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FIRST RECORD OF *MICROICHTHYS COCCOI* (ACTINOPTERYGII: PERCIFORMES: EPIGONIDAE) FROM THE BALEARIC ISLANDS (WESTERN MEDITERRANEAN)

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Background. *Microichthys coccoi* Rüppell, 1852 was originally described based on a stranded individual collected in the Strait of Messina, Sicily, central Mediterranean. The distribution range of the species is poorly known, as very few individuals have been recorded from Italy, Greece, and Turkey in the Mediterranean, and from the Azores in the north eastern Atlantic. The aim of this study was to report the presence of *M. coccoi* from the Balearic Islands (western Mediterranean). The history of the species' known records is compiled and its presence in the Atlantic is discussed.

Material and methods. A specimen of *M. coccoi* was collected from a bottom trawl sampling, carried out at 591 m depth in the south of Mallorca (Balearic Islands) during the survey MEDITS_ES05_17 in June 2017. The fish (a female) was subjected to standard descriptive procedures and subsequently deposited in the collection of the Hebrew University of Jerusalem.

Results. *Microichthys coccoi* is recorded for the first time from the Balearic Islands, which expands its distributional range inside the Mediterranean more than 1000 km westwards.

Conclusions. Like the other known specimens, except for those collected in the Strait of Messina, the presently described individual was caught on the slope, confirming that *M. coccoi* is a deep-water species. The comparison of this fish with Azorean specimens indicated differences in the number of pectoral-fin rays, the most important character distinguishing the species of *Microichthys*. Hence, further work is necessary to classify the Azorean population, which if confirmed as *M. coccoi*, would make necessary a modification of the species' description and if rejected, an additional Atlantic species should be described.

Keywords: Epigonidae, cardinalfish, morphometry, expanded distribution

INTRODUCTION

The family Epigonidae includes seven valid genera, of which only two are present in the Mediterranean, *Epigonus* and *Microichthys*, comprising three and two species, respectively. The information on the two known species of the genus *Microichthys*, *Microichthys coccoi* Rüppell, 1852 and *Microichthys sanzoi* Sparta, 1950, is very scarce, particularly regarding their distribution ranges. In fact, most information on these species has been gathered from few individuals stranded along the Sicilian coast of the Strait of Messina (Battaglia et al. 2014). While *M. sanzoi* is endemic to this area, *M. coccoi* has been regarded to have a wider distribution in the central and eastern Mediterranean, as well as the north eastern Atlantic (Azores).

In addition to individuals stranded in the Strait of Messina (Rüppell 1852, Facciola 1900, Bini 1968, Guglielmo et al. 1971, Cavallaro and Bonina 1972, Cavallaro and Moio 1972, Berdar et al. 1977), *M. coccoi* has been collected from deep-sea sampling stations using bottom trawl gears, although according to their morphological traits it is considered to be a component of the pelagic environment (Cavallaro and Bonina 1972). This is the case of the record from Gökova Bay, Turkey, Aegean Sea, where the species was collected at 600 m depth using a beam trawl (Mater et al. 1988). More recently, Mytilineou et al. (2005) reported the species for the first time in the Ionian Sea waters of Greece from a bottom trawl sampling station at 549 m depth. The species also appears in the faunistic lists of observers

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on board the commercial fleet targeting Norway lobster and red shrimp in the Northern Tyrrhenian Sea at depths ranging from 300 to 650 m (Sartor et al. 2003), but these records cannot be confirmed. The remaining specimens have been reported from the Azores Archipelago in the north eastern Atlantic. The first reports from this region were by Koefoed (1952), who believed them to be young *Epigonus telescopus* (Risso, 1810). Porteiro et al. (1999) concluded that Koefoed's specimens were probably *M. coccoi* and reported an additional seven specimens of *M. coccoi* collected in the Azores region by the Woods Hole Oceanographic Institution (WHOI) R/V *Atlantis II* cruise 101 in 1978.

In the present paper, we report a single female specimen of *M. coccoi* captured during the recent MEDITS bottom trawl survey developed around the Balearic Islands in June 2017. It represents a new record of *M. coccoi* and significantly expands the distribution range of this rare species. Some comments on the Atlantic individuals considered to belong to this species are also made.

