

Systematic Palaeontology (Vertebrate Palaeontology)

Record of the slender mola, genus *Ranzania* (Teleostei, Tetraodontiformes), in the Miocene of the Chelif Basin, Algeria

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Abstract

A fossil slender mola (Tetraodontiformes, Molidae) is described from the Miocene (Messinian) of the Chelif Basin, Algeria. The material consists of a single individual largely incomplete, solely represented by part of the anal-fin pterygiophores complement. The specimen is referred to the genus *Ranzania* because of the elongate slender morphology and thick and well-ossified consistence of the bones, which are also characterized by a dense and moderately spongy texture. However, it has been left unnamed, awaiting more complete and better-preserved material. This is the first occurrence of the genus *Ranzania*, and more generally of the family Molidae, in the Messinian of the Mediterranean. It provides new data about the structure and diversity of Miocene pelagic fish communities of the Chelif Basin. **To cite this article:** *G. Carnevale, F. Santini, C. R. Palevol 6 (2007).*

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Résumé

Description d'un Molidae élancé, du genre *Ranzania* (Téléostéens, Tétraodontiformes) du Miocène du bassin de Chélif (Algérie). Un fossile de *Ranzania* (Tétraodontiformes, Molidae), provenant des sédiments du Miocène (Messinien) du bassin de Chélif (Algérie), est décrit. Le seul spécimen connu est en grande partie incomplet et caractérisé par une portion des ptérygiophores de la nageoire anale. Ce fossile appartient au genre *Ranzania*, en raison de la morphologie générale très élancée et de l'ossification avancée du squelette. Les os sont également caractérisés par une texture dense et modérément spongieuse. Une détermination au niveau de l'espèce n'est pas possible, car le matériel connu n'est pas suffisamment complet. Ce spécimen atteste la première apparition du genre *Ranzania*, et plus généralement de la famille des Molidae, dans le Messinien de la Méditerranée. Cette découverte fournit de nouvelles données au sujet de la structure et de la diversité des communautés pélagiques miocènes de poissons du bassin de Chélif. **Pour citer cet article :** *G. Carnevale, F. Santini, C. R. Palevol 6 (2007).*

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Keywords: Teleostei; Molidae; *Ranzania*; Miocene; Messinian; Chelif Basin; Algeria

Mots clés : Teleostei ; Molidae ; *Ranzania* ; Miocène ; Messinien ; Bassin de Chélif ; Algérie

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1. Introduction

Fishes from the family Molidae, commonly known as ocean sunfishes, are greatly modified tetraodontiforms, which occur in the pelagic system in temperate and tropical waters all over the world. Molidae are characterized by a curious morphology, with a laterally compressed body that appears to be truncated posteriorly. Members of this family are among the largest teleosts, reaching 3.3 m in length and 1500 kg. Nevertheless, they possess a greatly reduced skeleton, with the complete disappearance of the caudal fin and have fewer vertebrae than any other fish [45]. Because of their enormous dimensions, these fishes have been recognized as the most fecund vertebrates, with the ability of producing as many of 300 million eggs at one time [33,42]. Within the Tetraodontiformes, the family Molidae belongs to the suborder Tetraodontoidei, which includes all the so-called gymnodonts (Diodontidae, Eoplectidae, Molidae, Tetraodontidae, Triodontidae, Zignoichthyidae), a highly specialized group characterized by a partial-to-complete fusion of jawbones into a beak-like structure [41]. Today, the family Molidae consists of four valid species, in three genera [33]: *Masturus*, *Mola*, and *Ranzania*. Independent phylogenetic analyses of the family based on morphological and molecular data have provided strong support for the sister-group relationship between *Masturus* and *Mola*, and for a basal position of the genus *Ranzania* [4,22,40,45,54]. As remarked by Santini and Tyler [40], the fossil record of this group is rather poor in comparison to that of the other tetraodontiform families. Here, we describe a fossil molid from the Miocene of the Chelif Basin, near Oran, northwestern Algeria. The comparative analysis of the fossil has revealed that it is a member of the genus *Ranzania*, representing the first occurrence of the genus, and more generally of the family Molidae, in the Messinian of the Mediterranean. This study is part of a long-term project focused on the completion of the investigations on the Miocene fishes of the Chelif Basin. These palaeoichthyological studies were inaugurated by Camille Arambourg [1] with the impressive monograph *Les poissons fossiles d'Oran*, and have started up again in the last decade with the description of many new taxa [10,11,13,15–19] and the reinterpretation of several others [2,3,8,9,14], formerly presented by Arambourg.

