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First record of *Cucullanus cirratus* (Müller, 1777) (Nematoda, Cucullanidae) in Western Mediterranean Sea from *Phycis blennoides* (Teleostei: Gadidae)

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ABSTRACT

The helminthological examination of 110 greater forkbeard *Phycis blennoides* (Brunnich, 1768) caught from Western Algerian coasts, revealed the presence of 35 mature nematodes located in the intestine of the fishes. These specimens were identified as Cucullanus cirratus (Müller, 1777) by the general morphology especially the characteristic structure of the esophagus. This is the first record of this parasite in the Mediterranean Sea and *P. blennoides* represents a new host record.
KEY WORDS: Gadidae, parasitic worms, Cucullanidae, Northwest Africa, Mediterranean Sea.

1. INTRODUCTION

The greater forkbeard is a gadoid fish widely distributed in Mediterranean with an important economic value as a part of the mixed demersal and deep fisheries. Many aspects of its life story have been studied in the Mediterranean Sea [1], [2]; [3] studied its growth, feeding habits and depth size trends, respectively, in the Western Basin; [4] investigated its distribution and diet in the Ligurian Sea; [5] analyzed its feeding in the Northern Tyrrhenian Sea; [6], studied its biology and population dynamics in the Northern Aegean Sea and [7] studied its reproduction from the Northwest Mediterranean, however, little is known about its parasite fauna especially nematodes [8], [9]. Studies related to nematode parasites of fishes in Algeria are very rare [10] and restricted on freshwater fishes [11]; [12]; therefore, the aim of this study is to report the first occurrence of *Cucullanus cirratus* in the Western coasts off Algeria and provide a description of these Mediterranean specimens.

2. MATERIALS AND METHODS

In total, 110 greater forkbeard *Phycis blennoides* caught in Oran Bay (35°43' N - 0°37' W) (Figure1), Western Algerian Coasts, were acquired from fishermen, between October 2011 and August, 2013. Specimens were transported in plastic containers to the laboratory where individual body weight and size (total length), sex, and maturity stage were recorded. The range of fish size (total length) was 25 to 45 cm. The whole gastro-intestinal tract was removed immediately after capture and all portions (stomach, pyloric caeca and intestine) were opened by a longitudinal incision. Removal of contents was obtained by successive washes with a wash bottle in a Petri dish; the food material collected was examined under a dissecting microscope, Zeiss Stemi 2000. Only helminthes infesting this tract were examined; worms were collected alive and subsequently rinsed in saline solution (9% NaCl), fixed in 70% alcohol, and stored in the same solution.

For light microscopy, worms were cleared in lactophenol and examined under a microscope (Zeiss, Germany). Drawings were made with a drawing tube attached to a light microscope (Zeiss,Germany) For the identification of nematodes, drawings were compared with those of specialists in parasitic nematodes of fishes [13], [14], [15], [16], [17].

3. RESULTS

Taxonomic summary

Superfamily: Seuratoidea Hall, 1916; **Family:** Cucullanidae Cobbold, 1864; **Genus**: *Cucullanus* Müller, 1777, *Cucullanus cirratus* Müller, 1777. **Host:** *Phycis blennoides* (Brunnich, 1768) (Teleostei: Gadidae-new host record); **Dates of collection**: 25 October 2011 to 7 September 2013; **Locality**: Oran 35°43' N Western Algerian Coast; **Localization:** intestine and rectum; **Prevalence:** 35/110= 31.8%; **Mean intensity**:1.6.

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Description

This is based on 3 specimens (one male and two females): Medium-sized, yellowish-colored nematodes. The cuticle is finely striated transversally except in lateral fields where it is slightly striated; the striae anastomose were at irregular intervals. Cephalic extremity presented the usual features of the genus *Cucullanus*; it is rounded and slightly dorsally bent. The oral opening is dorsoventrally elongated, spindle-shaped like, oblique, being dorsal end posterior to the ventral end. Narrow cuticular flange surround the mouth with a row of numerous small teeth. Two submedian cephalic papillae and a pair of small lateral amphids surround the oral opening (Figure 2a).

Nerve ring is encircled the esophagus and is situated approximately at the first and the second third of esophagus length.

Excretory pore is situated between nerve ring and the junction of esophagus and intestine (its position varies from one specimen to other, slightly anterior or slightly posterior to this limit). Deirids are situated at mid-distance between nerve ring and excretory pore.

