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THE FAMILY RANELLIDAE, GRAY, 1854 (=CYMATIIDAE, IREDALE, 1913) IN THE ATLANTIC, ZOOGEOGRAPHICAL CONSIDERATIONS(**)

KEY WORDS: Gastropoda, Ranellidae, Atlantic

Summary

Of the 39 species and subspecies of the Family Ranellidae (= Cymatiidae) which are to found living in the Atlantic, several of them deserve special attention in relation to their taxonomic status and present geographical distribution. Such is the case of *Cymatium pileare* (L.) for which we propose the creation of a new Indo-Pacific subspecies: *C. pileare orientalis* n. ssp. Other species commented on are: *C. aquatile*, *C. turtoni*, *C. corrugatum*, *C. krebsi*, *C. tranquebaricum*, *C. trigonum*, *C. gibbosum*, *C. occidentale*, *C. pharcidum*, *Linatella succincta* and *Sassia lewisi*.

By considering diverse biological and zoogeographical aspects, their relationships with the Ranellidae fauna of the Indo-Pacific are discussed. For those species that present a restricted or anomalous geographical distribution, the very marked climatic changes of the Neogene and Quaternary which greatly affected oceanographic conditions, are considered to represent the fundamental causal factor.

Riassunto

Fra le 39 specie e sottospecie di Ranellidae (= Cymatiidae) viventi in Atlantico, alcune meritano particolare attenzione sia per lo status tassonomico, sia per l'attuale distribuzione geografica. È questo il caso di *Cymatium pileare* (L.) per il quale si propone la nuova sottospecie indopacifica *C. pileare orientalis* n.ssp. Altre specie che vengono qui esaminate sono: *C. aquatile*, *C. turtoni*, *C. corrugatum*, *C. krebsi*, *C. tranquebaricum*, *C. trigonum*, *C. gibbosum*, *C. occidentale*, *C. pharcidum*, *Linatella succincta* e *Sassia lewisi*.

Vengono discussi i rapporti con la fam. Ranellidae dell'Indopacifico, prendendo in considerazione diversi aspetti biologici e zoogeografici. Si ritiene che per quelle specie che mostrano una distribuzione geografica ristretta o anomala, la causa prima sia dovuta alle intense variazioni climatiche avvenute nel Neogene e nel Quaternario, con forte influenza sulle condizioni oceanografiche.

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Introduction

By studying the amphi-atlantic gastropods (GARCIA-TALAVERA, 1981), the family *Ranellidae* attracted our attention as a result of the large number of species that are found living on the two sides of the Atlantic. Analyzing the zoogeographical conditions that this implies, one observes that the principal cause is the prolonged planktotrophic larval state during the reproduction of the species, which allows them to disperse widely (SCHELTENA, 1971) at the same time being favoured by the marine currents (Fig. 1).

A proof of this are those species of *Ranellidae* that are considered cosmopolitan, or, more correctly, pantropical such as: *Cymatium muricinum*, *C. parthenopeum*, *C. nicobaricum*, *C. aquatile*, *Linatella succincta*, ecc. Therefore we can affirm without fear of being mistaken, that the family *Ranellidae* presents the greatest number of species with a wide geographical distribution amongst the prosobranchial gastropods.

This fact also brings up the question of what is the cause of the «anomalous» distribution of certain species. Apart from the already mentioned causes, one can consider the climatic changes that took place during the Quaternary and other earlier Epochs, which markedly affected the oceanographic conditions amongst others, the temperature and the currents, principal factor for dispersion and genetic flow. The problem should be confronted, bearing in mind the «temporal perspective» within the spatial one, without adhering strictly to taxonomic laws that are valid only for current biology. Consequently, we can say that it is possible to find living together in the same geographical province the type species and a subspecies, as in the case of *Cabestana cutacea* (LINNE, 1767) and *Cabestana cutacea dolaria* (LINNE, 1767) in the Canary Islands and West Africa. This is possible as a result of disconnections between populations during certain periods of time within which speciation can occur, then later meeting up again, but now with a certain degree of genetic differentiation, sometimes producing hybridizations or «intermediate forms».

In summary, species of the *Ranellidae* are excellent subjects for zoogeographical studies or for tracking palobiogeographical events. It would appear that in many aspects, eg. feeding and reproduction, the family *Ranellidae* is the most advanced among the Mesogasteropods (LAXTON, 1969). On the other hand, the prolonged planktotrophic stage initially implies a certain degree of primitivism in this aspect, but at the same time it bestows on them a great advantage for dispersal (HOUBRICK & FRETTER, 1969).

The data presented in this work, is the result of many years of research and recompilation of the literature, concentrating primarily on the regions we know better: Macaronesia, West Africa and the Caribbean, although we possess information from virtually the whole Atlantic. Amongst the many diverse taxonomic publications referring to the *Ranellidae* worthy of mention are those of LEWIS (1972), KILIAS (1973) and BEU (1985), whilst with respect to zoogeographical aspects of the atlantic, those of CLENCH and TURNER (1957), SAUNDERS (1980) and KILBURN (1984) stand out.

