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**Light and Scanning Electron Microscopy on *Cucullanus aliyai* Akhtar and Mujib (2012) (Nematoda: Cuculanidae) From the Rabbitfish *Siganus canaliculatus* of The Red Sea, Egypt**

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**ABSTRACT**

In the present study, new host and locality records of *Cucullanus aliyai* Akhtar and Mujib (2012), a cuculanid nematode isolated from the intestine of the rabbitfish, *Siganus canaliculatus* collected from the Red Sea, coasts of Hurghada city, Egypt during the period from January to September 2017. Fifteen out of 55 (27.3%) of the examined fish were infected. Worms were recorded by naked eyes on the flesh, stomach, intestines, as well as body cavities of the infected fish. Light and scanning electron microscopy revealed that the isolated worms possessed the important criteria characteristic for members of family Cuculanidae: dimensions of oesophagus, spicules, mucron, size of pseudobuccal capsule, eggs, the position of deirids, excretory pore and vulva, numbers and arrangement of caudal papillae, host groups and zoogeographical regions. The recorded parasite was whitish and small-sized, female worms were  $9.40 \pm 2$  (7.4-10.3) x  $2.5 \pm 0.2$  (2.00-2.60) mm while male worms were  $6.30 \pm 0.02$  (6.00-8.30) mm x  $1.60 \pm 0.02$  (1.59-1.73) mm. Oral aperture was dorsoventrally elongate, slit-like, surrounded by distinct collarette, beared one row of small denticles on its inner surface; four submedian cephalic papillae and a pair of prominent lateral amphids present. Oesophagus was of two distinct portions: anterior pseudobuccal capsule measured  $0.50 \pm 0.02$  (0.47-0.053) mm in length, narrowing immediately below nerve ring; and posterior with a club-shaped muscular structure measured  $0.45 \pm 0.02$  (0.41-0.49) mm in length

**INTRODUCTION**

Nematodes represent the most frequent and the most important parasites of fishes in the freshwater, brackish-water and marine environments throughout the world (Moravec, 2007). Although many species were recorded worldwide, the progress in the research of fish nematodes has been achieved during recent years. Adult nematodes are found in the intestine of fish, while larval stages are sometimes found on the flesh and viscera causing severe diseases and economical losses (Moravec *et al.*, 2005, Timi & Lanfranchi, 2006 and Moravec *et al.*, 2008). The larval stages are infective to humans and have the greatest impact on consumer acceptance of fish as a source of protein (Moravec, 1994 and Dick & Choudhury, 1995).

The genus *Cucullanus* Müller (1777) includes over 100 nominal parasitic species in marine and freshwater fishes, and in aquatic turtles (Dick & Choudhury, 1995, Costa *et al.*, 2004, Moravec *et al.* 2005, 2007, Timi & Lanfranchi 2006 and Kinoshita *et al.* 2014). Taxonomically, the morphological characters such as dimensions of the body, oesophagus, spicules, size of pseudobuccal capsule, eggs, the position of deirids, excretory pore, vulva, numbers, and arrangement of caudal papillae, host groups and zoogeographical regions are important criteria for differentiating and identifying *Cucullanus* species (Moravec *et al.*, 1993, 1997, 2005, Caspeta-Mandujano *et al.*, 2000 and Li *et al.*, 2015). During a recent survey on parasitic helminths infecting marine fishes, nematode parasites were isolated from the rabbitfish *Siganus canaliculatus* (Perciformes: Siganidae) from the Red Sea, coasts of Hurghada city, Egypt during the period from January to September 2018. They were identified morphologically and morphometrically by light and scanning electron microscopy.

#### MATERIALS AND METHODS

A total of fifty-five specimens the rabbitfish *Siganus canaliculatus* (Perciformes: Siganidae) were randomly collected from the Red Sea, coasts of Hurghada city, Egypt during the period from January to September 2017. Fish were transported alive to the laboratory using small containers containing seawater with aeration. Fish were dissected and examined thoroughly for nematode endoparasites using a stereomicroscope. Worms were isolated and washed in a physiological saline 0.6 % followed by relaxation and fixation in 70% hot ethyl alcohol. They were cleared and then mounted in lactophenol. Photomicrographs were taken using Zeiss Axiovert 135 microscope supplied with a Canon Digital Camera. Measurements were presented as mean±S.D. (range). For scanning electron microscopy, specimens were fixed in 4% buffered glutaraldehyde, washed in

cacodylate buffer, and dehydrated in alcohol. After passing through an ascending series of Genosolv-D, specimens were processed in a critical point drier "Bomer-900" with freon 13, sputter-coated with gold-palladium in a Technics Hummer V, and examined with an Etec Autoscan at 20 kV Jeol scanning electron microscope.