MATERIALS AND METHODS

A new specimen of *Microichthys coccoi* was collected from a bottom trawl sampling carried out at a depth ranging between 583 and 616 m (mean depth of 591 m) during the MEDITS_ES05_17 survey that took place around the Balearic Islands in June 2017 (Fig. 1). The bottom trawl used was a GOC73, which had average horizontal and vertical openings within 16–21 m and 2.4–3.1 m, respectively, and is equipped with 10 mm diamond mesh in the codend. Hauls had a duration from 20 to 60 min of effective sampling (bottom time) depending on depth stratum (50–800 m), at a speed of 3 knots. For more specifications on the sampling details see Bertrand

et al. (2002). The net was equipped with a CTD (SeaBird 37 MicroCat) in order to measure depth, salinity, and temperature of the water at 2 m above the bottom during the haul.

The measurements and counts of this specimen, which is deposited in the Hebrew University of Jerusalem with the code HUI 20683, were made according to Battaglia et al. (2014) and Fricke (1983). The family classification followed Van der Laan et al. (2014), while genus and species classification followed Eschmeyer et al. (2017). Facciola's (1900) re-description of the species from the Strait of Messina and data provided in Tortonese's key to the species of the genus *Microichthys* (see Tortonese 1986) were used to identify our specimen. It was compared to individuals identified as *M. coccoi* from the Azores Archipelago, so far the only area where fish representing this genus have been recorded out of the Mediterranean. The five Atlantic individuals analysed are kept in the Museum of Comparative Zoology, Harvard University (MCZ), where they are registered with the following catalogue numbers: MCZ 149630-149634.

RESULTS

Family EPIGONIDAE Poey, 1861

Microichthys Rüppell, 1852

Microichthys coccoi Rüppell, 1852

Fig. 2, Tab. 1

Material. HUI 20683, one female, 25.4 mm SL, 591 m depth, western Mediterranean, Balearic Islands, south of Mallorca, 39°6.38'N, 2°35.56'E, Cruise MEDITS_ES05_17, bottom trawl, St. 186, 591 m depth, 10 June 2017, R/V *Miguel Oliver*.

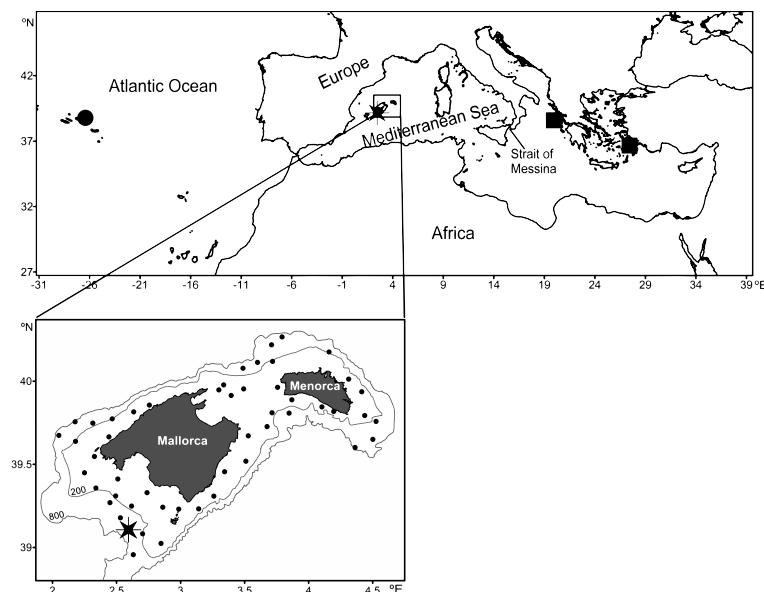


Fig. 1. Map showing records of *Microichthys coccoi*, with the inset depicting the Balearic Islands and sampling sites of the MEDITS_ES05_17 survey (black dots); other collection sites: ★ = presently described new record, Strait of Messina = the original description site, ■ = other Mediterranean records, question mark = an unconfirmed record off Porto Santo Stefano; ● = the 200 and 800 m isobaths are marked on the map

Description. Fin-ray counts: D VII + I, ix; A II, viii; P1 xvi, P2 I, 5; C (iii), i, 19, i, (iii). Gill rakers (first arch) 8 + 20 = 28; branchiostegal rays: 6; pored lateral-line scales: 43 + 3; pyloric caeca 4. Absolute and relative values of morphometric measurements are given in Table 1.

Body slender, laterally compressed, deepest at beginning of first dorsal fin. Head large, compressed, nape slightly humped. Preopercle posteriorly describing right angle, with two denticles on its posterior margin and one on lower margin. Opercular spine present, pungent, forming ridge, originating in vicinity of preopercle. Snout large and oblique with lower jaw prominent and longer than upper jaw. Teeth only present anteriorly. Lower jaw with one row of small curved teeth. Upper jaw without teeth. Vomer with triangular patch of 12 teeth, arranged in 3 rows (6 teeth in frontal row, 4 in median row and 2 in posterior row). Eye large, round, orbital diameter about equal to snout and to postorbital length; bony rim of orbit raised above dorsal profile; interorbital region with one ridge, as long as half eye diameter, above anterior part of each eye (Fig. 2).