Amongst the species that deserve special comment figure: *C. aquatile*

(REEVE, 1844) = *C. martinianum* (D'ORB., 1846) which should definitely be treated as a species separate from *C. pileare* with which until recently, it was associated, there existing a large confusion between *pileare*, *martinianum* and *aquatile*, considered synonyms for many authors (CLENCH and TURNER, 1957; KILIAS, 1973; ABBOTT, 1974; etc.). The description given of *martinianum* (D'ORB., 1846) clearly corresponds to *aquatile*: «Cette espèce, bien distincte du Triton pileare par sa bouche jaune rougeatre et non marquée de taches alternes noirs et blanches...». For his part E.A. SMITH (1890) remarks: «The shell in the d'Orbigny collection marked «*T. martinianum*, d'Orb.» is quite a typical *aquatilis*...». Finally, we are convinced that d'Orbigny's *pileare* and *americanum* are really *parthenopeum*.

***Cymatium (Monoplex) pileare orientalis* n. ssp.**

Diagnosis.

The new subspecies differs from the type species in the following characters: the general form of the shell is more elongated, the aperture is longer and narrower, the base of the external lip is thinner and not so curved in *orientalis*. In addition, the plicae on the internal lip project further in the interior of the aperture, the siphonal canal is slightly longer, the red coloration is more intense sometimes even violet and finally, almost always there are wide grey blue bands on the last whorls. As regards size, the larger dimensions are always attained by *orientalis*. (Fig. 2).

Dimensions

Holotype: maximum length of shell	93.4 mm
maximum width of shell	39.4 mm
maximum length of aperture	36.5 mm
maximum width of aperture	19.3 mm

Remarks

What has motivated us to consider *orientalis* as a subspecies are the clear differences expressed above and which moreover, are clearly visible to the naked eye and remain constant in the specimens from the Western Indo-Pacific. However one has to mention that *C. pileare* is a highly variable species. After having examined many individuals from the Atlantic, we have noted a great variability of forms but always maintaining a common pattern that differentiates them from *orientalis*. Due to the fact that LINNE (1758) based his description on a specimen from the Atlantic (mistakenly Mediterranean), we consider that the type species should be that of the Atlantic. At the present time, we believe that there is a genetic disconnection between the Atlantic and Indo-Pacific populations.

BEU (1985) considers that *C. pileare* (L.) is not to be found in the Atlantic, its place being taken by *C. martinianum* (D'ORB.) and *C. aquatile* (REEVE). We ourselves, for reasons already expressed, regard *C. martinianum* as synonymous with *C. aquatile* and, consequently, the type species of *C. pileare* is that which lives in the Atlantic. (Fig. 3)

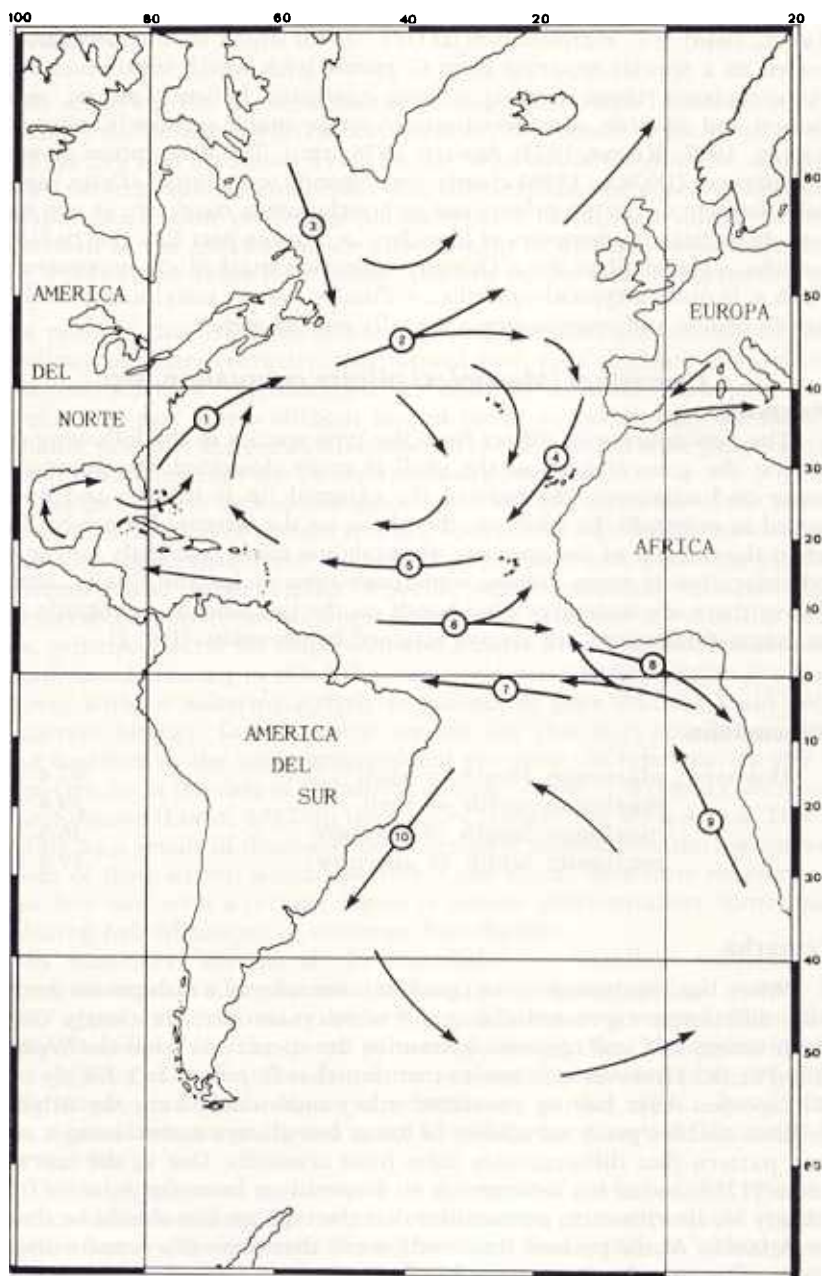


Fig. 1. Main currents systems of the Atlantic.

