

Critical review of fossil record of *Ranina* Lamarck, 1801 (Decapoda, Brachyura, Raninidae), with description of *Tethyranina* n. gen.

Giovanni Pasini¹, Alessandro Garassino^{2*}

Abstract - Pasini & Garassino (2017a) revised the fossil record referred to *Ranina* Lamarck, 1801 by Karasawa *et al.* (2014). As result only four species were considered as possible valid species within *Ranina*: *R. palmea* E. Sismonda, 1846, *R. pellattieroi* De Angeli & Beschin, 2011, *R. propinqua* Ristori, 1891, and *R. ranina* (Linnaeus, 1758). These species are herein revised and discussed, based on updated observations and critical review of the fossil materials and on a re-definition of the main diagnostic proxy characters *sensu* Schweitzer (2003) of the type species *R. ranina* (Linnaeus, 1758). This review allows us to establish that *R. ranina* from the middle Pleistocene of Ryukyu Islands (Japan) and *R. palmea* from the middle Miocene of Italy have consistent proxy characters with the extant *Ranina* to be considered as valid species within the genus. Moreover, *Tethyranina* n. gen., with *T. propinqua* (Ristori, 1891) n. comb., is herein proposed to accommodate this questionable fossil species previously assigned to *Ranina*. Finally *R. pellattieroi* De Angeli & Beschin, 2011, lacking the typical characters of *Ranina*, is considered as a doubtful species within Ranininae.

Key words: Raninidae, Ranininae, *Ranina ranina*, systematics, proxy characters.

Riassunto - Revisione critica delle specie fossili di *Ranina* Lamarck, 1801 (Decapoda, Brachyura, Raninidae), con la descrizione di *Tethyranina* n. gen.

Pasini e Garassino (2017a) hanno revisionato le specie fossili attribuite a *Ranina* Lamarck, 1801 da Karasawa *et al.* (2014). Il risultato è stato quello di considerare come possibili specie valide riferibili a *Ranina* solo *R. palmea* E. Sismonda, 1846, *R. pellattieroi* De Angeli & Beschin, 2011, *R. propinqua* Ristori, 1891 e *R. ranina* (Linnaeus, 1758). Queste specie sono oggetto di discussione in questa studio sulla base di nuove osservazioni e di una nuova re-definizione dei principali caratteri diagnostici esterni ("proxy characters" *sensu* Schweitzer, 2003) della specie tipo *R. ranina* (Linnaeus, 1758). Lo studio ha permesso di stabilire che *R. ranina* del Pleistocene medio delle Ryukyu Islands (Giappone) e *R. palmea* E. Sismonda, 1846 del Miocene medio italiano, presentano consistenti caratteri esterni tipici di *Ranina* Lamarck, 1801,

e sono quindi considerate come specie valide all'interno del genere. Inoltre si propone *Tethyranina* n. gen., con *T. propinqua* (Ristori, 1891) n. comb., specie precedentemente attribuita a *Ranina*. Infine, *R. pellattieroi* De Angeli & Beschin, 2011, non presentando i caratteri tipici di *Ranina* è considerata specie *dubia* nella sottofamiglia Ranininae.

Parole chiave: Raninidae, Ranininae, *Ranina ranina*, sistematica, caratteri diagnostici esterni.

INTRODUCTION

Recently Pasini & Garassino (2017a) gave a preliminary review of the 23 fossil species previously referred to *Ranina* by Karasawa *et al.* (2014). As result, three species were assigned to *Lophoranina* Fabiani, 1910, one species to *Calappa* Weber, 1795, one was considered a doubtful species within Decapoda, four specimens were considered as *Ranina nomina dubia*, and twelve were considered doubtful species within the genus. Later, Pasini & Garassino (2017b) revised two species, previously assigned to *Ranina*, assigned them to *Alcespina* Pasini & Garassino, 2017. Based upon these reviews, only four species were considered as possible valid species within *Ranina*, as follows: *R. palmea* E. Sismonda, 1846, *R. pellattieroi* De Angeli & Beschin, 2011, *R. propinqua* Ristori, 1891, and *R. ranina* (Linnaeus, 1758).

These species are herein discussed, based on updated observations, critical review of fossil species, and re-definition of the main diagnostic proxy characters *sensu* Schweitzer (2003) of the type species, *Ranina ranina* (Linnaeus, 1758), also supported by the direct observation of a large sample of different sized taxidermy-preserved specimens of both sex from the Pacific area (Pasini pers. obs., 2015-2017) and the most recent observations on the extant specimens of the type species by Luque (pers. comm., 2017).