#### RESULTS

*Cucullanus aliyaii* Akhtar and Mujib (2012)  
Nematoda: Cuculanidae

15 out of 55 specimens (27.3%) of the examined fish were found to be naturally infected with nematode parasites. The infection was recorded in the intestine of the host fish. The adult worms were relatively small, slender, whitish with a broad anterior end. Oral opening dorsoventrally elongated, surrounded by narrow membranous flange or collarete and supported by a ring of numerous teeth (Figs.1,2,8,9). Four submedian cephalic papillae and a pair of prominent lateral amphids were observed (Figs.1, 8). Esophagus consisted of two distinct portions: anterior end with sclerotized lining expanded anteriorly to form a pseudobuccal capsule, narrowed immediately below the nerve ring; while the posterior end was muscular with a claviform aspect and opened into the intestine through valves. The pseudobuccal capsule or esophastome was wider than the posterior part of esophagus. The entire esophagus of female worms measured  $0.95\pm 0.02$  (0.83-1.00) mm in length, length of the pseudobuccal capsule was  $0.50\pm 0.02$  (0.47-0.053) mm with a maximum width was  $0.11\pm 0.02$  (0.07-0.13) mm, while in males, the entire esophagus was  $0.65\pm 0.02$  (0.54-0.89) in length, terminated at a posterior club-shaped muscular part measured  $0.45\pm 0.02$  (0.41-0.49) mm in length and  $0.12\pm 0.02$  (0.10-0.15) mm in width. Body covered by cuticle which was transversely striated (Figs.3,11).

#### Male:

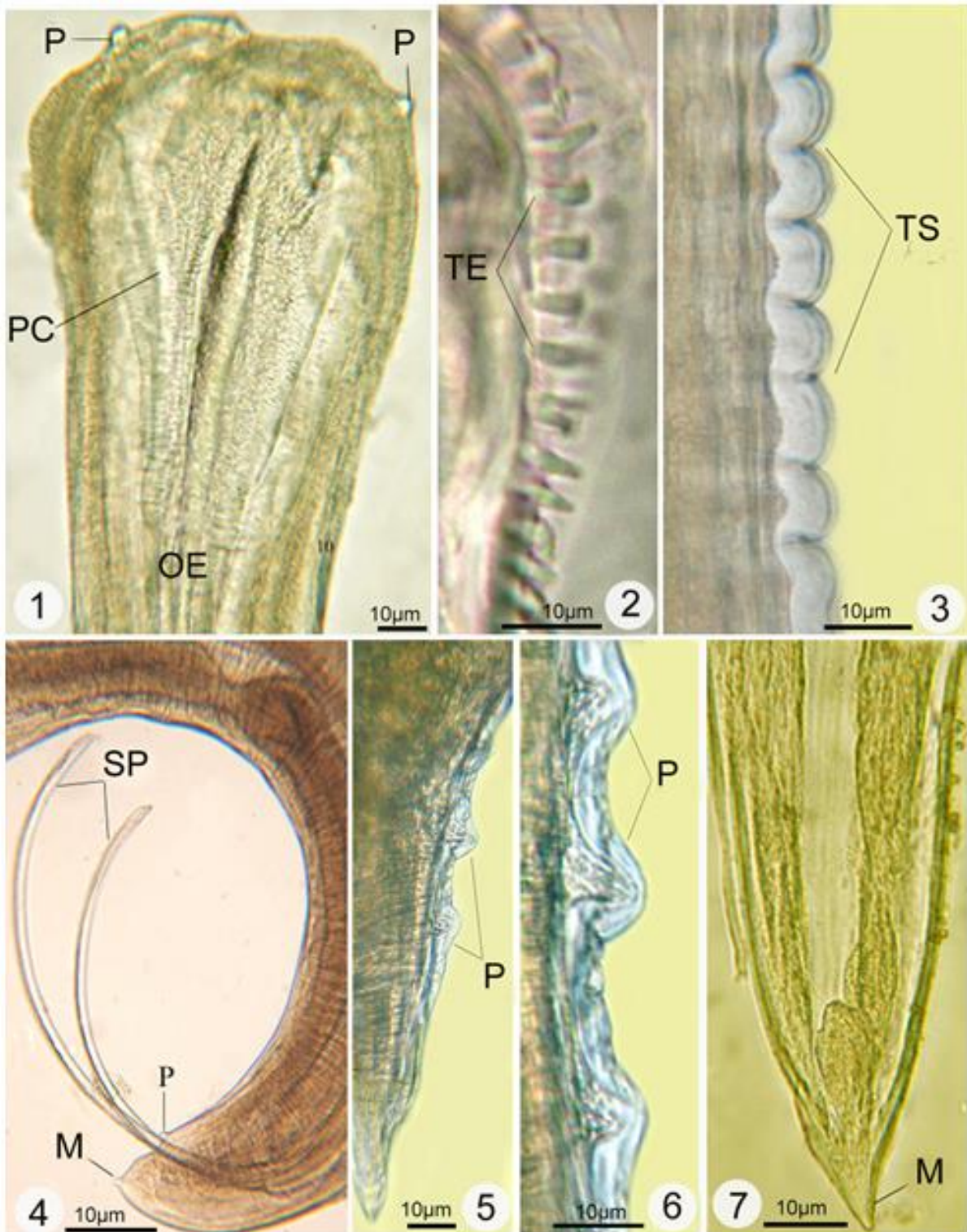
Body smaller than those of female worms, it was about  $6.30\pm 0.02$  (6.00-8.30) mm long and  $1.60\pm 0.02$  (1.59-1.73) mm wide with

