calappa* Weber, 1795

Type species: *Cancer granulatus* Linnaeus, 1758, by subsequent designation of Latreille (1810).

Included fossil species: see Schweitzer *et al.* (2010: 82, 83).

Calappa granulata (Linnaeus, 1758)
Fig. 2D, E

Material and measurements: Two carapaces (MSNM i27906 – lcxp: 11 mm; wcxp: 15 mm; i27907 – incomplete); two right and one left complete propodus (MSNM

i27893 – hpa: 22 mm; ld: 13 mm; li: 8 mm; lpa: 16 mm; MSNM i27894 – hpa: 18 mm; ld: 12 mm; li: 5 mm; lpa: 14 mm; MSNM i27895 – hpa: 16 mm; ld: 10 mm; li: 5 mm; lpa: 12 mm); four right dactyli (MSNM i27896 – ld: 23 mm; MSNM i27897 – ld: 21 mm; MSNM i27898 – ld: 10 mm; MSNM i27899 – ld: 8 mm).

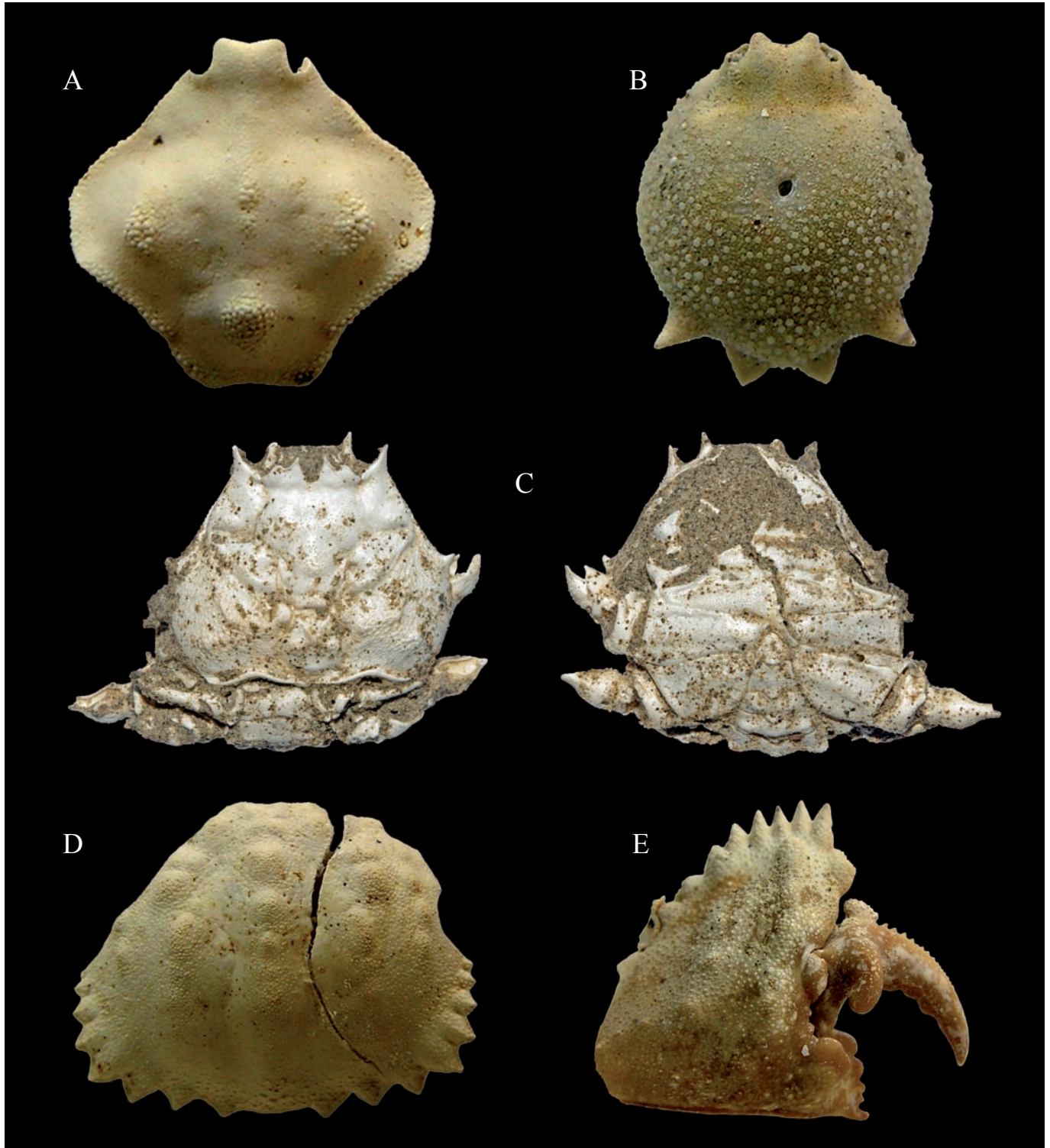


Fig. 2 - A) *Ebalia* cf. *E. deshayesi* Lucas, 1846, MSNM i27902, carapace in dorsal view (x 12). B) *Illia nucleus* (Linnaeus, 1758), MSNM i27903, carapace in dorsal view (x 6). C) *Medorippe lanata* (Linnaeus, 1767), MSNM i27884, carapace in dorsal and ventral views (x 2). D) *Calappa granulata* (Linnaeus, 1758), MSNM i27906, incomplete carapace in dorsal view (x 4.6). E) *Calappa granulata* (Linnaeus, 1758), MSNM i27893, right chela, outer view (x 2.5).

Description: Postero-lateral margins of the granulate carapace strongly convergent with triangular teeth; regions well marked by two longitudinal grooves dividing the dorsal surface of carapace in three parts bearing blunt lined tubercles; subtriangular propodus, higher anteriorly; upper margin with a rim of pointed triangular spines; lower margin with a longitudinal row of small granulations; outer margin of propodus with some granulations; short triangular index curved downward distally; robust long pointed dactylus strongly curved, directed-downward distally with granulations along the upper margin and a typical strong prominence on the basis of the outer margin.