EXTERNAL MORPHOLOGIC CHARACTERS (PROXY CHARACTERS) OF *RANINA*

The fossil specimens tentatively assigned to *Ranina* Lamarck, 1801, are still very scarce (Pasini & Garassino, 2017a), including mostly incomplete or badly preserved specimens, with the ambulatory legs and pleonal parts that are often scarcely preserved, and therefore, not useful in morphological comparisons. Moreover the absence of

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a clear definition for the diagnostic external morphologic characters [proxy characters *sensu* Schweitzer (2003)] of the type species (*Ranina ranina*) has resulted not clearly defined characters for fossil specimens (Guinot pers. comm., 2014; Luque pers. comm., 2016). The most recent diagnosis for *Ranina* was proposed by Karasawa *et al.* (2014: 45), based on the extant *R. ranina*, reporting the anterolateral spines as "... *bifid or trifid*". This assumption, however, results unclear as checked by direct observations on the shape of anterolateral spines in many extant specimens in which both spines result to be trifid (Pasini pers. obs., 2015-2017), as confirmed also by Nyborg (pers. comm., 2016). According to Luque (pers. comm., 2017), "*There might be some intraspecific variability in extant R. ranina, and occasionally a specimen can display a trifid spine in one side, but bifid in the other side. This seems to be an exception to the 'trifid' rule, but I would confidently say that, at least as for extant R. ranina goes, both anterolateral spines in mature males and females are consistently trifid*".

Moreover, Matondo Dulce-Amor & Demayo (2015: 253) gave a description of the external morphological characters, describing the orbito-frontal and latero-anterior margin of the extant *R. ranina* from Philippines as having a "*trifid fronto-lateral lobe (= first anterolateral spine)*" and "*anterolateral (margin) has a trifid lobe... (= second anterolateral spine)*", beside "... *however, in smaller, younger individuals, carapace variation is inconspicuous*", and "*this observation agreed with that of Uchida*", based on the extant *R. ranina* from the Hawaiian Islands area by Uchida (1986). Recently Emmerson (2016: 258) also clearly described the extant *R. ranina* from the western Indian Ocean as having "...; *two trifid processes on the anterolateral corner of carapace, ...*", supporting our observations on the anterolateral spine shape in *R. ranina*.

The trifid anterolateral spines is an important character that once combined with the triangular rostrum, the direction of the anterolateral spines, the shape of the postorbital spine, and the dorsal ornamentation, represents a mix of peculiar distinctive proxy characters almost distinguishing *Ranina* from the other species of the genus.

In this study we tentatively follow a selected combination of these diagnostic proxy characters based (in part) on the more recent diagnosis for the genus by Karasawa *et al.* (2014), pointing out that, both anterolateral spines in extant *Ranina* are trifid (not "*bifid and trifid*" as reported by Karasawa *et al.*, 2014: 54), adding substantial morphological observations on the shape of the postorbital spine and arrangement of each of the anterolateral spines (see following discussion in this paper).

Abbreviations

lcp: carapace length; MCZ: Museo civico "G. Zanato", Montecchio Maggiore, Vicenza (Italy); MFM: Mizunami Fossil Museum, Mizunami (Japan); MPUR: Museo Geologico Università "La Sapienza", Roma (Italy); MSNM: Museo di Storia Naturale di Milano, Milano (Italy); MUSNAF: Museo di Storia Naturale dell'Accademia dei Fisiocritici, Siena (Italy); s1-s6: pleonal somites 1 to 6; wcxp: carapace width.

SYSTEMATIC PALAEONTOLOGY

Infraorder Brachyura Latreille, 1802
Section Raninoidea Ah Yong, Lai, Sharkey, Colgan & Ng, 2007

Superfamily Raninoidea De Haan, 1839

Family Raninidae De Haan, 1839

Subfamily Ranininae De Haan, 1839

Included genera

Alcespina Pasini & Garassino, 2017; *Lophoranina* Fabiani, 1910; *Ranina* Lamarck, 1801; *Raninella* A. Milne Edwards, 1862; *Remyranina* Schweitzer & Feldmann, 2010; *Tethyranina* n. gen. (this study); *Vegaranina* Van Bakel *et al.* 2012.

Genus *Ranina* Lamarck, 1801 (Fig. 1)

Ranina Lamarck, 1801: 156.

Hela von Münster, 1840: 24.

Palaeonotopus Brocchi, 1877: 6.

Ranina - De Haan 1839: 137. – Poore 2004: 322. – Karasawa *et al.* 2014: 45.

Diagnosis by Karasawa *et al.* (2014): Carapace generally widest in anterior one quarter, narrowing posteriorly; rostrum trifid, with axial two spines serving as inner orbital spines, central spine triangular; intra- and outer orbital spines triangular; anterolateral margin generally with two spines that are bifid or trifid, often larger and more complexly ornamented in males; postfrontal region depressed slightly below level of remainder of carapace, can be granular or scabrous; remainder of carapace ornamented with forward directed spines; appendages and pterygostome ornamented with less densely-spaced spines; sternum smooth.

Remarks: The diagnosis of *Ranina* is based on the characters of the extant type species *R. ranina*.

The systematics adopted in this study follows partially the recent diagnosis for the genus proposed by Karasawa *et al.* (2014: 45), but pointing out that the first and second anterolateral spines are trifid in both sexes, also in juvenile stages, and never bifid as previously reported by some authors (Sakai, 1937; Poore, 2004; Karasawa *et al.* 2014). Moreover, we add herein some others useful proxy generic characters to the diagnosis by Karasawa *et al.* (2014), as follows:

- the postorbital spine shape, divided distally into two spines, is forked (= bifid), with the outer spine shorter than the inner; however, as pointed out by Luque (pers. comm., 2017) "*some small specimens seem to have not just bifid but multi-spinose outer orbital/postorbital spines; this clearly seems to change during ontogeny, and those additional small spines become obsolete and disappear*".