- | | |
|-------------------------------|--------------------------------|
| 1. - Gulf Stream | 6. - Equatorial Countercurrent |
| 2. - North Atlantic Drift | 7. - South Equatorial Current |
| 3. - Labrador Current | 8. - Guinea Current |
| 4. - Canary Current | 9. - Benguela Current |
| 5. - North Equatorial Current | 10. - Brazil Current |

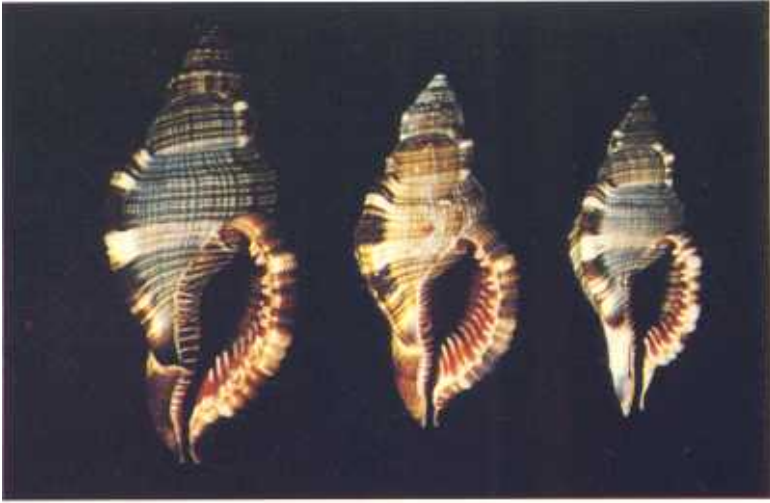


Fig. 2. *C. pileare orientalis*: left (Holotype from Philippines), center (Mozambique), right (Japan).



Fig. 3. From left to right: *C. aquatile* (Canary Is.), *C. pileare pileare* (W. Indies), *C. pileare orientalis* (Japan).

Distribution

Indo-Pacific (several forms). Type locality Mactan, Philippines Is.

Derivatio nominis

We have assigned the name *orientalis* taking note of its geographical distribution with respect to *pileare pileare* of the Atlantic.

The Holotype of *Cymatium pileare orientalis* is deposited in the Natural Science Museum of Tenerife (Canary Islands), catalogued with the N° TF MCM-T24.

The following species deserve special mention in regard to distribution and taxonomic status:

— *Cymatium krebsi* (MÖRCH, 1877) differs clearly from *C. corrugatum* (LAMARCK, 1816) in the general form of the shell, the longer and straighter siphonal canal, the totally white colour of the aperture, the central columellar fold being much more prominent than the rest, etc., sufficient differentiating characters to regard it as a separate species and not as a subspecies of *corrugatum* as certain authors claim, KILIAS (1973) and BEU (1985) among others.

It was cited for the first time in the Eastern Atlantic (Canary Islands) by us (G. TALAVERA, 1981), where it cohabits with *C. corrugatum*.

— *C. tranquebaricum* (LAMARCK, 1816) is a very interesting and variable species that until recently (G. TALAVERA, 1981), was not known from the Western Atlantic, being considered exclusively West African. Within the last few years, several specimens have been dredged in Venezuela by us and by F. Fernández. Various forms of this species exist. The most recent has been described by P. BERNARD (1985) for Gabon. The shell is characterized by its paler colour and the absence of the dark brown spiral bands. Moreover, it inhabits greater depths than the typical species. We feel that this form corresponds to *C. problematicum* DAUTZENBERG and FISCHER, 1906, of the Cape Verde Islands. Another very interesting form exists without varices, more globose, with a finer external lip which is sometimes flared, and white in colour instead of being slightly orange as the typical form. We have not been able to compare the protoconch nor the animal, as all the specimens have been found dead.

We think that it could correspond to a variety which we provisionally assign the name of *linatelloides* for its similar to the species of the genus *Linatella*. REEVE (1844) cites and illustrates this variety, being surprised by the great variability on the species.

— *C. trigonum* (GMELIN, 1791), which appeared to be an exclusively West African species was recorded from Isla de Aves (Venezuela) by GIBSON-SMITH (1971). Recently, we have found it living at 15 meters off the island of Saint Helena thus amplifying its area of distribution to that part of the South Atlantic. In addition, we have discovered it fossilized in Quaternary deposits in the Canary Islands (TALAVERA, KARDAS and RICHARDS, 1978).

— *C. gibbosum kobelti* (VON MALTZAN, 1884) (= *gomezi* NORDSIECK and GARCÍA-TALAVERA, 1979), was described as a new subspecies on the basis of several specimens collected off the island of La Palma (Canary Islands) at a depth of 100 meters. Subsequently, specimens have been found in Senegal, Cape Verde Islands (SAUNDERS, 1980 as *kobelti*) and Gabon (BERNARD, 1985).

Equally, Saunders and Bernard as well as ourselves, noted differences from the type species of the Peruvian region as a result of which, taking into account its actual geographical distribution, we still feel that it refers to a good subspecies. Recently, specimens have been dredged off Venezuela and consequently we can state that it is found in the Western Atlantic (G. TALAVERA, 1982).