two sub-equal spicules measured  $1.20 \pm 0.02$  (1.18-1.2) mm long (Fig. 4). Terminal papillae were observed (Fig. 5, 6, 12).

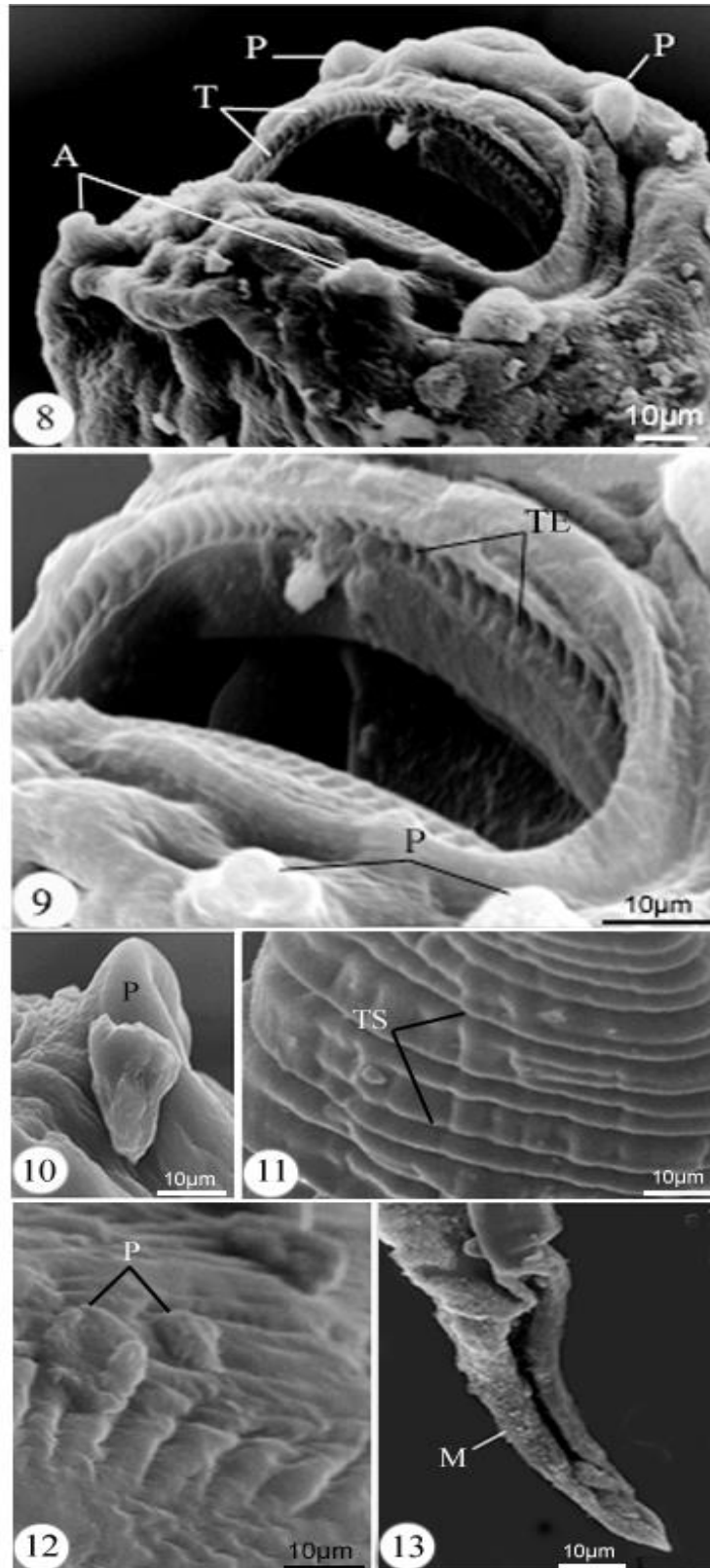
**Female:**

Body long with pointed posterior end and a broad anterior end measured  $9.40 \pm 2$  (7.4-10.3) mm in length and  $2.5 \pm 0.2$  (2.00-2.60) mm in width, with broadly conical tail or

mucron (Figs. 7, 13). The vulva was post equatorial, with vulvar lips elevated at a distance of  $3.80 \pm 0.02$  (3.82-4.10) mm from the anterior extremity. Vagina long, with muscular tube and directed upward. Uterus thin-walled contained numerous relatively large, thin-shelled eggs.



**Figs. 1-7:** Photomicrographs of the nematode *Cucullanus aliyai* (F: Cucullanidae) infecting the rabbitfish *Siganus canaliculatus*. **1:** The broad anterior part of the worm as a club shaped pseudobuccal capsule (PC), equipped with cephalic papillae (P), a muscular oesophagus abbreviated as (OE). **2-7:** High magnifications of: **2:** pseudobuccal capsule teeth (TE). **3:** Transverse striations of cuticle (TS); **4:** Posterior end of male with two long spicules (SP) and a short mucron (M); **5, 6:** Caudal papillae (P) of male; **7:** Posterior end of an adult female terminated at a mucron (M).



**Figs.8-12:** Scanning electron micrographs of the parasite showing high magnifications of: **8, 9:** The anterior part of the worms showing the row of teeth (TE) lining the pseudobuccal capsule. Also, four cephalic papillae (P) and amphids (A) were observed; **10:** Papilla (P); **11:** Transverse striations (TS) of cuticle; **12:** papillae (P) at posterior end of male; **13:** Posterior end of female terminated at a mucron (M).