The tail of both sexes is conical and pointed.

Male: This has a body length of 7.25 to 10.75 mm, maximum width of 0.155 to 0.257 mm. The length of the esophagus is 0.89 to 1.25 mm. The distance of nerve ring from cephalic extremity is 0.35 to 0.42 mm. Precloacal sucker is present with 10 pairs of caudal papillae, 5 preanal and 5 pairs postanal. All preanal pairs are subventral, with the first two pairs (counting from cloacal opening) located close to each other, and the papillae of the last two pairs surrounding the precloacal sucker. All postanal papillae are lateral except the first and the fifth pair; they are subventral and dorsolateral, respectively. It has equal spicules of 0.45 to 0.98 mm length, well sclerotized, gubernaculum Y shaped, with a length of 0.12 to 0.14 mm. The tail conical length is 0.178to 0.345 mm with pointed tip (Figure 2b).

Female: This has a body length of 10.75 to 17.70 mm, a maximum width of 0.187 to 0.325 mm. Length of entire esophagus is 0.985 to 1.250 mm. Distance of nerve ring from anterior extremity is 0.198 to 0.450 mm. The conical tail is 0.290 to 0.364 mm, with sharply pointed tip (Figure3a). The vulva is not salient and somewhat posterior to the middle of the body. The short vagina is directed interiorly, with the uterus amphidelphic and eggs ovals (Figure 3b).

4. DISCUSSION

Cucullanidae (Cobbold, 1864) are parasites of fishes and rarely reptiles [17]. Most of them are medium or large nematodes mainly characterized by a highly developed cavity formed from the esophagus, a mouth somewhat inclined dorsally and intestinal caecum absent [18]. However, they show many similarities making detailed comparisons among all of them difficult [19]. [20] proposed a classification of the family on the basis of the nature of the hosts, indeed Cucullanidae show very strict host specificity and the great majority of species has been found in phylogenetically related fishes [16], [20], [21].

Taking this into account, we prefer to deal with our parasites according to their host groups, rather than with their zoogeographical region [17], [22]. Our nematodes were directly compared with that so far reported, called *C. cirratus* (type species of the genus *Cucullanus*) common parasite in Atlantic cod *Gadus morhua*. Nevertheless, despite the small size of specimens recovered in the present study, which probably resulted from colonizing an unusual host and the different number of male caudal papillae (10 pairs in the present material against 11 pairs); their morphology and measurements are in overall agreement (especially the position of the deirids that are situated at mid-distance between nerve ring and excretory pore) with the original description of *C. cirratus* [23].

In the Mediterranean Sea, [14] recorded four species of Cucullanidae infecting marine fish; their morphology is rather uniform (Table 1). They all have deirids and excretory pore situated at the same level, 11 pairs of male caudal papillae and a preanal sucker. *Cucullanus micropapillatus* Tôrnquist, 1931 (from *Symphodus cinnereus, Symphodus tinca* and *Symphodus ocellatus*) [24], [13], are tiny nematode not exceeding 5 mm, with deirids and excretory pore which are situated somewhat posterior to the end of the esophagus. *Cucullanus hians* Dujardin, 1845 (from *Conger conger* and *Muraena helena*) occur in the Mediterranean and Adriatic Seas [25], [26]. They are medium sized with thick cuticle, deirids and excretory pore are situated somewhat anterior at the end of the esophagus. Mediterranean *C.cirratus*, *C. micropapillatus* and *C. hians* are provided with a protruding cloacal region considered by [27] to be a valid taxonomic trait. In their description of *Cucullanus faliexae*, a new Cucullanidae species from the marine anguilli-form fish *Gymnothorax javanicus* (Bleeker) from French Polynesia, [27] noted that in addition to *C. faliexae*, there are only four other species of *Cucullanus* with a protruding cloacal region: *C. micropapillatus* Törnquist, 1931, *C. sciaenae* Gupta et Gupta, 1979, *C. theraponi* Rasheed, 1968, and *C. laurotravassosi* Petter and Le

Bel, 1992. However, [28] reported that this feature is characteristic of an additional nine species, of which *C. australiensis* Baylis, 1927, *C. filiformis* Yamaguti, 1935, *C. hians* (Dujardin, 1845), *C. muraenesocis* Yamaguti, 1961, *C. murenophidis* Campana-Rouget, 1957 and *C. robustus* Yamaguti, 1935 were described from marine anguilli-form fishes.