Discussion. The studied specimens have the typical morphological characters of the representatives of Calappidae and they have been assigned to the fossil *Calappa granulata*. This species was previously reported from the Pliocene of Tuscany, Piedmont, Emilia Romagna and Sicily; from the Pleistocene of Monte Pellegrino (Sicily); from the Early Pleistocene of Poggio i Sodi (Siena, Tuscany), and Fabro Scalo (Terni, Umbria) (Ristori, 1891a; Gemmellaro, 1914; Garassino & De Angeli, 2004a; Garassino *et al.*, 2004; De Angeli *et al.*, 2009; Pasini & Garassino, 2012; Baldanza *et al.*, 2013; 2014; Garassino & Pasini, 2013; Pasini & Garassino, 2013). Extant *C. granulata* is widespread in the Mediterranean Sea, living usually in sandy, muddy and detrital bottoms from 30 to 150 meters deep.

Family Epialtidae MacLeay, 1838
Subfamily Pisinae Dana, 1851
Genus *Pisa* Leach, 1814

Type species: *Cancer biaculeatus* Montagu, 1813, by monotypy.

Included fossil species: see Schweitzer *et al.* (2010: 93).

Pisa armata (Latreille, 1803)
Fig. 3A

Material and measurements: One right propodus with carpus lacking dactylus (MSNM i27880 – hpa: 11 mm; li: 6 mm; lpa: 12 mm); one left propodus lacking dactylus and carpus (MSNM i27881 – hpa: 9 mm; li: 5 mm; lpa: 10 mm); one incomplete left propodus (MSNM i27882 – li: 5 mm).

Description: Propodus with smooth rectangular palm, longer than high, with rounded dorsal and lower margins, slightly inflated medially, compressed at the insertion with the dactylus; typical index with lower margin strongly curved downward-directed proximally, then forward-directed and spooned at the tip; a rim of small teeth is present along the outer margin; trigonal short carpus with stout rounded tubercles.

Discussion. Even though incomplete, we ascribe confidently to this species three propodi for the above-mentioned characters, sharing with the propodus of the

extant *Pisa armata*. This species was already reported in the fossil record of Italy from the Early Pliocene of “La Serra” quarry (Pisa, Tuscany, central Italy) (Garassino *et al.*, 2012), and from the Late Pleistocene of Monte Pellegrino (Palermo, Sicily, southern Italy) (Gemmellaro, 1914). In the Mediterranean Sea, *P. armata* occupies usually rocky hard grounds or mud-sandy rich in weeds, ranging from 1 to 500 meter deep, but commonly between 50-160 meter deep (Falciai & Minervini, 1992).