Origin of first dorsal fin just behind lower end of pectoral-fin base; first spine of first dorsal fin about slightly more than one quarter length of second spine. Spine of second dorsal fin long, as long as first soft ray. First and second dorsal fins separated by gap of about half of orbit diameter; isolated dorsal-fin spine absent. Origin of anal fin below base of second soft ray of second dorsal fin. Anal fin with two spines, first one about one third of second one, which is sharp, robust, and longer than rays. Uppermost and lowermost two pectoral-fin

rays unbranched, remainder branched. Posterior tip of pectoral-fin rays not reaching vertical line drawn from anus. Upper margin of pectoral-fin base on level of lower edge of pupil. Pelvic fins reaching to anus when laid back. Caudal fin forked.

Anus located slightly anterior to vertical line through origin of second dorsal fin. Morphology of urogenital papillae indicating that specimen is female. Scales deciduous, all ctenoid. Lateral line starting immediately behind upper angle of operculum and reaching caudal peduncle; gently curving along sides of body. No trace of luminous organ around belly or visceral region.

Colour of preserved specimen (Fig. 2): head and body yellowish grey, snout lighter; tip of jaws, occipital region, opercle and sides of body with scattered melanophores. Pectoral-fin base dark but distally transparent. Peritoneum black. Sides of body with twenty oblique black lines extending from below lateral line to mid-body. Caudal peduncle black, with dark colour extending dorsally to below base of seventh ray of second dorsal fin, and ventrally to below fourth ray of anal fin. Coloration of first dorsal fin not visible due to loss of fin membrane. Second dorsal fin mottled with dark pigment. Anal-fin base mottled with dark pigment, anal fin distally transparent. Posterior half of pelvic fins dark. Caudal fin transparent.

Remarks. *Microichthys coccoi* was originally described by Rüppell (1852: 1), based on a single, small specimen washed ashore in the Strait of Messina, Sicily, Italy. The species was mentioned but not examined by Günther (1859: 229), Canestrini (1860: 313), Döderlein (1879: 34; 1881: 77), and Giglioli (1880: 19). Döderlein (1889:

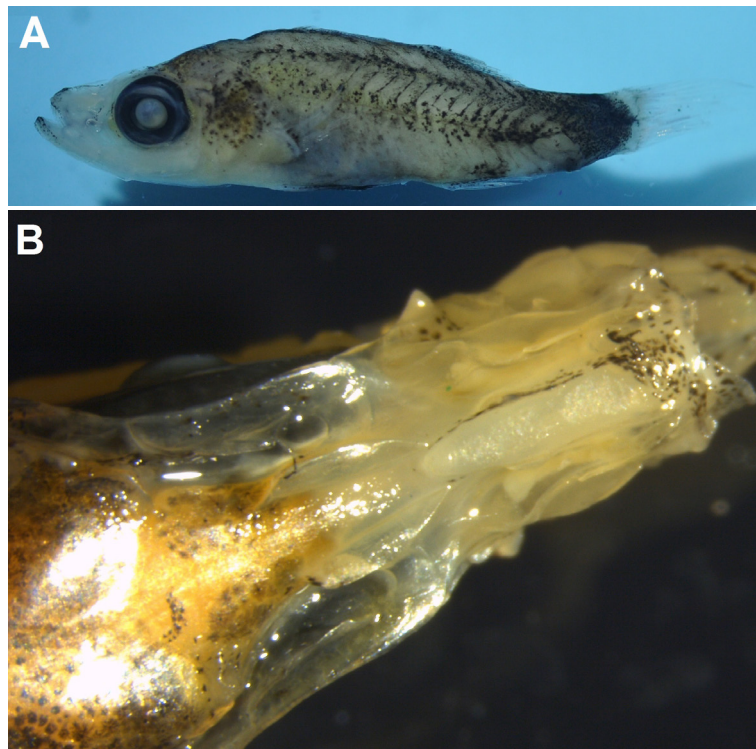


Fig. 2. Specimen of *Microichthys coccoi*, HUIJ 20683, 25.4 mm SL, western Mediterranean Sea, south of Mallorca, Balearic Islands, Spain; female, lateral view (A); detail of the interorbital ridge above each eye (B)

37) redescribed the holotype. Facciola (1900: 188, pl. 8) was the first author who collected and thoroughly described four additional specimens, also from the Strait of Messina. Gonzales (1946) described additional, larval specimens from the type locality. Bini (1968: 51, fig.) compiled his description out of existing information on the species. Guglielmo et al. (1971), Cavallaro and Bonina (1972), Cavallaro and Mojo (1972), and Berdar et al. (1977) reported other four specimens from the Strait of Messina; subsequent records of the species by Fraser (1972: 5), Tortonese (1973), Mayer (1974: 199), Tortonese (1986: 808) and Fredj and Maurin (1987) were based on Bini (1972). Landini and Menesini (1977: 4) reported fossil material from the Pleistocene of Calabria, probably belonging to *M. coccoi*. The total material of

the species collected from the Strait of Messina does not exceed 13 specimens.