- the first anterolateral spine, slightly inclined outward and the second anterolateral spine more inclined at about a 45-degree angle to the carapace longitudinal median axis, never strongly forward or outward directed; however, as pointed out by Luque (pers. comm., 2017) "*this seems to change quite a bit among populations* (of extant *R. ra-*

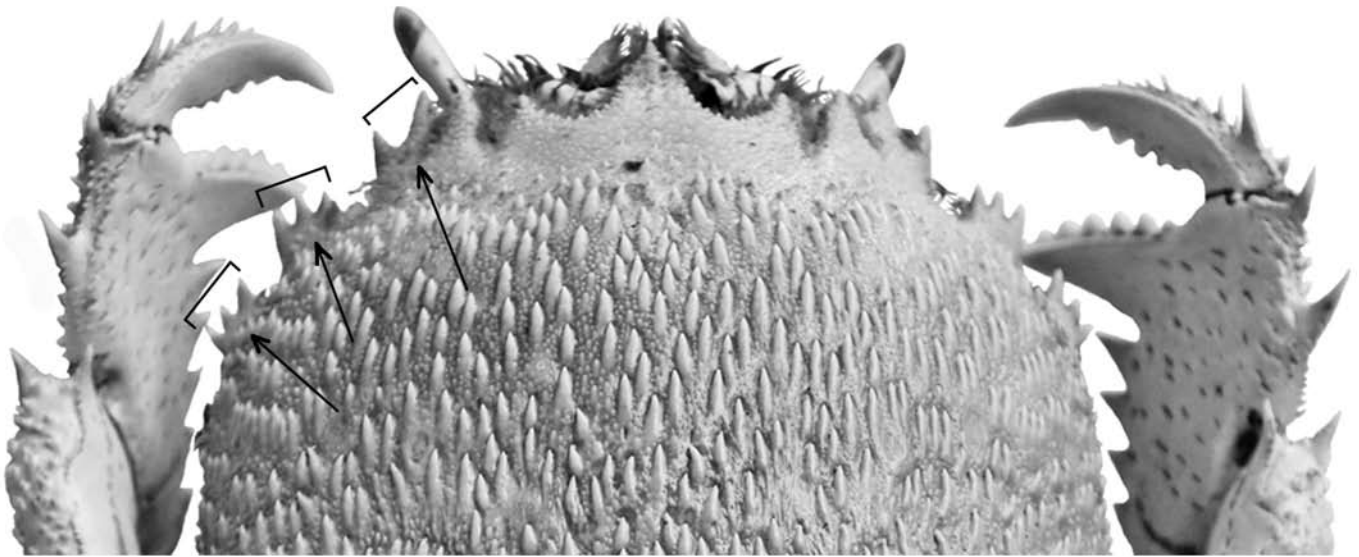


Fig. 1 - *Ranina ranina* (Linnaeus, 1758), MSNM Cr 2442, extant adult female, Western Indo-Pacific Ocean. Orbitofrontal outline with the main diagnostic proxy characters.

nina); some tend to have closely spaced spines directed forwards, whereas others have a wider spaced spines and inclined at more pronounced angles”. We were unable, however, to consider in the fossil record these variations due to the scarcity of specimens.

The combination of these unambiguous additional morphological characters are also adopted in this study to distinguish *Ranina* from others fossil genera within Ranininae.

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

Stratigraphic range: middle Miocene – middle Pleistocene and extant.

Including fossil species: *Ranina palmea* E. Sismonda, 1846; *R. ranina* (Linnaeus, 1758).

Paleogeographic distribution: Mediterranean area (exclusively fossil) - Indo-Pacific area (fossil and extant).

Emended diagnosis (present study): Carapace sub-void, wider anteriorly; dorsal ornamentation, with sparse granular-spiny tubercles directed forward, never ranging into tegulate rims; triangular rostrum; postorbital spine bifid, forked, with the outer spine shorter than the inner in adult extant species [small specimens (immature-juveniles) seem to have not just bifid but multi-spinose outer orbital-postorbital spines, whereas in some large sized specimens the secondary spine can be much developed than the outer-postorbital spine (Luque pers. comm., 2017)]; first and second anterolateral spines always trifid, often larger and more complexly ornamented in males; first one slightly inclined outward with the second diverging usually at but not more than a 45-degree angle to the carapace longitudinal median axis, more complexly ornamented and developed in adult males. Large, flat chelae with transverse dactylus; dactylus bearing 7 spines on the upper margin and pointed tip downward directed; propodus flat, lined with tubercles; propodus with 2 prominent dorsal spines and 5 prominent spines on the lower margin; elongate carpus with 2 parallel spine on the anterior upper margin pointing outward in opposite direction; merus with

a single spine on the upper anterior margin. Appendages and pterygostome ornamented with less densely-spaced spines; sternum shield smooth, s1-s3 fused, s4 broad at the anterior margin, convex and lateral margin concave; s5 with shallow longitudinal depression.

***Ranina palmea* E. Sismonda, 1846 (Fig. 2)**

Ranina palmea E. Sismonda, 1846: 64, Pl. 3, figs. 3, 4.