— *C. occidentale* (MÖRCH, 1877), until quite recently known as *C. rubeculum occidentale* CLENCH and TURNER, 1957, is a species that pertains to the denominated «rubeculum complex» (ARTHUR, 1983; G. TALAVERA, 1985) that shows certain analogies with the species of the Central Pacific, *beui* TALAVERA, 1985 and *blacketi* IREDALE, 1936, although they should be considered apart. BEU (1985) considered *blacketi* and *beui* synonymous with *occidentale*. In the Eastern Atlantic or more specifically in the Canary Islands, some specimens have been collected recently that show certain differences with respect to the Western population of the Caribbean Province, although bearing in mind the wide «communication» that exists via the ocean current network, a continuous genetic flow is feasible, although of little «success» for the Eastern population. Subsequently, we feel that only one amphiatlantic species is involved.

— *C. turtoni* (E.A. SMITH, 1890) we consider not to be a good species but a form of *parthenopeum* (VON SALIS, 1793). All the specimens that we have examined from Saint Helena are clear by *parthenopeum*. E.A. SMITH (1890) together with the description of *C. turtoni* also cites *Triton olearium* (L.) which, from his description, appears to correspond to *C. parthenopeum* since he states that the *T. americanum* D'ORB., examined by us in the British Museum and identified as *C. parthenopeum*, is *T. olearium*. We have examined specimens from the Gulf of Guinea and Angola which match the description of Smith and which do not cease to be forms of *parthenopeum* with a more elevated spiral, more pronounced suture and more circular aperture.

If we study the problem from a zoogeographical point of view, it does not seem logical that a cosmopolitan species as *C. parthenopeum* is, could give rise to another species on an island which, although possessing endemisms pertaining to families with short or no planktotrophic life, is in the route of the currents of the Southern Atlantic as the presence of other species of the family such as *Charonia variegata* or *C. trigonum* testify.

- *C. pharcidum* (DALL, 1889). This is another of the species that has created a lot of confusion. Commonly it is associated with *tenuiliratum* (LISCHKE, 1873): KILIAS, 1975; NORDSIECK and G. TALAVERA, 1979; BEU, 1985, among others. CLENCH and TURNER (1957) as well as ABBOTT (1974) and ABBOTT and DANCE (1982) regard it as synonymous with *krebsi* MÖRCH, 1877 and as a form of *vespaceum* (LAMARCK, 1822) respectively, whilst G. TALAVERA (1981) and FINLAY & VINK (1982) already cite this species as *pharcidum*. We ourselves, after the examination of numerous specimens from the Western Indo-Pacific and the Atlantic, have reached the conclusion that two different species are involved and that both live together in the Northwest Pacific (Philippines and Japan) whilst only *pharcidum* inhabits the Eastern and Western Atlantic.

- *Linatella succincta* (LINNÉ, 1771). The recent discovery of the presence of this species in waters of the Gulf of Guinea by BERNARD (1981), serves to confirm that are still some surprises left in relation to the geographical distribution of the family *Ranellidae*. At first sight, this species is one of the representatives with a more anomalous distribution. However, when taking into consideration the ecology of the species, one can appreciate that it is not so illogical. *Linatella succincta* inhabits preferably warm waters with coralline bottoms and within the whole Eastern Atlantic, it is only in the Gulf of Guinea where these conditions are met. Nevertheless, what is very striking, is that the species is not found in the Caribbean where ideal conditions exist. Perhaps we are dealing with a case of a recent introduction in the Atlantic and as such, the species has not had sufficient time as yet to reach the other side. It is highly likely that when we have accumulated more knowledge of the biology and ecology of this species, we will be able to find the answer.

- *Sassia lewisi* HARASEWYCH and PETUCH, 1980, represents the only species known to date of the genus *Sassia* inhabiting the Western Atlantic (Caribbean). Fossil species of the Pliocene are known from the Mediterranean (*Sassia apenninica* SASSI, 1827) but it appears that they disappeared from the Quaternary onwards. In the present day, two subspecies of the former species, *Sassia apenninica nassariformis* (G.B. SOWERBY III, 1902) and *apenninica remensa* (IREDALE, 1936) live respectively in South Africa (Indian Ocean) and the Western Pacific. The other species that inhabits the Atlantic is *Sassia philomelae* (WATSON, 1880) from Tristan da Cunha, although its presence in these islands of the Southern Atlantic is more logical since the majority of the *Sassia* live in austral regions. The same is not true with *Sassia lewisi* whose presence in Caribbean appears a little anomalous although it shows a certain relationship with *S. apenninica remensa* (IREDALE, 1936) (= *semitorta* KURODA and HABE, 1952).

LIST OF SPECIES

Family **Ranellidae** GRAY, 1854. (= Cymatiidae IREDALE, 1913).
Subfamily **Ranellinae** GRAY, 1854.

Genus **Argobuccinum** HERMANNSEN, 1846.

Argobuccinum proditor tristanense DELL, 1964 - Tristan de Cunha (S. Atlantic).

A. pustulosum pustulosum (LIGHFOOT, 1786) - S. Africa.

Genus **Fusitriton** COSSMANN, 1903.

Fusitriton magellanicus magellanicus (RÖDING, 1798) - Uruguay, Argentina, Chile.

F. magellanicus murrayi (E. A. SMITH, 1891) - S. Africa.

Genus **Gyrineum** LINK, 1807.

Gyrineum louisae LEWIS, 1974 - Indo-W. Pacific., E. Atlantic.

Genus **Ranella** LAMARCK, 1816.

Ranella olearia (LINNÉ, 1758) (= *gigantea* LAMARCK, 1816) - Mediterranean E & W. Atlantic, Reunión, N. Zealand.