## DISCUSSION

Cucullanidae Cobbold (1864) includes intestinal nematodes characterized by a highly developed buccal cavity formed by the esophagus as described by Berland (1970), and males with or without a pre-cloacal sucker harboring 10–15 pairs of caudal papillae (Maggenti, 1971). About 100 species of *Cucullanus* have been described from fishes of different orders of which at least 70 species were collected from marine or brackish water fishes (González-Solís *et al.*, 2007 and Moravec *et al.*, 2008). Yamaguti (1961) listed 60 species within the genus *Cucullanus* including the genotype. In addition, Gupta and Masoodi (1982) described *C. sootai* and listed another 30 species, including *C. rituali* (Karve, 1952); *C. jaiswali* (Ali, 1956); *C. indica* (Agrawal, 1965); *C. pseudotropi* (Agrawal, 1967); *C. arabianse* (Petter, 1974); *C. tharaponi* (Rasheed, 1968); *C. pangasius* (Soota and Chaturvedi, 1971); *C. jalnaensis*; *C. alii*; *C. malvanae*; *C. tachysuri* (Kalyankar, 1971); *C. bilqeesi*, (Bilqees *et al.*, 1971, Petter, 1974); *C. carioca* (Vicente and Fernandes, 1973); *C. rougetae* (Vicente and Santos, 1974); *C. bagrae* (Petter, 1974); *C. karachii* (Zaidi and Khan, 1975); *C. olivaceus* (Akram, 1976); *C. guerrori* (Arya and Jhonson, 1975); *C. ariusi* (Srivastava and Gupta, 1976); *C. sciaenai* (Gupta and Gupta, 1979); *C. rivulatus* (Soota and Dey Sarkar, 1980); *C. trichiurisi*; *C. simhai* (Gupta and Naqvi, 1983); *C. thapari*; *C. mastacembeli* (Gupta and Srivastava, 1984). Later on more species have been described both from freshwater and marine fishes of various localities including *C. rhamphichthidis* (Moravec, 1979); *C. campanae* (Labre and Petter, 1984); *C. fugianensis* (Wang, 1984); *C. brevispiculus* (Moravec *et al.*, 1993); *C. riograndensis*; *C. fabrigasi* (Fortes *et al.*, 1993a, b); *C. mexicanus* (Capseta-Mandujanoi, 2000). The fish fauna of the Red Sea is highly enriched and nearly 500 species of bony, as well as cartilaginous fish, were recorded from different coasts. The study of the Fish parasites in the Red Sea

waters has been evoked recently for the last three decades. Many investigations have been triggered from the coasts of the Arabian Gulf as (Bayoumy *et al.*, 2008, Khalil *et al.*, 2014 *et al.*, 2016 and Abdel-Baki *et al.*, 2017). According to Moravec *et al.* (1993), the genus *Cucullanus* includes several species that bear many similarities. Due to minute differences in the morphology and because of inadequate descriptions, a detailed comparison among species is very complicated. Therefore, some authors prefer to deal with these parasites according to their host groups (Petter, 1974, Moravec *et al.*, 2005, 2008, González-Solís *et al.*, 2007 and López-Caballero *et al.*, 2009) or their zoogeographical region (Moravec *et al.*, 1997, Sardella *et al.*, 1997, Caspeta-Mandujano *et al.*, 2000, Daniel *et al.*, 2002 and Lafranchi *et al.*, 2004). The data obtained in the present study by light and scanning electron microscopy revealed that the pseudobuccal capsule (oesophastome) of the recorded parasite is wider than the posterior part of the oesophagus, with a continuous row of teeth. Also, the surface nature and morphology of parasitic worms seem to be important in the intricate relationship between these organisms and their hosts, the cuticle has rugae or folds that described as transverse ridges and an external raised incomplete annulations; branched and interrupted on the cuticle surface. The female tail has a pair of sensory papillae situated in a ventrolateral position, which represent the phasmids and they are considered to be comparable to the amphids seen on the head and may have both a glandular and sensory function in agreement with (Melarn, 1976). By comparison with similar previously recorded species such as *C. longicollis* Bayoumy *et al.* (2008) infecting *Mullus surmuletus*, it was observed that it has markedly longer spicules; 2 pairs of triangular teeth and a row of sensitive papillae along the body, which are not observed in the parasite recorded (Petter 1974, Ivashkin & Khromova 1976 and González-Solís *et al.*,

2007). The chitinous triangular teeth are probably used during penetration into and migration through the intestinal wall of the fish host; while the row of sensitive papillae served for orientation during sexual intercourse. Also, in comparison with *C. aliyai* (Akhtar and Mujib (2012) recorded from *Otolithus ruber*, the parasite recorded in the present study had a body dimension larger than those of *C. aliyai* but they are much similar with it in the shape of the mouth opening, arrangement of teeth and cephalic papillae, these features guide the classification of the present species belonging to genus *Cucullanus*.

### Conclusion

The parasite recorded in the present study possessed all of the characteristics features of family Cucullanidae, and by comparison with the most similar species to the present parasite, it was observed that it is similar in morphology to *C. aliyai* and *C. longicollis* in general and it is closely similar to *C. aliyai*. So, it is concluded that the present parasite should be classified as *C. aliyai* with new host and locality records in Egypt.