Ranina palmea – Reuss 1859: 21. – Crema 1895: 672, Pl. 3, figs. 12a-e. – A. Milne Edwards 1872: 4, 9. – Fabiani 1910: 9. – Glaessner 1929: 362. – De Angeli *et al.* 2009: 120, 121. – De Angeli & Beschin 2011: 13, 15. – Van Bakel *et al.* 2012: 209. – Karasawa *et al.* 2014: 260.

Hela palmea - Lörenthey in Lörenthey & Beurlen 1929: 109.

Diagnosis: Sismonda (1846) only provided a limited morphological description and comparisons (in Italian language).

Type material: Reale Museo Geologico di Torino, today lost (Ormezzano pers. comm., 2014).

Type locality: Torino Hill sandstone (Piedmont, north-western Italy).

Geological age: Neogene (middle Miocene, “Helvetian” – now Serravallian).

Examined material: Line drawings proposed by Sismonda (1846: Pl. 3, figs. 3, 4) and later by Crema (1895: Pl. 3, figs. 12a-e).

Description: We provide herein a literal translation of the original description by the author, wrote in old Italian language and never previously translated, to facilitate comparisons and discussion of this lost species.

Literal translation: “... *The specimen consists of a big sized crustacean, having maximum transversal diameter of 0,077 (meters), longitudinal of 0,083 (meters), ab-*

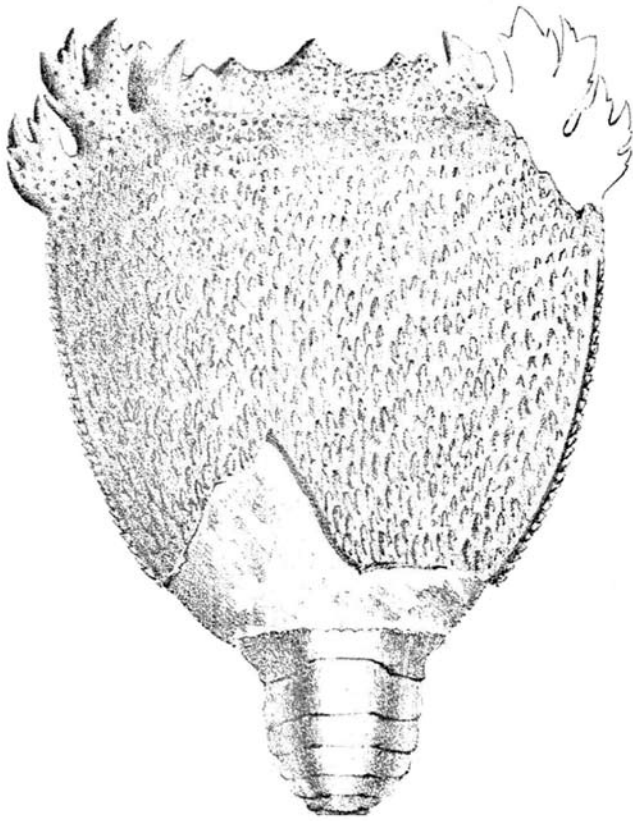


Fig. 2 - *Ranina palmea* E. Sismonda, 1846, original line drawing by the author (Sismonda, 1846: Pl. 3, fig. 3).

domen excluded. (The carapace) has a triangular shield leaning to an ovate shape, convex dorsally and with thousands of small tubercles or spines fairly elongated, flattened, forward directed, bigger toward the abdomen, worsen to thinner tubercles on the frontal region. Upper, or frontal margin concave, divided in nine lobes, of which the outermost are separated each other by deep furrows. The central lobe is scarcely projected, originating a triangular rostrum, strengthen at each side by a fairly acute tooth; this tooth is shorter than the others (teeth), giving the front concave, a distinctive character of the male individuals, as observed by Milne-Edwards (instead) the female front is arcuate and convex; and anymore, in added to the sexual differences, according to De Haan, that the upper margin of the palms of the *Ranina* males are armed by obtuse spines, while the spines are acute in females. The lobes nearby the median (*mytoyens internes*) end in a single tooth; the following (lobes) (*mytoyens externes*) are wide, flattened, and ending with two teeth, each splitting in other ones smaller; a detail not well represented in the drawing (= Pl. 3, fig. 3); finally the more external frontal lobes, the last and second last, are the more developed, flattened, wide, ending in three points or triangular teeth, they also bears smaller pointed spines here and there along the margins of the main tips of the anterolateral spines, and this is the main difference among the described specimen and the *Ranina Dentata* by Latreille [= *R. ranina* (Linnaeus, 1758)]. Lateral margins convex, shaw-like rimmed, abdomen narrow, trian-

gular, elongate, slightly down-turned, with seven dorsally carinate rings, having convex anterior margin, concave posteriorly. The sternum and maxilliped are covered by an hardened sandstone... . Walking legs poorly preserved. The left distal thoracic cheliped (fig. 4) is the only more or less preserved, limited to the carpus and manus that is very flattened, both are covered by rather high and protruded small tubercles; the upper margins bears two large spines, moreover the lower margin of the fixed finger has five teeth, the dactylus, flattened, curved also bears some teeth along the margins. Fossil in the Miocene sandstone from the Torino hill. ”

Discussion. Since the type material is lost, the discussion is simply based on the original description by Sismonda (1846) and observations on the line drawings proposed by Sismonda (1846: Pl. 3, figs. 3, 4) and later by Crema (1895: Pl. 3, figs. 12a-e).