2. Material and age

The specimen was found among the undescribed material of the palaeoichthyological collection of the 'Laboratoire de paléontologie' ('Département Histoire

de la Terre') of the 'Muséum national d'histoire naturelle' (MNHN), Paris. It consists of a largely incomplete skeleton preserved on laminated diatomitic marls. The fossil was collected during the early years of the 20th century from the diatomaceous deposits of the Chelif Basin, northwestern Algeria. Unfortunately, there is no indication about the exact locality of provenance of the specimen. Diatomaceous sedimentation extensively occurred in the Chelif Basin during the Messinian (Late Miocene) in response to enduring upwelling phenomena [32,38], and the resulting deposits represent the basal relatives of carbonate platforms [34,39]. Large-scale correlations proposed by Cornée et al. [21] suggested that in the western Mediterranean, such a diatomaceous sedimentation occurred between 6.7 and 5.95 Ma.

3. Systematic palaeontology

Subdivision Teleostei *sensu* Patterson & Rosen, 1977.
Order Tetraodontiformes *sensu* Santini & Tyler, 2003.
Family Molidae *sensu* Santini & Tyler, 2002.
Genus *Ranzania* Nardo, 1840.
Ranzania sp. (Fig. 1).

3.1. Material

Fragments of the anal-fin skeleton of a molid, reposit in the MNHN, and numbered MNHN ORA1777.

3.2. Description

The material consists of eight elongate slender bones. These bones are thick and well ossified, characterized by a dense and moderately spongy texture. All the bones are incomplete, lacking a variable portion of their dis-

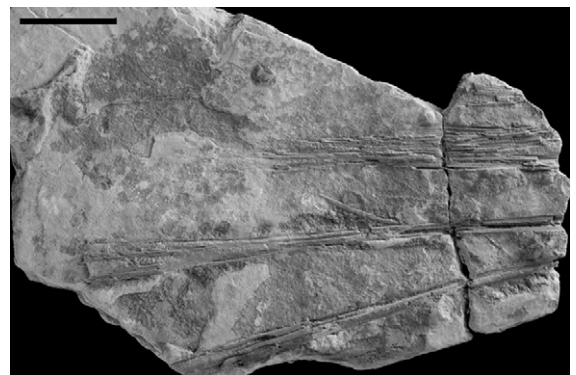


Fig. 1. *Ranzania* sp. from the Miocene of Algeria. MNHN ORA1777. Scale bar: 50 mm.

Fig. 1. *Ranzania* sp. du Miocène d'Algérie. MNHN ORA1777. Échelle : 50 mm.

tal extremities. The bones, except for the first and the last ones, are arranged in clusters separated by a wide gap. Each cluster appears to be constituted by two elements. The longer bone (5th) measures 235 mm, while the shorter (8th) 33 mm. What appear to be the proximal extremities of the bones (4th and 5th) of the second cluster seem to be rather complete. These portions of such bones appear to be weakly to moderately ossified. The morphology, arrangement, and relative dimensions of these bones seem to indicate that they represent part of the anal-fin pterygiophore complement of a molid of the genus *Ranzania* (see e.g., [22,36,45,48]). Consequently, the weak ossification of the fourth and fifth preserved bones may be related to its original cartilaginous structure. As evidenced by the recent study performed by Johnson and Britz [28], the proximal and distal tips of the anal-fin pterygiophores of the extant slender mola *Ranzania laevis* become completely ossified late during the ontogeny.

4. Discussion

Due to their highly unusual and bizarre morphology, fishes of the family Molidae have long fascinated naturalists and ichthyologists (see [43]). Since the first half of the 19th century, several authors (e.g., [7,20,22,24–26,28,29,36,37,45,53]) have investigated various aspects of their peculiar anatomy and life histories, providing a large amount of data about their structure and biology. Santini and Tyler [40] were the first to provide a cladistic study of interrelationships among living taxa belonging to this family. According to their conclusions, the monophyly of the Molidae is supported by 31 synapomorphies, which refer to skeletal features clearly not observable on MNHN ORA1777 because of its evident incompleteness. However, despite its largely fragmentary nature, the material documented herein can be referred to family Molidae, based on the relative dimensions and morphology of the bones (Figs. 1 and 2C). Within the family Molidae, the well-ossified nature of the bones, as well as their elongate slender morphology and their arrangement in clusters are clearly indicative of the genus *Ranzania*. The degree of ossification of the skeleton of the ocean sunfishes is considered as a salient distinctive feature at generic level [5,23,36,40,44,45]. *Ranzania* is characterized by dense, moderately spongy (sub-osseous [23]) texture of the bones, whereas *Masturus* and *Mola* possess soft, weakly ossified bones with a highly spongy structure. As far as the morphology of the bones is concerned, the general appearance of the anal pterygiophores described herein is consistent with that characteristic of the genus *Ran-*