### REFERENCES

- Abdel-Baki, A.S.; Al Ghamdi, A.; Al-Quraishy, S. (2017): First record of three African trichodinids (Ciliophora: Peritrichida) in cultured Nile tilapia (*Oreochromis niloticus*) in Saudi Arabia with re-evaluation of their host specificity. *Parasitol. Res.*, 116(4):1285-1291.
- Akram, M. (1975): A new nematode from the marine fish of Karachi Coast. *Sindh Uni. Res. J.*, 9: 89-91.
- Akhtar, Y. and Mujib F. (2012): A new species of *Cucullanus* (nematode: Cucullanidae) from edible fish *Otolithus ruber* (Sciandae) based on light and scanning electron microscopy. *Curr. Nematol.*, 23 (1,2): 33-40
- Akram, M. (1976): A new nematode from the marine fish of Karachi coast. *Sindh Univ. Res. Jour. (Sci. Ser.)* 9: 89-91.
- Agarwal, V. (1965): Some new nematode parasites from fresh water fishes of Lucknow *Indian. J. Helminth.*, 17: 1-17.
- Ali, S.M. (1956): Studies of the nematode parasites of fishes and birds found in Hyderabad. *Indian. J. Helminth.*, 8: 1-83.
- Arya, S. N. and Johnson, S. (1975): A new Cucullanoid nematode from *Cybium guttatum* from Indian water (Spiruroidae, Cucullanidae) *M. Sociedad de Ciencias Naturales La Salle*, 35(102): 291-295.
- Bayoumy, E.M.; AbdEl-Monem, S. and Ammar, A.K. (2008): Ultrastructural study of some helminth parasites infecting the goatfish, *Mullus surmuletus* (Osteichthyes: Mullidae) from Syrt coast, Libya. *J. Life. Sci.*, 5(1): 17 – 24.
- Berland, B. (1970): On the morphology of the head in four species of Cucullanidae. *Sarsia*, 43: 15–64.
- Bilqees, F. M., Khanum, Z. and Jehan, Q. (1971): Marine fish Nematodes of West Pakistan I. Description of seven new species of Karachi coast *J. Sci. Karachi*, 1 (1) : 175-184.
- Caspeta-Mandujano, J. M., Moravec, F. and Aguilar-Aguilar, R. (2000): *Cucullanus mexicanus* sp. n. (Nematoda: Cucullanidae) from the intestine of the freshwater catfish *Rhamdia guatemalensis* (Pimelodidae) in Mexico. *Helminthologia*, 37: 215–217.
- Cobbold, T.S. (1864): Entozoa: An introduction to helminthology with reference, more particularly, to the intestinal parasites of man. London, 1-480.
- Costa, G.; Madeira, A.; Pontes, T. and D'Amélio, S. (2004): Anisakid nematodes of the blackspot seabream, *Pagellus bogaraveo*, from Madeiran waters. Portugal. *Acta Parasitol.*, 49: 156-161.
- Daniel V.I.; Timi J.T. and Sardella, N.H. (2002): *Cucullanus marplatensis* sp. nov. (Nematoda, Cucullanidae) parasitizing *Odontesthes argentinensis* (Valenciennes, 1835) (Pisces, Atherinidae) from Argentinian waters. *Acta Parasitol.*, 47: 41–46.