Crema (1895: 672) added some observations to the description by Sismonda (1846), and proposed a re-drawing of the species under direct observation: “(I) Refigure the right chela (fig. 12c) and propose a schematic representation of the anterior lateral side (fig. 12a) of the specimen, due that the original figures reported to date contains several inaccuracy” (literal translation). Moreover the author reported “(I) examined also several carapace fragments and the dorsal shield of a young specimen...”. The fossil site of the additional material is not clearly specified in the description by Crema, but the author reported at the end of his notes “*Elveziano: Colli Torinesi, Sciolze. Bardassano [Elvezian (Serravalian); Torino Hills, Sciolze. Bardassano – Piedmont. northwestern Italy]*”, that is not the type locality of the Sismonda’s specimen. Crema (1895: 672, 673) pointed out that the dorsal ornamentation “... specially in the anterior and median parts shows other smaller tubercles among the spiny tubercles, less marked than in the living species (= *R. ranina*)...”; that “the abdomen is very different from the ideal reconstruction proposed by Sismonda, shows the first five segments well preserved, but lacks of the telson; is perfectly close to this of *R. serrata* (= *R. ranina*)” (Pl. 3, fig. 12b); and moreover that “... the left chela is about 1/3 bigger than the right... (Pl. 3, fig. 12c), and that “The parts observables of the walking legs are close to the of the *R. serrata*” (Pl. 3, fig. 12e).

Ranina palmea shows all the typical proxy characters of the genus, such as: carapace subovate, convex dorsally, ornate by forward pointed spines or tubercles forward directed, smaller on the frontal region; rostrum triangular with two nearly acute spines at the wide bottom; anterolateral spines flattened and wide, trifid, the first one wider; the second one more inclined at a less than a 45-degree angle to the carapace longitudinal median axis, and in having same shape and ornamentation on the flattened spiny chela and elongate carpus; serrate anterolateral margin, convex; long serrate posterolateral margin, narrowing posteriorly, posterior margin straight; elongate, triangular pleon, smooth, with somites dorsally inflated longitudinally, convex anteriorly and nearly concave posteriorly; flattened, tuberculate chela with two wide dorsal spines forward directed; curved dactylus, flattened, with dentate dorsal margin; flattened fixed finger, occlusal margin with five rounded teeth.

Moreover, based upon the body size (lcp: 83 mm; wcxp: 77 mm) and presence of well-developed anterolateral spines, according to Sismonda (1846), the specimens might belong to an adult (mature) male, in the hypothesis that also the fossil mature representatives of *Ranina* had a notable sexual difference in the shape of the anterolateral spines, as in the extant type species.

An hypothesis for the female and male growth-reproductive patterns (= adult stages) of the extant *R. ranina* is given for instance by the model proposed by Minagawa (1993: 2029, fig. 8), and also inferable to the different stages of growth of carapaces figured by Sakai (1937: 179, text-fig. 45), whereas according to Nyborg (pers. comm., 2016), the juvenile stage drawing proposed by Sakai (1937) is incorrect at level of the anterolateral spine (figured as bifid and trifid), whereas both are always trifid.

According to Sismonda (1846: 65) and Crema (1895: 672), the specimen has a general carapace shape and dorsal ornamentation close to those of the adult males of extant *R. ranina*. Indeed, Sismonda (1846: 65), pointed out that the “major difference among the fossil described (= *Ranina palmea*) and the *R. dentata* by Latreille [= *R. ranina* (Linnaeus, 1758)]”, consist in the presence on “...the more external lobes of the front, the last and second one are the more developed, flattened, wide, ending in three points or triangular teeth, then also bearing smaller poin-

ted spines here and there along the margins of the main tips of the anterolateral spines ...”.

The relative shortness of the frontal spines, the shorter wider triangular rostrum, the more serrate, spiny postorbital bifid spine, and the presence of accessorial sparse spines along both anterolateral spines are characters that can justify the specific assignment to *R. palmea*.

In conclusion we can consider *R. palmea* as a valid species within *Ranina*, representing the oldest fossil species known for the genus. The presence of *Ranina* in the paleo-Mediterranean almost since the middle Miocene is very intriguing, opening a new look to the possible origins for the genus, joined to some paleo-geographic problematics.

***Ranina ranina* (Linnaeus, 1758) (Fig. 3A, B)**

Cancer raninus Linnaeus, 1758: 625 (as *Cancer raninus*), subsequent designation by Latreille (1810).

Ranina ranina – Oshiro & Sakida 1980, Pl. 2, fig. 9. – Karasawa 1997: 39, Pl. 7, fig. 1. – Karasawa 2000: 173, Tab. 1, Pl. 2, fig. 9. – Schweitzer *et al.* 2010: 74. – De Angeli & Beschin 2011: 13. – Van Bakel *et al.* 2012: 209. – Karasawa *et al.* 2014: 260. – Pasini & Garassino 2015: 51. – Famiani *et al.* 2015: 344 (synonymies just for the fossil species).