R. australasia gemmifera (EUTHYME, 1889) - S. Africa, Caribbean.

Subfamily **Cymatiinae** IREDALE, 1913.

Genus **Cabestana** RÖDING, 1798.

Cabestana cutacea cutacea (LINNÉ, 1767) - Medit., W. Africa.

C. cutacea dolaria (LINNÉ, 1767) (= *africana* ADAMS, 1854) - Canary Island, W. Africa, S. Africa.

C. felipponei (VON IHERING, 1907) - Brazil, Uruguay, Argentina.

Genus **Charonia** GISTEL, 1848.

Charonia lampas lampas (LINNÉ, 1758) (= *nodifera* LAMARCK, 1822) - Medit., E. Atlantic.

Ch. lampas pustulata (EUTHYME, 1889) (= *weisbordi* GIBSON-SMITH, 1976) - Brazil, S. Africa.

Ch. tritonis variegata (LAMARCK, 1816) - Medit., E. & W. Atlantic.

Genus **Cymatium** RÖDING, 1798.

Subgenus **Cymatium** RÖDING, 1798.

Cymatium (Cymatium) femorale (LINNÉ, 1758) - W. Atlantic.

C. raderi D'ATTILIO & MYERS, 1984 - W. Atlantic.

Subgenus **Gutturnium** MÖRCH, 1852.

Cymatium (Gutturnium) muricinum (RÖDING, 1798) - Pantropical.

Subgenus **Monoplex** PERRY, 1811.

Cymatium (Monoplex) aquatile (REEVE, 1844) (= *martinianum* d'ORBIGNY, 1846) - Indo-W. Pacific, E & W. Atlantic.

C. corrugatum (LAMARCK, 1816) - Medit., Macaronesia, W. Africa.

- C. krebsi* (MÖRCH, 1877) - W. Atlantic, Canary Is.
C. nicobaricum (RÖDING, 1798) - Indo-W. Pacific, Canary Is., Ascensión I., Caribbean.
C. parthenopeum parthenopeum (VON SALIS, 1793) - Medit., E & W. Atlantic, S. Africa, S. W. Pacific.
C. pileare pileare (LINNÉ, 1758) - E. & W. Atlantic.
C. tranquebaricum (LAMARCK, 1816) - Canary & Cap Vert Is., W. Africa, Venezuela.
C. trigonum (GMELIN, 1791) - Canary & Cap Vert Is., W. Africa, S. Helena.

Subgenus **Ranularia** SCHUMACHER, 1817.

- Cymatium (Ranularia) cynocephalum* (LAMARCK, 1816) (= *caribbeum* CLENCH & TURNER, 1957) - Indo-W. Pacific, W. Atl., Cap Vert Is., Gulf of Guinea.
C. rehderi VERRIL, 1950 - W. Atlantic.

Subgenus **Septa** PERRY, 1810.

- Cymatium (Septa) occidentale* (MÖRCH, 1877) (= *rubeculum occidentale*) CLENCH & TURNER, 1957) - Caribbean, Canary Is.

Subgenus **Turritriton** DALL, 1904.

- Cymatium (Turritriton) comptum* (A. ADAMS, 1854) (= *vespaceum* Atlantic records) - Indo-W. Pacific, Caribbean, Canary & Cap Vert Is.
C. gibbosum kobelti (VON MALTZAN, 1884) - W. Africa, Canary Is., Venezuela.
C. labiosum (WOOD, 1828) - Indo-W. Pac., Caribbean, Canary & Cap Vert Is.
C. pharcidum (DALL, 1889) - Caribbean, Canary Is., N. W. Pacific.

Genus **Linatella** GRAY, 1857.

Subgenus **Linatella** GRAY, 1857.

- Linatella (Linatella) caudata* (GMELIN, 1791) (= *cingulata* LAMARCK, 1822 - *poulsenii* MÖRCH, 1877) - Indo-W. Pacific, Caribbean, Canary & Cap Vert Is.

Subgenus **Gelagna** SCHAUFUSS, 1869.

- Linatella (Gelagna) succincta* (LINNÉ, 1771) (= *clandestina* LAMARCK, 1816) - Indo-W. Pacific, Gulf of Guinea.

Genus **Sassia** BELLARDI, 1872.

- Sassia lewisi* HARASEWYCH & PETUCH, 1980 - Caribbean.
S. philomelae (WATSON, 1880) - Tristan da Cunha.

Subfamily **Personinae**, GRAY, 1854.

Genus **Distorsio** RÖDING, 1798.

- Distorsio clathrata* (LAMARCK, 1816) - Caribbean.
D. constricta macgintyi EMERSON & PUFFER, 1852 - W. Atlantic.
D. perdistorta FULTON, 1938 - Indo-W. Pacific, Canary Is., Gulf of Guinea, Caribbean.
D. smithi (VON MALTZAN, 1884) - W. Africa.

Zoogeographical considerations

In light of the present day distribution of the species of *Ranellidae* in the Atlantic, we would like to make some comments on the matter.