Superfamily Parthenopoidea MacLeay, 1838
Family Parthenopidae MacLeay, 1838
Subfamily Parthenopinae MacLeay, 1838
Genus *Derilambrus* Tan & Ng, 2007

Type species: *Parthenope angulifrons* Latreille, 1825, by original designation.

Included fossil species: *Derilambrus angulifrons* (Latreille, 1825).

Derilambrus cf. *D. angulifrons* (Latreille, 1825)

Material and measurements: Two small incomplete ?meri (MSNM i27905).

Description: Elongate ?meri, trigonal in transverse section, and strong spines arrayed in longitudinal rows along the margins.

Discussion. The studied small specimens show elongate ?meri, trigonal in transverse section, and strong spines arrayed in longitudinal rows along the margins, typical characters of the representatives of the family Parthenopidae and especially of *Derilambrus* Tan & Ng, 2007. The specimens could be tentatively ascribed to juvenile individuals of *Derilambrus* cf. *D. angulifrons*, previously reported in the fossil record of Italy from the Sicilian (Early Pleistocene) of Favignana Island (Sicily, southern Italy) by Garassino & De Angeli (2004b), and from the Zanclean (Early Pliocene) of “La Serra” quarry (Pisa, Tuscany, central Italy), by Garassino *et al.* (2012). Moreover we point out that the very similar, small chelipeds described by Ristori (1891b) from the Pliocene (now Pleistocene) of Monte Mario (Rome, central Italy), and by Garassino & De Angeli (2004a) from the Pliocene and Pleistocene of Emilia Romagna (northern Italy), ascribed respectively to *Lambrus?* sp. and to *Parthenope* sp., could be also assigned to *D. angulifrons*. The extant species lives at depths between 2 and 80 meter deep in the Mediterranean Sea and southwestern Spain, inhabiting on mud-sandy bottoms or along submarine seamounts and knolls in deeper waters.

Superfamily Cancroidea Latreille, 1802
Family Atelecyclidae Ortmann, 1893
Genus *Atelecyclus* Leach, 1814

Type species: *Cancer (Hippa) septemdentatus* Montagu, 1813, by monotypy.

Included fossil species: see Schweitzer *et al.* (2010: 100).

Atelecyclus undecimdentatus (Herbst, 1783)
Fig. 3B

Material and measurements: One right cheliped, lacking dactylus (MSNM i27879 – hpa: 11 mm; li: 6 mm; lpa: 14 mm).

Discussion. The studied specimen shows close affinities with the cheliped of the fossil and extant *Atelecyclus undecimdentatus* (Herbst, 1783), as described and figured by Garassino *et al.* (2012: 38; fig.18 B), having palm of cheliped slightly convex, trapezoidal in outline, spinate dorsally, with three distinct longitudinal tuberculate rims and index downward-directed. Based upon these peculiar characters, we ascribe the specimen to *A. undecimdentatus*. This species was previously reported by Garassino *et al.* (2012) from the Zanclean (Early Pliocene) of “La Serra” quarry (Pisa, Tuscany, central Italy). Extant *A. undecimdentatus* lives in the eastern Atlantic and, less commonly, in Mediterranean Sea from 1 m to 60 m deep on sandy or gravel bottoms.

Superfamily Portunoidea Rafinesque, 1815
Family Portunidae Rafinesque, 1815
Subfamily Carcininae MacLeay, 1833
Genus *Carcinus* Leach, 1814

Type species: *Cancer means* Linnaeus, 1758, by monotypy.

Included fossil species: any fossil species known to date.

Carcinus sp.

Material and measurements: Two loose dactyli (MSNM i28013 – ld: 14 mm; MSNM i28014 – ld: 12 mm).

Discussion. We ascribe tentatively two complete dactyli partially washed to this genus. Dactyli are strong, elongate, curved with pointed tips, bearing a rim of short teeth on the occlusal margin. This kind of dactylus is present in *Carcinus* Leach, 1814, widespread in the Mediterranean Sea and Atlantic Ocean. The studied specimens show affinities with the dactyli previously reported by Garassino & De Angeli (2004a: 44, fig. 8) from the Pliocene of Campore (Parma, Emilia Romagna, N Italy), also referred to *Carcinus* s.l.