zania. As reported by Tyler [45] and Santini and Tyler [40], the dorsal- and anal-fin pterygiophores of *Masturus* and *Mola* are widely expanded anteroposteriorly, plate-like (Fig. 2A and B), while in *Ranzania* they are long, slender rods (see Fig. 2C). Moreover, because of their anteroposterior enlargement, the haemal pterygiophores of *Masturus* and *Mola* are broadly in contact among each other. On the contrary, the clusters of long and slender elements that characterize *Ranzania* are separated by a wide gap, as in the Algerian fossil documented herein (Fig. 2C).

The genus *Ranzania* consists of one living species, *R. laevis*, and at least four extinct species, *R. grahami*, *R. ogaii*, *R. tenneyorum*, and *R. zappai*. *Ranzania grahami*

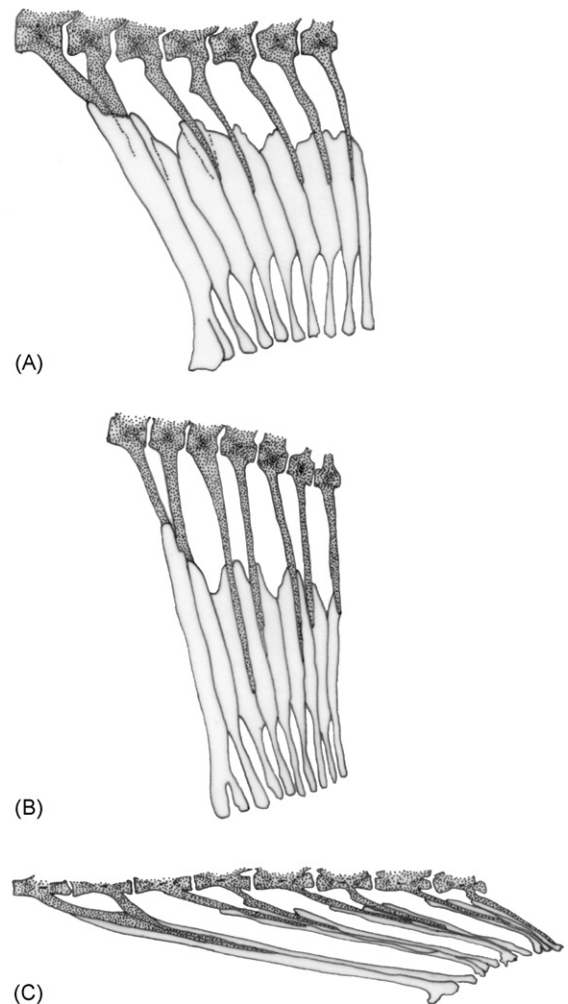


Fig. 2. Comparison of the anal-fin pterygiophores arrangement in the Molidae *Masturus lanceolatus* (A), *Mola mola* (B), and *Ranzania laevis* (C). Modified from Tyler [45].

Fig. 2. Comparaison de la structure des pterygiophores de la nageoire anale des Molidae *Masturus lanceolatus* (A), *Mola mola* (B), and *Ranzania laevis* (C). Modifié d'après Tyler [45].

was established based on the premaxillary and dentary beaks, nasal plate, jugular plate, branchial fragments, and part of the armour shield from the lower Middle Miocene Calvert Formation, Virginia [52]. *Ranzania ogaii* was described by Uyeno and Sakamoto [48] based on an incomplete articulated skeleton from the Middle Miocene Hiranita Formation, Japan. *Ranzania tenneyorum* is based solely on a premaxillary beak from the lower Middle Miocene basal phosphate horizon of the Calvert Formation, Virginia [52]. Finally, *R. zappai* was described by Carnevale [12] based on articulated dermal scale plates from the Middle Miocene of Torricella Peligna, central Italy. Therefore, the material described herein can be compared only with *R. laevis* and *R. ogaii* in order to interpret its possible systematic affinities. Unfortunately, the inadequate preservation of MNHN ORA1777 and the apparent absence of morphological characters in the anal-fin pterygiophores that are useful for discrimination at the specific level (see [40]) do not allow a more detailed taxonomic analysis. The fossil is therefore left unnamed, awaiting more complete material. In any case, much new comparative information is necessary before the fossil described herein can be definitely assigned at the specific level.