- Dick, T.A. and Choudhury, A. (1995): Phylum Nematoda. In: Fish Diseases and Disorders Volume I Protozoon and Metazoon Infection (ed. Woo PTK Cambridge University Press. Cambridge, UK). pp., 415-446.
- Fortes, E.; Hoffmann, R.P. and Sarmento, J.M. (1993a): Nova especie de nematodeo *Cucullanus*, *C. riograndensis* sp. n., de *Pimelodus maculatus* Laeepede, 1803(Pisces), do Lago do Guiba, Rio Grande do Sul, Brasil. *Rev. Bras. Med. Vet.*, 15: 79-82.
- Fortes, E.; Hoffmann, R.P. and Sarmento, J.M. (1993b): *Cucullanus fabrigasi* sp.n. nematoda parasita do intestino do peixe *Pimelodus maculatus* (Lacepede, 1803) do Rio Guaiba, Poroto Alegre, Rio Grande do Sul, Brasil. *Arq. Fac. Veter. UFRGS.*, 21: 71-76.
- González-Solís, D.; Tuz-Paredes, V. M.; and Quintal-Loria, M. A. (2007): *Cucullanus pargi* sp. n. (Nematoda: Cucullanidae) from the grey snapper *Lutjanus griseus* off the southern coast of Quintana Roo, Mexico. *Folia Parasitol.*, 54: 220–224.
- Gupta, S. P. and Gupta, R. C. (1979): On some nematode parasites of marine fishes. *Indian J. Helminth.*, 29: 104-112.
- Gupta, P.C. and Masoodi, B.A. (1982): Three new and one known piscine nematodes from Kanpur. *Kanpur Univ. Res. J.*, (Sci.) 3:57-70.
- Gupta, S.P. and Naqvi, N.H. (1983): Nematode parasites of fishes. VIII. On two new species of the genus *Indocucullanus* Ali, 1956 from fishes. *Indian. J.Helminth.* 34(1): 78-85.
- Gupta, S.P. and Srivastava, A.B. (1984): On three new nematode parasites (Nematoda: Cucullanidae) from Indian fishes. *Acta Parasitol. Polonica*, 29(10): 77-84.
- Ivashkin, V.M. and Khromova, L.A. (1976): *Cucullanata* and *Gnathostomatata* of animals and man and the diseases caused by them *Osnovy nematologii* 27. Nauka, Moscow, 436 pp. (In Russian.)
- Kalyankar, S. D. (1971): On some nematodes from Indian with the description of a new species (Ascaridodidea: Stomachidae). *Riv. Parasitol.*, 33: 203-208.
- Karve, J. N. (1952): Some parasitic nematode of fishes. III. *J. Univ. Bombay*, 21 (3): 1-14.
- Khalil, M.I.; El-Shahawy, I.S. and Abdelkader, H.S. (2014): Studies on some fish parasites of public health importance in the southern area of Saudi Arabia. *Rev Bras Parasitol Vet.*, 23(4):435-42.
- Kinoshita, Y.; Fujimoto, K.; Lee, M.; Shinohara, R.; Kobayashi, Y.; Kawana, S. and Saeki, H. (2014): Two cases of allergies due to *Anisakis simplex*, positive to specific IgE for ani S 12 allergen. *Alerugi*, 63(10):1348–1352.
- Lebre, C. and Peter, A. J. (1984): *Cucullanus campanae* n. sp. (Cucullanidae, Nematoda), a parasite of *Solea vulgaris vulgaris*. *Bull. Du Mus.d'Histoire Naturelle*, 6: 999-1005.
- Lanfranchi, A. L.; Timi, J. T. and Sardella, N. H. (2004): *Cucullanus bonaerensis* n. sp. (Nematoda: Cucullanidae) parasitizing *Urophycis brasiliensis* (Pisces: Phycidae) from Argentinean waters. *J. Parasitol.*, 90: 808–812.
- Li, L.; Zhao, W.T.; Guo, Y.N. and Zhang, L.P. (2015): Nematode parasites infecting in the starry batfish *Haliutaea stellata* (Vahl) (Lophiiformes: Ogcocephalidae) from the East and South China Sea. *J. Fish. Dis.*, 39(5):515-29.
- Lopez-Caballero, J., Osorio-Sarabia, D., and Garcí'a-Prieto, L. (2009): *Cucullanus costaricensis* n. sp. (Nematoda: Cucullanidae), a parasite of *Bagre pinnimaculatus* (Siluriformes: Ariidae) from Río Tempisque, Costa Rica. *J. Parasitol.*, 95: 413–423.
- Maggenti A.R. (1971): Review of the family Cucullanidae Cobbold, 1864 and the genus *Bulbodacnitis* Lane, 1916 with a description of *Bulbodacnitis ampullostoma* sp. n. (Nematoda:

- Cucullanidae) from *Salmo gairdnerii* Richardson. Proc. Helminthol. Soc. Wash., 38: 80–85.
- Melaren, D.J. (1976): Sense Organs and Their Sections. In: The Organization of Nematodes (Ed, Coll A). Academic Press., 139 – 161.
- Moravec, F. (1979): Observation on the development of *Cucullanus* (*Truttaedacnitis*) *truttae* (Fabricius, 1794) (Nematoda: Cucullanidae) Folia Parasitol., 26: 295-307.
- Moravec, F. (1994): Parasitic Nematodes of Freshwater Fishes of Europe. Kluwer Academic Publishers. London, UK.
- Moravec F (2007): Nematode parasites of fishes: recent advances and problems of their research. Parassitologia, 49(3):155-60.
- Moravec, F.; Kohn, A., and Fernandes, B. M. M. (1993): Nematode parasites of fishes of the Parana´ River, Brazil. Part 2. Seuratoidea, Ascaridoidea, Habronematoidea and Acuarioidea. Folia Parasitol., 40: 115–134.
- Moravec, F., Kohn, A., and Fernandes, B. M. M. (1997): New observations on seuratoid nematodes parasitic in fishes of the Parana´ River, Brazil. Folia Parasitol., 44: 209–223.
- Moravec, F., Lorber, J., & Konecny, R. (2008): *Cucullanus maldivensis* n. sp. (Nematoda: Cucullanidae) and some other adult nematodes from marine fishes off the Maldive Islands. Sys. Parasitol., 70: 61–69.
- Moravec, F., Sasal, P., Wu´rtz, J., and Taraschewski, H. (2005): *Cucullanus oceaniensis* sp. n. (Nematoda: Cucullanidae) from Pacific eels (*Anguilla* spp.). Folia Parasitol., 52: 343–348.
- Petter, A.J. (1974): Essai de classification de la familli des Cucullanidae. Bull. Mus. Natl. Hist. Nat. Paris, Series 3, Zoologie, 177: 1469-1491.
- Rasheed, S. (1968): The nematodes of the genus *Cucullanus* Muller, 1777, from the marine fish of Karachi coast. An. Esc. Nac. Cienc. Biol. Mex., 15: 23-59.
- Sardella, N. H.; Navone, G. T., and Timi, J. T. (1997): A new species of *Cucullanus* (Nematoda: Cucullanidae) parasite of *Genypterus blacodes* and *G. brasiliensis* (Pisces: Ophidiidae) in the South West Atlantic. Parasite, (4): 41–47.
- Soota, T. D. and Chaturvedi, Y. (1971): On five new nematodes from vertebrates. Zool. Anz., 187: 310-317.
- Soota, T. D. and Dey Sarkar, S. R. (1980): On three species of the nematode genus *Cucullanus* Mueller, 1777, and a note on *Lappetascaris lutjani* Rasheed, 1965, from Ind. Mar. fish. Rec. Zool. Surv. India., 76:1-6.
- Srivastava, A. B. and Gupta, S. P. (1976): Nematode parasites of fishes 2. On two new species of *Indocucullanus* Ali, 1956. Japan J. Parasit., 26:46-48.
- Timi J.T. and Lanferanchi A.L. (2006): A new species of *Cucullanus* (Nematoda: Cucullanidae) parasitizing *Conger orbignianus* (Pisces: Congridae) from Argentinean waters. J. Parasitol., 92: 151–154.
- Vicente, J.J. and Fernando, B.M.M. (1973): On a new nematode of the genus *Cucullanus* Mueller, 1777, parasite of Norurado fish ( Nematoda: Camallanoidae). Atas de Sociedade Biol. Rio. Janerio., 17: 31-33.
- Vicente, J.J. and Santos, E. Dos. (1974): Helminth of fish from the north Flumineuse litoral. Mem. Inst. Oswaldo Cruz., 27: 173-180.
- Wang, P.Q. (1984): Descriptions of three new species and a list of parasitic nematodes from vertebrates in Fujian province. Wuyi Sci. J., 4: 113-132.
- Yamaguti, S. (1961): Systema helminthum , Vol. III, Part 1 and 2, The nematodes of vertebrates , Interscience Publ. New York.
- Zaidi, D. A. and Khan, D. (1975): Nematode parasites from fishes of Pakistan. Pakistan. J. Zool., 7: 51-73.