Taking as a reference the recent work of BEU (1985), out of a total of 154 species and subspecies living at the present time, 105 are in the Pacific, 51 in the Indian Ocean and 39 in the Atlantic. These figures suggest that is in the Pacific, independantly of its greater extension, where the best conditions for the existance of this family are to be found. On the other hand, the Indian Ocean in spite of being smaller in extension than the Atlantic, harbours a higher number of species than the latter. Another interesting point is that only 14 species inhabit the Eastern Pacific, an extremely low number compared to the near hundred that exist in the Western Pacific. Thus it would seem that the Western Pacific corresponds to what we could call «the irradiation centre» of the present day species of *Ranellidae*. If we examine in more detail these figures, we observe that of the 14 species living in the Eastern Pacific, fundamentally the Peruvian Region, 12 are endemic, which represents a high level of endemism (85%) for this Region. One can attribute as the principal cause of this phenomenon, the presence in this zone of a very strong up-welling which, with its low seasonal temperatures, represents a zoogeographical barrier for many warm water species. Furthermore, the temperature regime severely limits the presence of coralline formations in this region as similarly is the case in the Eastern Atlantic and thus, the substrate or ecosystems become a fundamental determinant.

If we now concentrate on the Atlantic, we observe that of the 39 species and subspecies found there, 28 live in the East and 27 in the West, curiously very similar numbers. However of the 26 species that live exclusively in this Ocean, a greater number correspond to the Eastern sector (13) of which, 10 are endemic, whilst only 9, all endemic, inhabit the Western Atlantic. The 6 amphiatlantic species (exclusive of the Atlantic) complete the total.

On analyzing all this data, one reaches the conclusion that the principal faunistic contribution of the Atlantic with reference to the *Ranellidae* originates from the Western Pacific via the Indian Ocean, in successive connections and disconnections, with the most exigent species establishing themselves in the warm waters of equatorial and tropical regions (Gulf of Guinea, Caribbean). Another noteworthy fact is that many of the species that we have included as living on one or the other side of the Atlantic in reality, do not occur on the continental margins but on the islands more or less adjacent to them, where the oceanographic conditions are more apt for their existance. Such is the case of the 22 species that inhabit the Canary Islands situated at an approximate latitude of 30° N, whilst on the neighbouring West-African coast, at the same latitude, only 7 species are to be found. This is due as we have already mentioned, to two fundamental factors: the presence of an up-welling and the greater or lesser incidence of the oceanic currents of the Atlantic. We personally have confirmed these facts (TALAVERA, 1981) by observing that in the western islands where the Gulf Stream is more in evidence and at the same time the islands are

further away from the African Continent, a greater number of amphiatlantic species are to be found than in the eastern islands that are nearer to Africa and with water temperatures that are 3 or 4 degrees lower.

In addition, we believe that a greater part of the species actually inhabiting the Atlantic, have done so from the Pliocene in a series of successive influxes, via the Indian Ocean, coinciding with favourable climatic changes, the majority coming from the Western Pacific. Others have evolved in the Atlantic (endemics) during the interruptions of genetic flow that probably coincided with the glacial periods of the Quaternary. We feel that the contribution from the Eastern Pacific is, or has been, minimal since the last connection of the two American Subcontinents via the Isthmus of Panama. We even think that the incidence of the Panama Canal is very small, or possibly non-existent.

The possibility exists that the species which live at greater depths have been disconnected for a longer period of time than those of shallow coastal waters, although in the case of the family *Ranellidae* this is difficult to corroborate.

Finally, a very important factor to take into consideration with these zoogeographical aspects is the taxonomy, since among the *Ranellidae* there are genera that live solely in temperate or cold waters such as *Argobuccinum* or *Fusitriton*, others that are restricted to deep waters such as *Ranella* and *Sassia* and others of warm waters, that we treat as pantropical, such as the subgenera *Monoplex* and *Turritriton*.

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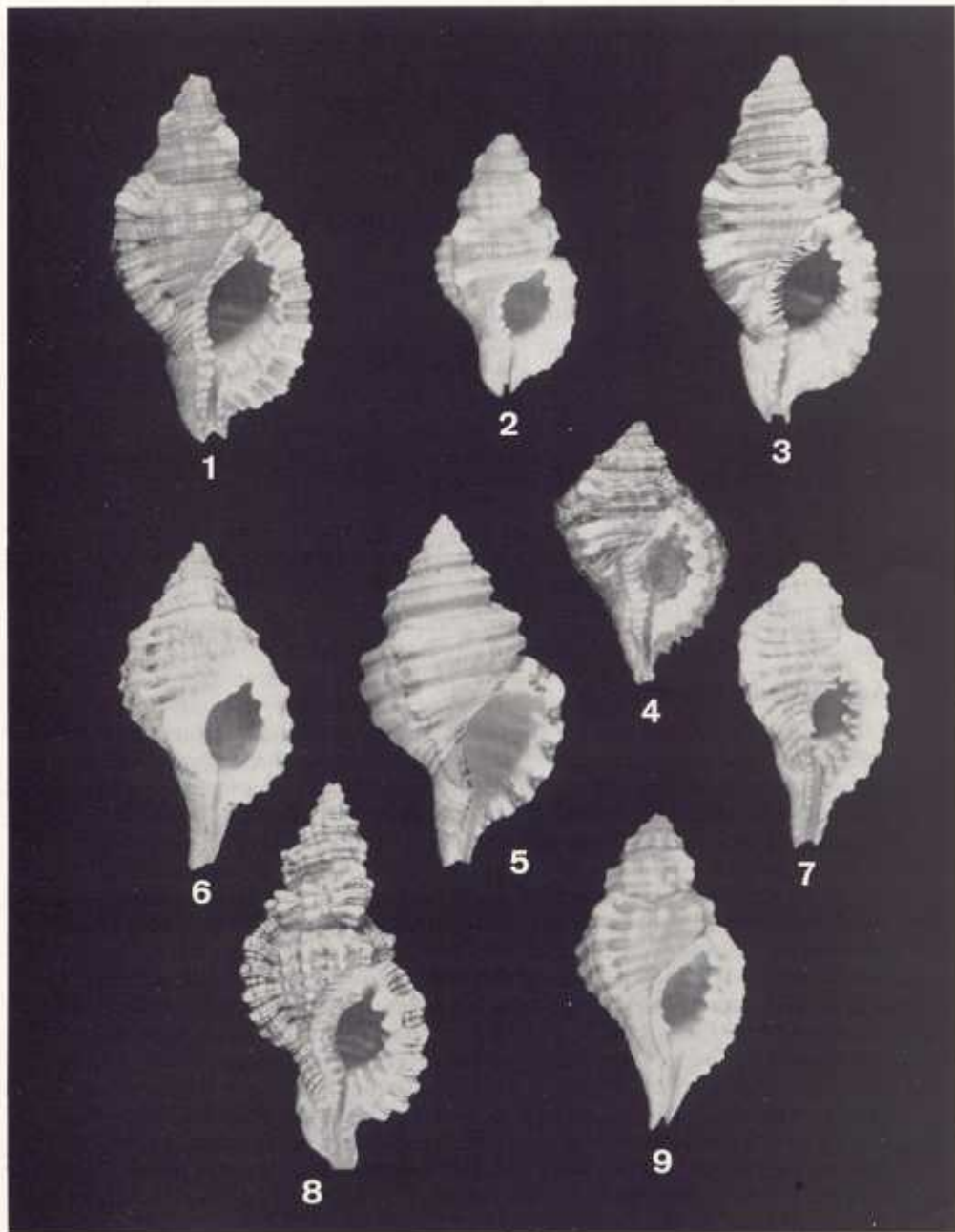