Outside Sicily, the species has been reported from the Aegean Sea of Turkey (Mater et al. 1988: 276), subsequently cited by Bilecenoglu et al. (2002: 81), Bilecenoğlu et al. (2014: 914), Fricke et al. (2007: 82), and Çoker and Akyol (2014: 163), and from the eastern Ionian Sea of Greece (D'Onghia et al. 2003, Mytilineou et al. 2005), subsequently cited by Papaconstantinou (2014: 110). A record from Porto Santo Stefano (northern Tyrrhenian Sea, Italy) by Sartor et al. (2003) could have been based on a misidentification and cannot be confirmed.

Additional specimens have been reported from the Azores by Koefoed (1952: 1, pl. 2, as “*?Epigonus telescopus* (non Risso 1810)”), Arruda (1997: 82), Porteiro et al. (1999: 15), Carneiro et al. (2014: 49), and Gon (2016: 2434). As it is discussed below, we consider the identity of the Azorean population as probably not conspecific with *M. coccoi*.

The traits studied in the presently reported individual fully agree with those reported for the species in the redescription by Facciola (1900). This author found that the only difference between his specimens and the holotype described by Rüppell (1852) was the anterior origin of the lateral line. It is situated at the upper angle of the operculum according to Facciola (1900), but below the first ray of second dorsal fin according to Rüppell (1852), which could be due to the external damage of Rüppell's specimen. Characters of the presently described individual are fully consistent with the character state described by Facciola (1900). The pectoral fin ray counts in our case agree with that in Tortonese (1986), who uses pectoral fin ray counts as a determinant meristic trait to distinguish among the two *Microichthys* species: *M. coccoi* (16) and *M. sanzoi* (20), both without any variation. In Tortonese's key, the spine in the pectoral fins described in Facciola (1900), who counted I + 16 rays, is not mentioned. This spine was also not present in the presently reported specimen. Our specimen also differs from *M. sanzoi* by lacking the vertical black bar in the caudal peduncle and the black filamentous pelvic fins that characterize the latter species (Battaglia et al. 2014).

Distribution and habitat. The presently reported individual was collected from a bottom trawl haul carried out at a mean depth of 591 m over a bathyal muddy bottom. The mean values of salinity and temperature of the water at 2 m above the bottom during the sampling were 13.31°C and 38.54‰, respectively. These values coincide with the respective parameters of the Levantine Intermediate Waters (LIW), a water mass that originates in the eastern Mediterranean, being found just above the Mediterranean deep waters. This water mass reaches the Balearic Islands after circulating along the northern part of the Mediterranean, being present during the entire year around the Archipelago, where it can be located between the depths of 200 and 700 m and it is characterized by an absolute maximum of salinity and a relative maximum of temperature (López-Jurado et al. 2008). According to the above-mentioned authors, LIW in the area where the specimen of *M. coccoi* was captured off

Table 1
Morphometric measurements and proportions of the specimen of *Microichthys coccoi*, HUIJ 20683, from the Balearic Islands

Parameter	Absolute value [mm]	Relative value [%]
Total length (TL)	31.8	
Standard length (SL)	25.4	79.9 TL
Caudal-fin length	6.1	24.0 SL
Head length (HL)	9.6	37.8 SL
Head width	3.9	15.4 SL
Head depth	5.5	21.7 SL
Body depth	6.7	26.4 SL
Body width	3.6	14.2 SL
Caudal-peduncle length	5.8	22.8 SL
Caudal-peduncle depth	2.1	8.3 SL
Trunk length	22.2	87.4 SL
Orbit diameter	4.7	49.0 HL
Interorbital distance	2.3	24.0 HL
Upper jaw length	2.7	28.1 HL
Lower jaw length	3.6	37.5 HL
Snout length	2.5	26.0 HL
Postorbital length	3.6	37.5 HL
Predorsal (1) length	10.0	39.4 SL
Predorsal (2) length	14.9	58.7 SL
Prepectoral length	9.6	37.8 SL
Preanus length	15.8	62.2 SL
Preanal length	16.9	66.5 SL
Prepelvic length	10.2	40.2 SL
Length of 1st D1 spine	1.1	4.3 SL
Length of 2nd D1 spine	3.6	14.2 SL
Length of 3rd D1 spine	4.4	17.3 SL
Length of D2 spine	3.3	13.0 SL
Length of 1st anal-fin spine	1.2	4.7 SL
Length of 2nd anal-fin spine	3.6	14.2 SL
Length of pelvic-fin spine	5.1	20.1 SL
Distance between pelvic spines	1.6	6.3 SL
Pectoral fin length	3.6	14.2 SL
Pelvic fin length	6.4	25.2 SL
Length of D1 base	3.9	15.4 SL
Length of D2 base	4.0	15.7 SL
Length of anal-fin base	3.2	12.6 SL