5. Conclusions

Like the other members of the family Molidae, *Ranzania* is a primarily pelagic fish that mostly inhabits the upper layers of the water column. Due to the loss of the caudal fin, the major locomotor thrust is furnished in these fishes by the greatly enlarged and powerful dorsal and anal fins (see [6]). The reduced capacity to active swimming is reflected by their alimentary attitudes, given that these fishes feed primarily on jellyfishes, but also on algae, seaweed, eelgrass, hydroids, ctenophores, molluscs, crustaceans, brittlestars, salps, and fish larvae (e.g., [33,52]). The occurrence of a slender mola in the Messinian deposits of the Chelif Basin provides new data about the structure of the Upper Miocene pelagic communities of this semi-enclosed enclave (see [38]) of the western sector of the Mediterranean. The fish communities of the pelagic realm of this basin were characterized by a broad palaeobiodiversity during the Messinian. A large number of large predatory sharks (e.g., *Carcharhinus*, *Carcharias*, *Carcharodon*, *Hexanchus*, *Isurus*, *Sphyrna*) and typically offshore teleost taxa of the families Bregmacerotidae (*Bregmaceros*), Carangidae (e.g., *Caranx*, *Decapterus*, *Seriola*, *Trachurus*), Clupeidae (e.g., *Alosa*, *Brevoortia*, *Etrumeus*, *Spratelloides*), Diodontidae (*Diodon*), Gempylidae (*Chelifichthys*, *Hemithyrsites*), Istiophori-

dae (*Makaira*), Myctophidae (e.g., *Ceratoscopelus*, *Lampanyctus*), Scomberesocidae (*Scomberesox*), Scombridae (*Euthynnus*, *Sarda*, *Scomber*), Syngnathidae [*Syngnathus albyi*; see 12], Tetraodontidae (*Archaeotetraodon*), Trichiuridae (*Lepidopus*), and Zeidae (*Zeus*) have been described from the main fossiliferous localities of this basin (e.g., [1]). Such amazing diversity was probably related to the heterogeneous palaeogeography and physiography that characterized the shelf environments of the Chelif Basin, and to the nutrient enrichment and eutrophication during biosiliceous deposition. In this setting, the large availability of prey in response to the water fertilization related to the enduring upwelling phenomena probably attracted a conspicuous and diverse assemblage of pelagic fishes to the basin, thereby producing a miscellaneous contingent of coastal pelagic, epipelagic, and migratory meso- and bathypelagic fishes.

As pointed out by Tyler and Santini [47], because of their pelagic lifestyle and the weakly ossified and spongy nature of the skeleton (at least in the genera *Masturus* and *Mola*), representatives of the family Molidae are rather rare in the fossil record and mostly represented by isolated jaws and dermal scale plates. The earliest molid, *Eomola bimaxillaria*, has been described from the Bartonian (~41 Myr) marls of the Kuma Horizon, North Caucasus, Russia [46]. The material consists of premaxillary beaks and other isolated bones of the upper jaw, suspensorium, and opercular series. This Eocene fossil is characterized by separate premaxillae that articulate medially by means of interdigitating processes (versus fused in the midline in extant molids). According to Tyler and Bannikov [46], such a separation represents the retention of the plesiomorphic condition typical of other tetraodontoid families, such as the Triodontidae and Tetraodontidae. The Neogene record of the molids is characterized by the repetitive occurrence of isolated jaws, often associated with shark teeth or marine tetrapod remains. Upper and lower beaks, isolated bones and dermal scale plates assigned to the Molidae (*Mola* and *Ranzania*) have been reported from several Neogene localities from Belgium, France, the Netherlands, and the United States [27,30,31,35,49–52]. A single largely incomplete articulated skeleton assigned to the genus *Ranzania* was described by Uyeno and Sakamoto [48] from the Middle Miocene Hiranita Formation, Chibumachi Group, Saitama Prefecture, Japan. Finally, an incomplete articulated dermal armour shield from the Serravallian (Middle Miocene) laminated calciturbidites outcropping near Torricella Peligna, Abruzzo, central Italy, has been recently presented by Carnevale [12] and referred to the genus *Ranzania*. Thus, it is evident that the meagre fossil record of the Molidae poorly

contributes to the understanding of the evolutionary patterns of this extremely derived group of fishes. For this reason, the fossil remains documented herein, even if strongly incomplete, provide precious information about the palaeodistributional history of this family, furnishing a further support to the idea that the Miocene ichthyofaunas from the Chelif Basin are of crucial importance for the fossil record of the Teleostei (see [11]).

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