Plate 1. - Atlantic *Ranellidae*. 1) *Cymatium aquatile* (Canary Is.). 2) *C. occidentale* (Canary Is.). 3) *C. pileare* (Canary Is.). 4) *C. tranquebaricum* (Senegal). 5) *C. parthenopeum* (Canary Is.). 6) *C. muricinum* (Canary Is.). 7) *C. trigonum* (Senegal). 8) *C. nicobaricum* (Canary Is.). 9) *C. krebsi* (Canary Is.).

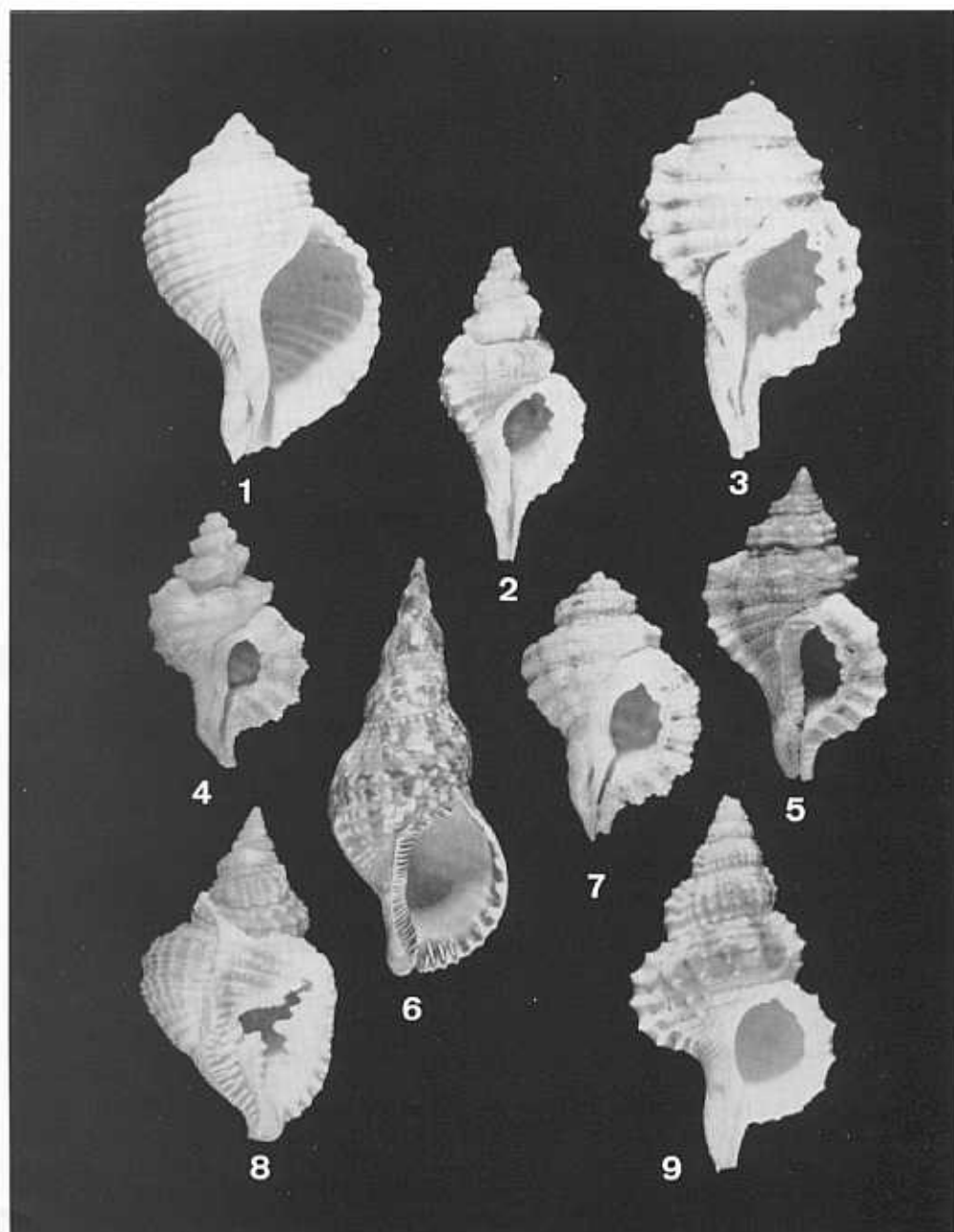


Plate 2. - Atlantic *Ranellidae*. 1) *Linatella caudata* (Canary Is.). 2) *Cymatium phurcidum* (Canary Is.). 3) *C. cynocephalum* (W. Indies). 4) *C. gibbosum* (Venezuela). 5) *C. comptum* (Cap Vert Is.). 