Superfamily Pilumnoidea Samouelle, 1819
Family Pilumnidae Samouelle, 1819
Subfamily Pilumninae Samouelle, 1819
Genus *Pilumnus* Leach, 1815

Type species: *Cancer hirtellus* Linnaeus, 1761, by monotypy.

Included fossil species: see Schweitzer *et al.* (2010: 120).

Pilumnus hirtellus (Linnaeus, 1761)
Fig. 3C, D

Material and measurements: One complete carapace (MSNM i27904 – lcp: 6 mm; wcp: 8 mm) and three right chelipeds (MSNM i27912, i27913 – hpa: 7 mm; ld: 5 mm; li: 3 mm; lpa: 9 mm; MSNM i27914 – ld: 7 mm; li: 5 mm).

Description: Subcircular carapace, wider than long, with anterolateral margins with four spines (excluding postorbital spine); smooth dorsal surface of the carapace with many pits.

Discussion. The above-mentioned characters are shared with the extant *Pilumnus hirtellus* (Linnaeus, 1761), having anterolateral margins with four spines (excluding postorbital spine) and near smooth dorsal surface with many pits. This species was previously reported by Garassino *et al.* (2012), from the Zanclean (Early Pliocene) of the “La Serra” quarry (Pisa, Tuscany, central Italy). This is the first record of this species from the Pleistocene in Italy and in the southern Mediterranean basin. The extant *P. hirtellus* lives in northeastern Atlantic, Mediterranean and Black Sea.

Family Xanthidae MacLeay, 1838
Subfamily Xanthinae MacLeay, 1838
Genus *Xantho* Leach, 1804

Type species: *Cancer incisus* Leach, 1804, by monotypy.

Included fossil species: see Schweitzer *et al.* (2010: 128).

Xantho cf. *X. incisus* (Leach, 1814)
Fig. 3E

Material and measurements: One left cheliped (MSNM i27908 – hpa: 5 mm; ld: 5 mm; li: 4 mm; lpa: 8 mm) and two right chelipeds (MSNM i27909 – hpa: 4 mm; ld: 3 mm; li: 2 mm; lpa: 6 mm; MSNM i27911 – hpa: 6 mm; ld: 4 mm; li: 3 mm; lpa: 8 mm).

Discussion. The studied chelipeds show general morphological characters similar to Xanthidae MacLeay, 1839. Moreover, the dorsal palm and merus ornamentation with coarse rugae and deep pits, closely resembles chelipeds of *Xantho incisus* (Leach, 1814). Beside the small sized and short dactylus are also typical characters of the female individuals. Based upon these observations, we ascribe tentatively both the specimens to female individuals of *Xantho* cf. *X. incisus*. This is the first report for the species from the Mediterranean fossil record.

The extant species lives in Mediterranean Sea on rocky environments, ranging from the subtidal level down to depths of about 100 meters (Zariquiey Álvarez, 1968).