Cucullanus campanae Lèbre and Petter, 1984 (from Solea vulgaris) are medium size nematodes with thick cuticle deirids and excretory pore situated at the level of the end of the esophagus. They occur in the Adriatic Sea. *Cucullanus longicollis* Stossich, 1899 (from *Mullus barbatus* and *Mullus sumuletus*) are found in the Mediterranean and Adriatic seas [24], [29], [13]. They are large nematodes with deirids and excretory pore situated at half length of the esophagus. [25] showed that most *Cucullanus* spp have an excretory pore posterior to the nerve ring using the position of this organ as criteria for classification. Similarly, the present study revealed that the excretory pore of our specimens is located between the nerve ring and the junction of esophagus and intestine that is almost the case of all Mediterranean *Cucullanus* species.

More recently, [30] described a new species of Cucullanidae, *Cucullanus egyptae*, found in the intestine of the European eel *Anguilla Anguilla* at the coast of the Gulf of Suez (Red Sea, Egypt). This species resembles our specimens in body length and width of both sexes, the number and arrangement of caudal papillae and equal length spicules. The new species is closely related to *Cucullanus dodsworthi* Barreto, 1922 as a sister taxon with a high percentage of identity.

Among the earlier congeneric species from the Mediterranean Sea, only *C. longicollis* resembles the present worms both in general morphology and the position of excretory pore. However, the deirids position is different; the size is bigger and moreover, *C. longicollis* are Mullidae specialist nematodes. Some authors even confuse these two species, based on the fact that *C.cirratus* have not been recorded in the Mediterranean Sea, they assigned all Cucullanidae found in this locality from gadoid fishes to *C. longicollis* [31].

Outside the Mediterranean, *C.cirratus* resembles most *Cucullanus dodsworthi* parasite in Checkered Puffer *Sphoeroides testudineus* (Pisces: Tetraodontiformes) from Mexican waters off the Yucatan Peninsula, but it differs in the position of deirids, excretory pore, form of gubernaculum and tail terminus, papillae disposition is noticeably similar. Nevertheless, [32] do not support the possibility that *C. Cirratus* is present in Brazilian waters.

C. cirratus occur from the North Atlantic Ocean and adjacent seas [33], [34] [35], [36], however, no study has revealed their occurrence in the Mediterranean Sea. Thus, our study represents the first report on the occurrence of this species in the Western Mediterranean Sea from *Phycis blennoides.* However, DNA analysis and SEM can provide more informations about this Mediterranean *Cucullanus cirratus*.