6) *Charonia tritonis variegata* (Canary Is.). 7) *C. labiosum* (Canary Is.). 8) *Distorsio perdistorta* (Canary Is.). 9) *Ranella olearia* (Canary Is.)

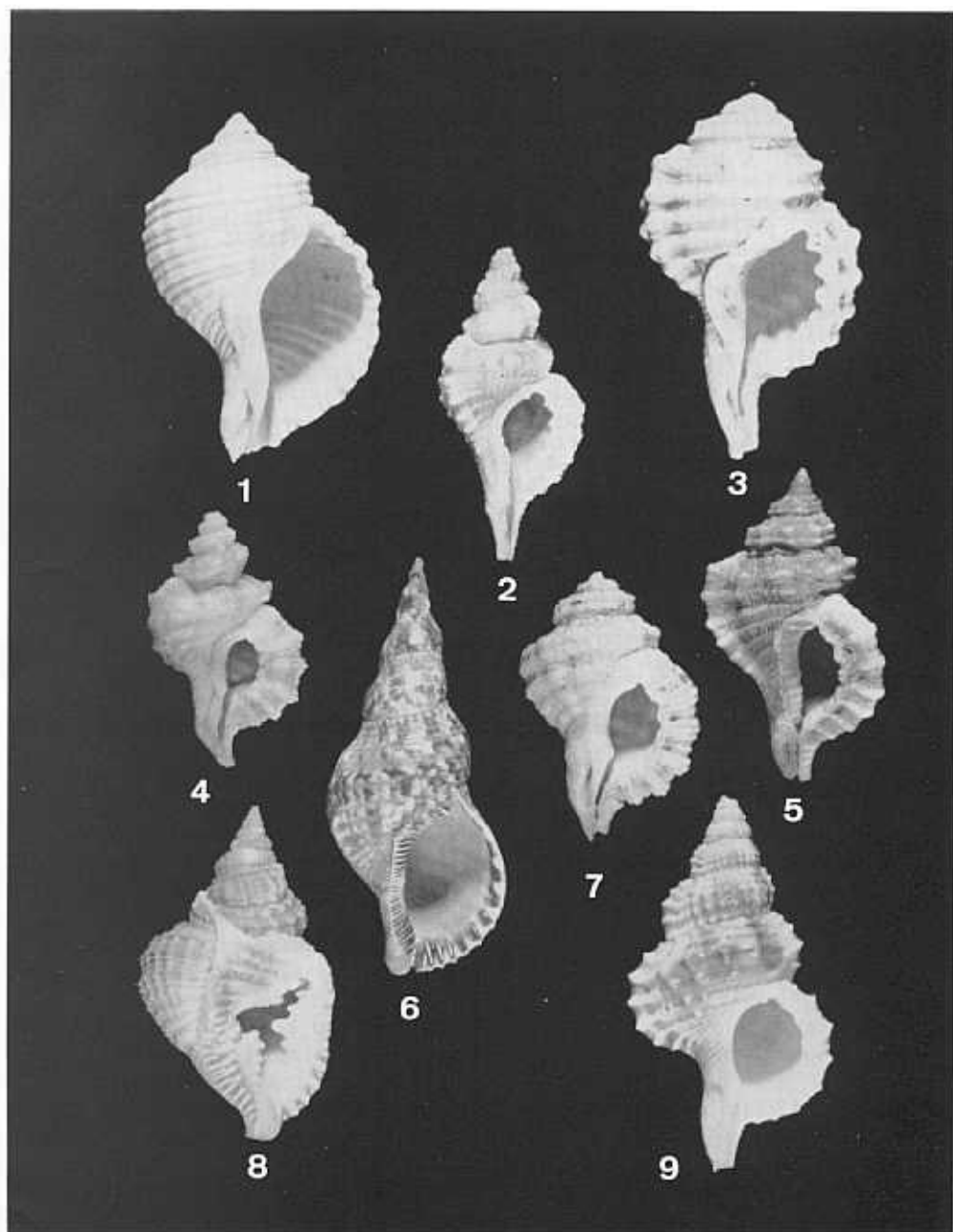


Plate 2. - Atlantic *Ranellidae*. 1) *Linatella caudata* (Canary Is.). 2) *Cymatium pharcidum* (Canary Is.). 3) *C. cynocephalum* (W. Indies). 4) *C. gibbosum* (Venezuela). 5) *C. comptum* (Cap Vert Is.). 6) *Cbaronia tritonis variegata* (Canary Is.). 7) *C. labiosum* (Canary Is.). 8) *Distorsio perdistorta* (Canary Is.). 9) *Ranella olearia* (Canary Is.).

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