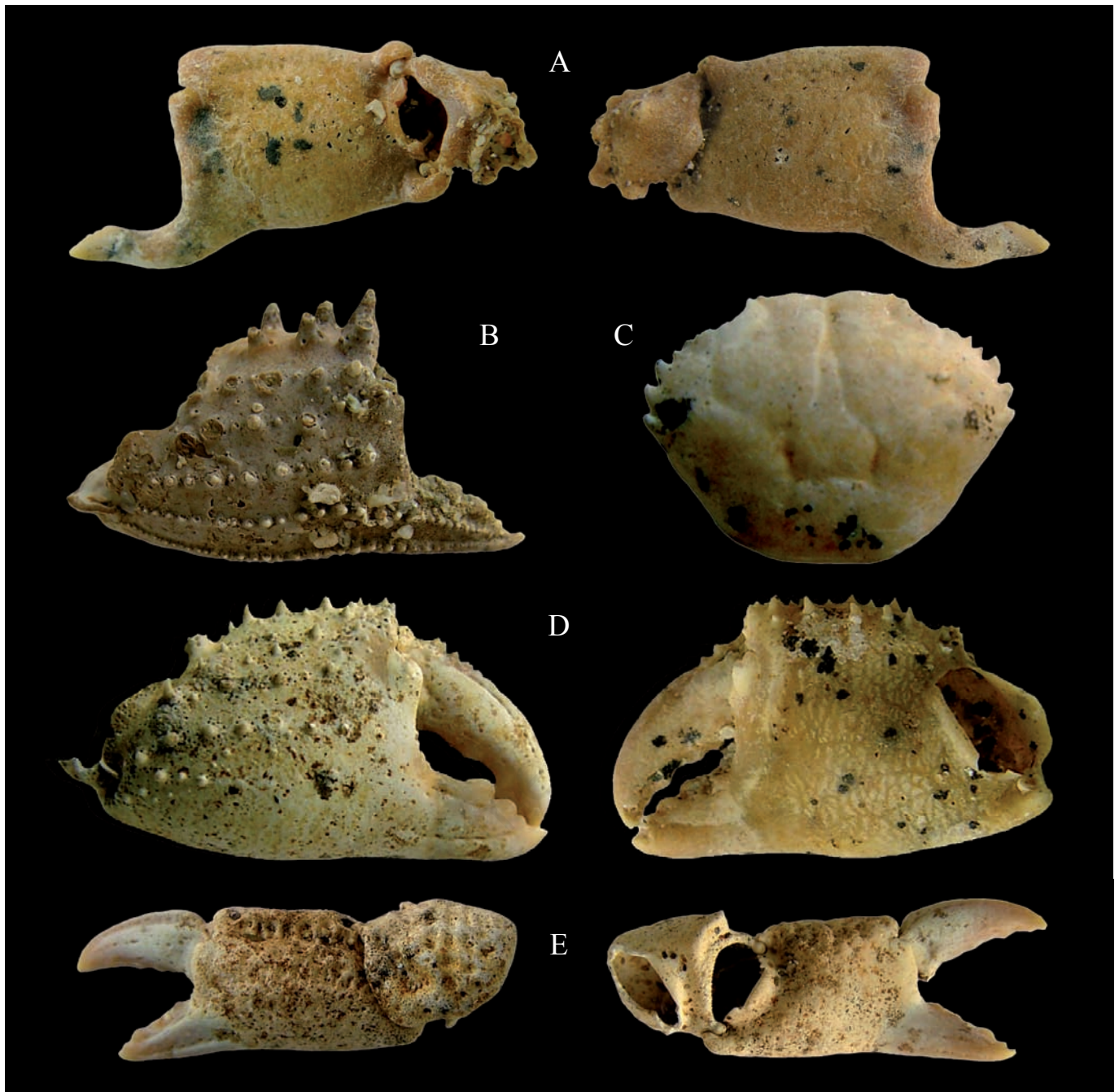


Fig. 3 - A) *Pisa armata* (Latreille, 1803), MSNM i27880, right chela, outer and inner views (x 3.2). B) *Atelecyclus undecimdentatus* (Herbst, 1783), MSNM i27879, right chela, outer view (x 3.7). C) *Pilumnus hirtellus* (Linnaeus, 1761), MSNM i27904, carapace in dorsal view (x 8.5). D) *Pilumnus hirtellus* (Linnaeus, 1761), MSNM i27912, right chela, outer and inner views (x 7.5). E) *Xantho* cf. *X. incisus* (Leach, 1814), MSNM i27908, left chela, outer and inner views (x 4.6).

REMARKS ON THE DECAPOD ASSEMBLAGE

The studied decapod assemblage, even though incomplete, shows the modernity of the extant Mediterranean fauna since the Tyrrhenian (Late Pleistocene), with the presence of species actually living along the Italian coasts of the Mediterranean Sea. Among the studied species, *Paguristes* cf. *P. syrtensis* and *Xantho* cf. *X. incisus* are reported for the first time in the Mediterranean fossil record, whereas two species belonging to Raninidae, the extant-fossil *Ranilia constricta* (actually living in Western, Central and Eastern Atlantic) and the fossil

Ranina propinqua are extinct in the Mediterranean basin, most probably due the selective climatic-environmental changes that occurred during the Holocene. Similarly, *Corallianassa* also does not inhabit the Mediterranean Sea today. Unfortunately, many others specimens collected from Trumbacà, belonging to different taxa, are too badly or poorly preserved, not allowing a systematic attribution. We hope future discoveries of well-preserved specimens will allow further knowledge of this very rich assemblage at the origin of the extant living Mediterranean decapod fauna.

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