southern Mallorca is more stable and wider than in other areas of northern Mallorca.

The most important accompanying demersal species in that sampling station were the fishes *Galeus melastomus* Rafinesque, 1810 (Pentanchidae), *Hymenocephalus italicus* Giglioli, 1884 (Macrouridae), and the decapod crustaceans *Geryon longipes* (Geryonidae), *Parapenaeus longirostris* (Penaeidae), *Plesionika* spp. (Pandalidae), *Nephrops norvegicus* (Nephropidae), and *Aristaeomorpha foliacea* (Aristeidae). Additional co-occurring fishes included meso- and bathy-pelagic species such as myctophids *Lampanyctus crocodilus* (Risso 1810), *Ceratoscopelus maderensis* (Lowe, 1839), *Benthoosema glaciale* (Reinhardt, 1837), and *Lobianchia dofleini* (Zugmayer, 1911), and the sternoptychid *Argyrolepelecus hemigymnus* Cocco, 1829.

The geographic area where the new individual was caught, the deep-water bottom trawl fishing grounds in southern Mallorca Island is an important deep-water decapod crustacean fishing ground which ranges from 400 to 800 m depth, in which the main target species is the blue and red shrimp (*Aristeus antennatus*). This species is in general caught at more than 600 m depth, whereas in the shallower part of this fishing ground, the main target species is the Norway lobster (*N. norvegicus*).

DISCUSSION

The epigonid specimen collected south of Mallorca (HUIJ20683) represents the species *Microichthys coccoi*, due to the coincidence of external morphological characteristics and meristic counts with the species redescription in Facciola (1900) and the data provided by Tortonese (1986).

Due to the supposed mesopelagic behaviour of the species, we cannot reject the possibility that its capture might have happened during the recovery of the net and its passage through the water column. However, the known records of the species (except those from the Strait of Messina where individuals appear on the shore due to a strong upwelling) are also based on individuals captured between 500 and 600 m depth by using bottom or beam trawls, which are sampling gears designed to collect species dwelling near the bottom (Matter et al. 1988, Mytilineou et al. 2005). This suggests that the species could spend at least part of its time near the bottom, similar to other meso- and bathy-pelagic species captured along with the presently reported specimen. Those other species were *Lampanyctus crocodilus*, *Ceratoscopelus maderensis*, *Argyrolepelecus hemigymnus*, *Benthoosema glaciale*, and *Lobianchia dofleini*. Such assumption is strengthened by the fact that sampling of deep scattering layers between 400 and 600 m, developed from pelagic trawl during December 2009 and July 2010 in the same area where the specimen of *M. coccoi* was captured off southern Mallorca, did not report any capture of this species (Olivar et al. 2012). However, all the accompanying species listed above appeared in those pelagic trawl samples.

The new record of *M. coccoi* from the Balearic Islands expands westwards its distribution range in the Mediterranean Sea by more than 1000 km and it is probably the westernmost confirmed record of the species

(Fig. 1). During the presently reported study, we analysed the individuals from the Atlantic (Azores) deposited at the MCZ. We agree with Porteiro et al. (1999) that those individuals superficially strongly resemble *M. coccoi*; however, the number of rays in the pectoral fin, three out of the five individuals analysed had 18 pectoral-fin rays (two specimens had at least 17 rays, but the pectoral fins were seriously damaged), do not agree with the counts of the two known species. As the number of pectoral-fin rays is the most important character distinguishing the species of *Microichthys* (see Tortonese 1986), it seems likely the Azores population of *Microichthys* is not conspecific with *M. coccoi*. Further work is necessary to classify the Azorean population. If confirmed as *M. coccoi*, the existing description of the species should be modified accordingly, and if rejected, an additional Atlantic *Microichthys* species should be described.

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