Figure 1- Map showing the sampling area

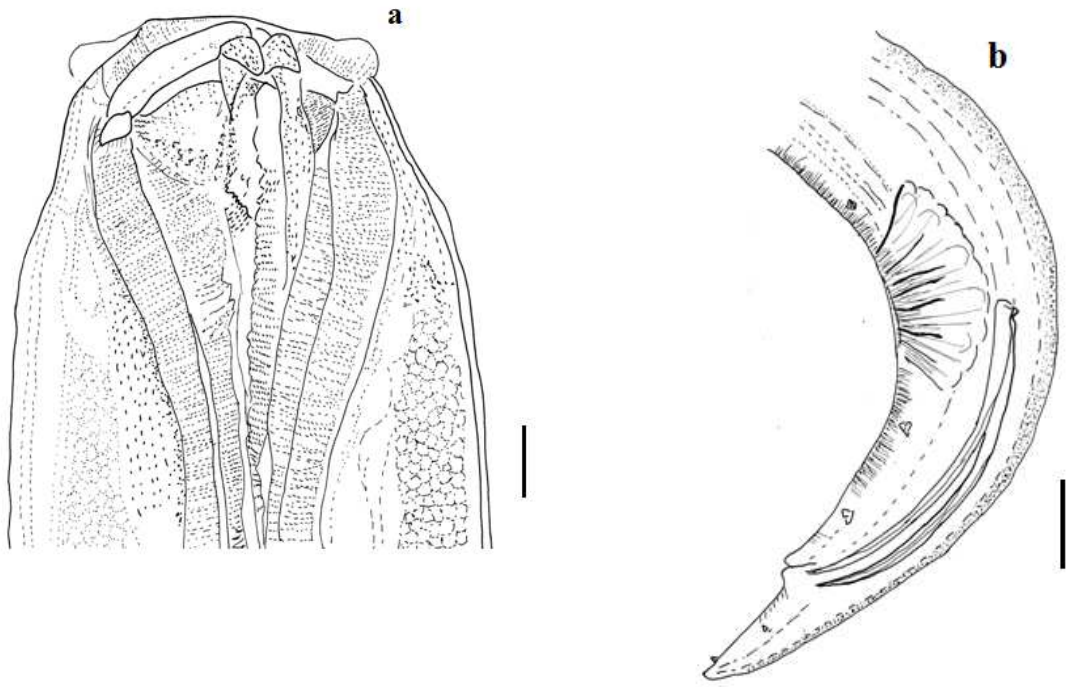

Figure 2- *Cucullanus cirratus*, a. Cephalic end of male. (Scale bar: 50 µm). 2b. Caudal end of male. (Scale bar: 100µm)

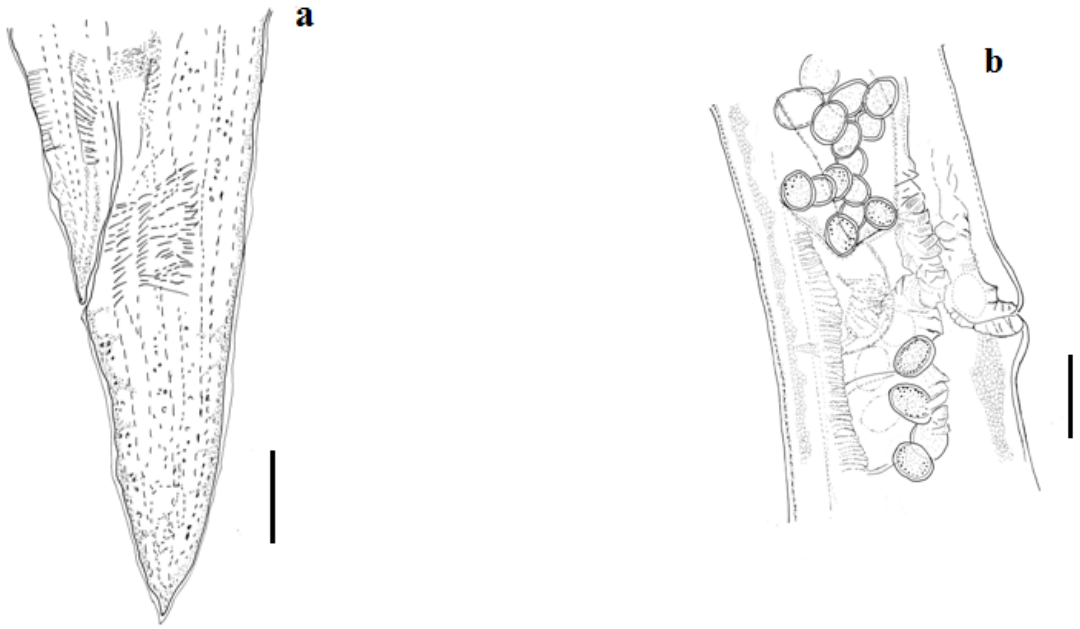

Figure 3- *Cucullanus cirratus*. a. Caudal end of female. b. Vulva region. (Scale bar: 100 µm).

Table 1- Comparative measurements of Mediterranean Cucullanidae species.

	***C.micropapillatus* Tôrnquist, 1931**		***C.hians* Dujardin 1845**		***C.campanae* Lèbre & Petter, 1984**		***C.longicollis* Stossich, 1899**	
Measurements	♂	♀	♂	♀	♂	♀	♂	♀
Body lenght mm	3-3.5	4.5-5	11-13	18-21	3-3.5	4-4.5	18-20	25-30
Body width µm	171		215		165		420	
Oesophagus lenght µm	510		580		530		1150	1400-1775
Cephalic extremity – nerve ring distance µm	180		225		245		500	820-900
Tail length µm	90	115	195	225			300	350-475
Gubernaculum length µm	100		315				660	
Spicule lenght µm	350-400		600-1260		600-875		730-1020	

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