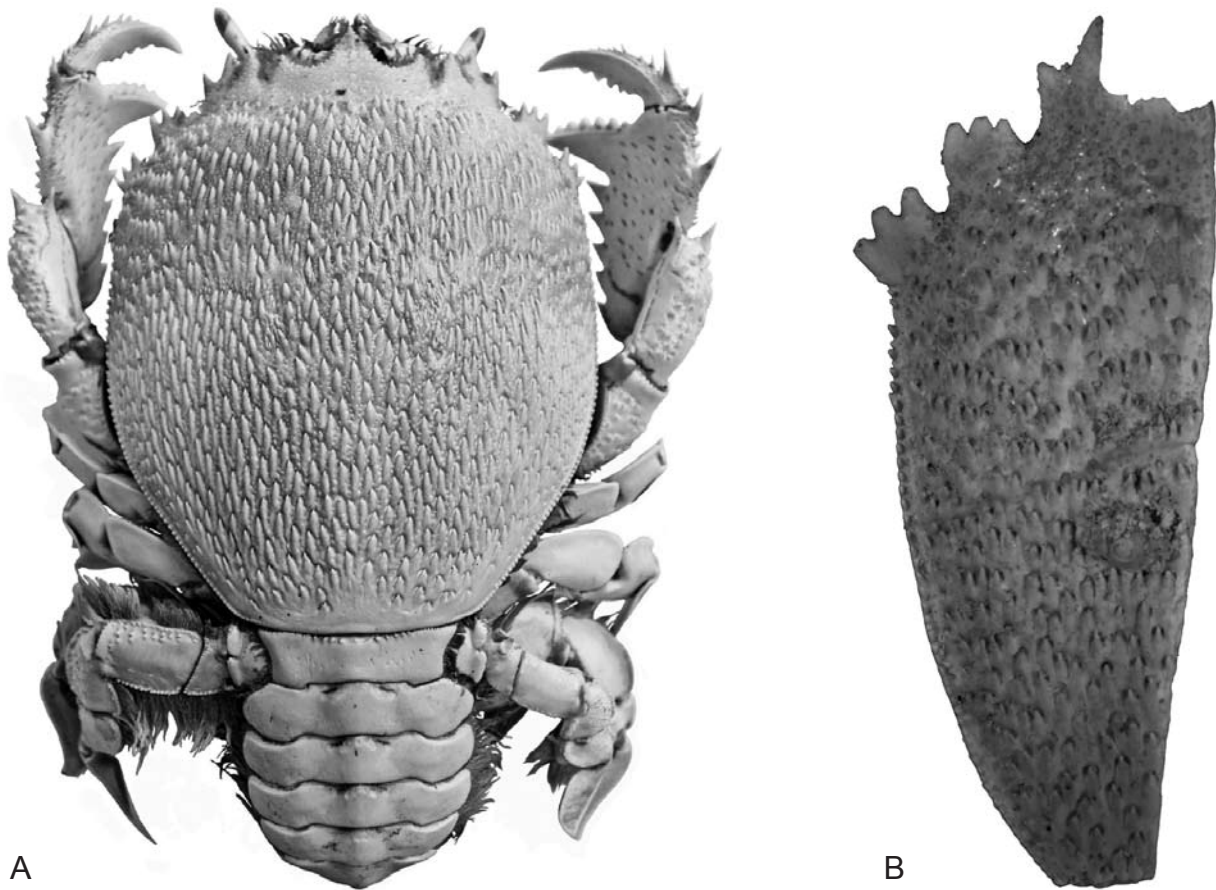


Fig. 3 - A) *Ranina ranina* (Linnaeus, 1758), MSNM Cr 2442, extant adult female, Western Indo-Pacific Ocean. (x 0.8). B) *Ranina ranina* (Linnaeus, 1758), WN-1, MFM 142326; Ryukyu Islands, Japan (x 2.5).

Diagnosis: as for the genus.

Locality: Ryukyu Group of Okinawa-jima (Ryukyu Islands, Japan).

Geological age: Naha Formation (middle Pleistocene) – Recent.

Examined material: One specimen (WN-1, MFM 142326), original picture.

Description: Carapace incomplete, broken longitudinally, with serrate margins; widest at anterior one-quarter, narrowing posteriorly; rostrum not preserved; intra- and outer orbital spines pointed, triangular; postorbital spine divided into two spines (= bifid), with the inner spine longer; anterolateral margin with two trifid spines forward directed, the second one more inclined at about 45-degree angle to the carapace longitudinal median axis; post-frontal region slightly depressed (as preserved) below level of remainder of carapace scabrous; remainder of carapace ornamented with forward directed inclined sparse spines, sometime aligned in groups of 4-6 on the central part of the carapace.

Discussion. Oshiro & Sakida (1980) reported *R. ranina* from the Pleistocene of the Ryukyu Islands (Japan) (Pl. 2, fig. 9 in Karasawa, 2000) the only fossil report for the extant species. Though incomplete, the specimen shows the main characters of the carapace of the type species *R. ranina* in having: a carapace widest at the anterior one-quarter, narrowing posteriorly; a bifid postorbital spine; an anterolateral margin with both two spines that are trifid and forward directed, the second one more inclined at about a 45-degree angle to the carapace longitudinal median axis; a post-frontal region depressed slightly below level of remainder of carapace, with sparse nodes; and the remainder of carapace ornamentation not uniform, with sparse forward directed inclined spines.

Genus *Tethyranina* nov.

Diagnosis: Carapace ovate, tapering posteriorly; wide fronto-orbital margin convex; dorsal surface with triangular tubercles-spines randomly arranged; pointed triangular rostrum; triangular orbital spine; subtriangular supraorbital spine flattened, forward directed with slightly undulate, convex outer lateral margin, followed by two wide, flat anterolateral spines slightly projected; first anterolateral spine bifid, slightly oblique to the middle longitudinal axis; second anterolateral spine trifid, outward directed, forming an angle about 45-degrees to the carapace middle line.

Type species: *Tethyranina propinqua* (Ristori, 1891) n. comb.

Fossil species: *T. propinqua* (Ristori, 1891) n. comb.

Etymology: Alluding to the palaeogeographic distribution (Tethys Ocean) and the closer raninid genus, *Ranina*.

Geological range: early Miocene – early Pleistocene.

Palaeogeographic distribution: The genus appears to be, from the current knowledge of the fossil record, restricted to the paleo-Mediterranean area.

Discussion. We justify the description of the new genus in having a unique combination of substantial dis-

tingtive characters within the Ranininae, such as the triangular rostrum, postorbital spine subtriangular flattened, forward directed, with slightly undulate, convex outer lateral margin; first anterolateral spine bifid, and second anterolateral spine trifid, outward directed, forming an angle about 45-degrees to the carapace middle line. The chelipeds are poorly known, as reported by Pasini, Garassino & De Angeli in Baldanza *et al.* (2014: 274), but appear similar in ornamentation and shape to those of *R. ranina*.

Tethyranina n. gen differs from the others Ranininae genera as follows:

- *Alcespina* Pasini & Garassino, 2017, has trifid pointed rostrum; first anterolateral spine bifid, forward directed, parallel to the middle longitudinal axis; second wide anterolateral spine pointed, flat, nearly straight anterior margin, strongly outward projected, forming an angle more than 75° (usually about 90°) to carapace middle line, with triangular unequal serrate spines (3-4) on the anterior edge.

- *Lophoranina* Fabiani, 1910, has typical carapace surface with typical transverse terraces, usually parallel to one another, two bifid anterolateral spines, broad sternum with C-shaped concave lateral margins.

- *Lophoraninella* Glaessner, 1936, has carapace with short scabrous ornamentation in anterior third, serrate transverse rimmed ornamentation on remainder carapace.

- *Ranina* Lamarck, 1801, has sub-ovate convex carapace with wider surface covered by densely spaced inclined nodes; a single triangular rostrum tip; smaller orbital spines, postorbital spine bifid, forked with inner spine shorter than the inner; two anterolateral palmate trifid spines, first slightly anterolaterally directed, the second diverging at about a 45-degree angle to the carapace longitudinal median axis.

- *Raninella* A. Milne Edwards, 1862, has carapace widest about half the distance posteriorly, carapace surface covered by densely spaced inclined nodes, anterolateral margin generally with two flattened spines triangular or more narrow, sternum lanceolate distally, narrow anteriorly and wider at level of the last posterior sternites.

- *Remyranina* Schweitzer & Feldmann, 2010, has expanded, moderately broad antero-lateral margin, ovoid carapace slightly larger than wide, and carapace ornamentation granular on anterior half and strongly terraced in posterior half widest about half the distance posteriorly on carapace, anterolateral margins appearing to have two projections, carapace ornamentation granular in anterior half and strongly terraced in posterior half.

- *Vegaranina* Van Bakel, Guinot, Artal, Fraaije & Jagt, 2012, has anterolateral margin with three triangular spines, carapace ornamented with developed broadly spaced transverse terraces.

Note. *Tethyranina* n. gen. seems to include fossil taxa only from the paleo-Mediterranean area. Indeed we cannot exclude that some of the European species (too poorly preserved for a certain assignment) and still considered doubtfully *?Ranina* (see Pasini & Garassino, 2017a) could also represent different taxa within this genus (see: *?Ranina brevispina*, *?R. haszliinskyi*, and perhaps *?R. granulata*).

***Tethyranina propinqua* (Ristori, 1891) n. comb. (Fig. 4A, B)**

Ranina propinqua Ristori, 1891: 11-14, Pl. 1, figs. 4-7 (illustrated as mirrored).

Ranina propinqua – Lörenthey 1898: 137. – Fabiani 1910: 9. – Glaessner 1929: 363. – De Angeli & Garassino 2006: 38. – Manni 2006: 108, fig. 38. – De Angeli *et al.* 2009: 120, 121. – Schweitzer *et al.* 2010: 74. – Pasini & Garassino 2010: 116. – De Angeli & Beschin 2011: 13, 15, 17. – Van Bakel *et al.* 2012: 209. – Pasini, Garassino & De Angeli *in* Baldanza *et al.* 2014: 274, 276, fig. 6A-E2. – Garassino *et al.* 2014: 122, fig. 1F. – Karasawa *et al.* 2014: 260. – Famiani *et al.* 2015: 342-344, fig. 4A-D.

Hela propinqua – Lörenthey *in* Lörenthey & Beurlen 1929: 109.

Diagnosis: as for the genus.

Type material: MPUR i.543.

Type locality: Città della Pieve (Perugia, Umbria, central Italy).

Type age: early Pleistocene (Gelasian-Calabrian).

Examined material: Holotype and three additional specimens: MUSNAF 7075, from the early Pleistocene of Fabro Scalo (Terni, Umbria); MSNM i28012, from the early Pleistocene of Orzalume-Cottano (Orvieto, Umbria); MSNM i2787, from late Pleistocene Trumbacà (Reggio Calabria, Calabria).

Description (see Pasini, Garassino & De Angeli *in* Baldanza *et al.*, 2014).

Discussion. Ristori (1891) described *R. propinqua* based on a sole well-preserved female specimen from Città della Pieve (Perugia, Umbria, Italy). Later, Pasini, Garassino & De Angeli *in* Baldanza *et al.* (2014) and Famiani *et al.* (2015) reported additional specimens of this species from Fabro Scalo (Terni, Umbria, Italy) and Orzalume-Cottano (Orvieto, Umbria, Italy), revising this poorly known species. Moreover, Bizzarri & Baldanza (2009) attested that the fossiliferous area reported by Ristori (1891) has to be referred to early Pleistocene (Gelasian-Calabrian). Garassino *et al.* (2014: 122, fig 1F) reported also *R. propinqua* from the late Pleistocene of Trumbacà (Reggio Calabria, southern Italy).

All the specimens reported cannot be assigned to *Ranina* since they lack the distinctive characters for the genus, whereas the combination of the triangular rostrum with anterolateral spines respectively bifid and trifid are typical of *Tethyranina* n. gen. to which the specimens are assigned.

Doubtful species assigned to *Ranina***?*Ranina pellattieroi* De Angeli & Beschin, 2011 (Fig. 5)**

Ranina pellattieroi De Angeli & Beschin, 2011: 15-17, fig. 3, Tab. 1.



Fig. 4 - A) *Tethyranina propinqua* (Ristori, 1891) n. comb., Holotype MPUR i.543, dorsal view. B) *Tethyranina propinqua* (Ristori, 1891) n. comb., Paratype MUSNAF 7075. (x 1.5).

Ranina pellattieroi – Karasawa *et al.* 2014: 260. – Pasini, Garassino & De Angeli in Baldanza *et al.* 2014: 276, fig. 8D. – Famiani *et al.* 2015: 344.

Diagnosis by De Angeli & Beschin (2011): Carapace slightly convex, longer than wide; triangular orbital spine, subtriangular supraorbital spine forward directed with outer slightly undulate, convex lateral margin; anterolateral margin short, with two spines; first anterolateral spine flat, forward directed; second anterolateral spine outward directed, with three needle-like small spines on distal margin; posterolateral margin long and rimmed; weak branchiocardiac groove; frontal area, orbital teeth, and anterolateral teeth with small granulations; hepatic and postfrontal regions with tubercles; median and posterior portion of the carapace with spiny tubercles arranged in small groups.

Type material: MCZ 3392-I.G.336930.

Type locality: Monte Crocetta di Creazzo quarry (Vicenza, N Italy).

Type age: early Miocene.

Examined material: Holotype.

Description: see De Angeli & Beschin (2011).

Discussion. The holotype shows only some generic morphological affinities with *Ranina*, but it cannot be assigned to this genus because in *Ranina* both anterolateral spines are trifold and in *R. pellattieroi* the first anterolateral spine is bifid and second is trifold. The frontal margin is incomplete, lacking the rostrum that is an important diagnostic character in *Ranina*, whereas the combination of

three proxy characters, such as the subtriangular postorbital spine, first anterolateral spine bifid and second one trifold more outward projected, fit in some way those of *Tethyranina* n. gen. However, the shape of the anterolateral spines more elongated and slender and the peculiar ornamentation of the dorsal carapace with “median and posterior part of the carapace with spiny tubercles arranged in small groups” (De Angeli & Beschin, 2011: 15) distinguish *R. pellattieroi* from *Tethyranina* n. gen. In conclusion, *R. pellattieroi* is herein considered a doubtful species within Ranininae.

CONCLUSIONS

This revision allows us to establish that:

- *Ranina ranina* from the middle Pleistocene of western Pacific (Japan) and *R. palmea* from the Miocene of the paleo-Mediterranean Sea, are the only two valid fossil species for *Ranina*. Consequently, no fossil representatives of *Ranina* are reported to date from the Eastern Pacific and Atlantic areas.

- *Tethyranina* n. gen. is herein proposed to accommodate *R. propinqua* from the Mediterranean area, previously assigned to *Ranina*.

- ?*Ranina pellattieroi* De Angeli & Beschin, 2011, lacking the typical characters of *Ranina*, and having incomplete rostrum and peculiar dorsal ornamentation, is herein parsimoniously considered as a doubtful species within Ranininae De Hann, 1839.

- Finally, this review attests that, at our present knowledge, the fossil record of *Ranina* is still too scarce and poorly documented to support possible valid hypotheses in order to clarify the real origin, distribution, and relationships of the genus with the other genera within Ranininae.

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Fig. 5 - ?*Ranina pellattieroi* De Angeli & Beschin, 2011, Holotype MCZ 3392-I.G.336930, dorsal view (x 1.5).

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