# *NEOECHINORHYNCHUS RAFIAE* SP. N. (ACANTHOCEPHALA: NEOECHINO-RHYNCHIDAE) FROM *MUGIL CEPHALUS* LINN., 1758 IN KARACHI COAST, PAKISTAN

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**ABSTRACT**

*Mugil cephalus* Linnaeus, 1758 is found in coastal subtropical and tropical waters around the world, being an important variety of fish. It is fished as well as farmed. A new species of thorny-headed worm (Acanthocephala: Neoechinorhynchidae) namely *Neoechinorhynchus rafiae* is being reported. The genus is distributed worldwide and parasitizes turtles and fish which is being reported from Karachi coast, Sindh, Pakistan. The new species *N. rafiae* has unique characteristics of the hooks of first and second row/circle of the same size thus differs from its congeners on this important character. The present species comes close to *N. oreini* Fotedar, 1968 but differs in a number of characters. The prominent feature observed in the present species is the presence of para-receptacle structure (PRS) prominent along ventral side of receptacle.

**Keywords:** *Neoechinorhynchus rafiae* sp.n., *Mugil cephalus*, Karachi coast, Pakistan.

## INTRODUCTION

Mullets are fish of the family Mugilidae which usually feed on zooplankton and algae. *Mugil cephalus* (Linnaeus, 1758) is found in coastal subtropical and tropical waters (Zahid *et al.*, 2015). It is an important food fish and is fished as well as farmed (FAO, 2016). Its roe is salted, dried and compressed as a speciality food in Italy, Japan, Korea, Turkey and Egypt. Fried Mullet is the most popular form but canned, baked and smoked are also popular in fish food outlets. Mullet are usually filleted and the remaining frames are mostly used for fish stock in stews and chowders (Anonymous, 2007). *Mugil cephalus* is a popular food item in the province of Sindh. Therefore, the interest was developed to investigate this fish for the presence of Acanthocephala parasites.

## MATERIALS AND METHODS

Fish (*Mugil cephalus* Linnaeus, 1758) were caught alive in January 2019 and brought to Parasitology Laboratory, Department of Zoology, University of Karachi, Pakistan. The fish were dissected and examined for collection of Acanthocephala parasites. During examination five parasites were recorded from a single fish small intestine. These specimens were fixed in cold 70% ethanol so that the proboscis come out of the body. Later these specimens were gently pressed between two slides for 24 hours and fixed in F.A.A solution, stained with Mayer's carmalum, dehydrated in graded series of alcohol, cleared in clove oil and rinsed in xylene. Finally, the specimens were permanently mounted in Canada balsam for further study, drawing were made with the aid of camera Lucida. Measurements are in millimeters (mm) and length by with. Photomicrographs were prepared using Nikon photomicroscope. Holotype and Paratype slides are in collection of senior author (F.S).

## RESULTS

***Neoechinorhynchus rafiae* sp.n.**
**(Figs. 1-3)**

Host: *Mugil cephalus* Linnaeus, 1758
Location: Small intestine
Locality: Karachi coast (24°51′ 39.4776N and 66°59′ 25.8036″E) Pakistan
No. of specimens recovered: 8 from 3 hosts
No. of hosts examined: 10

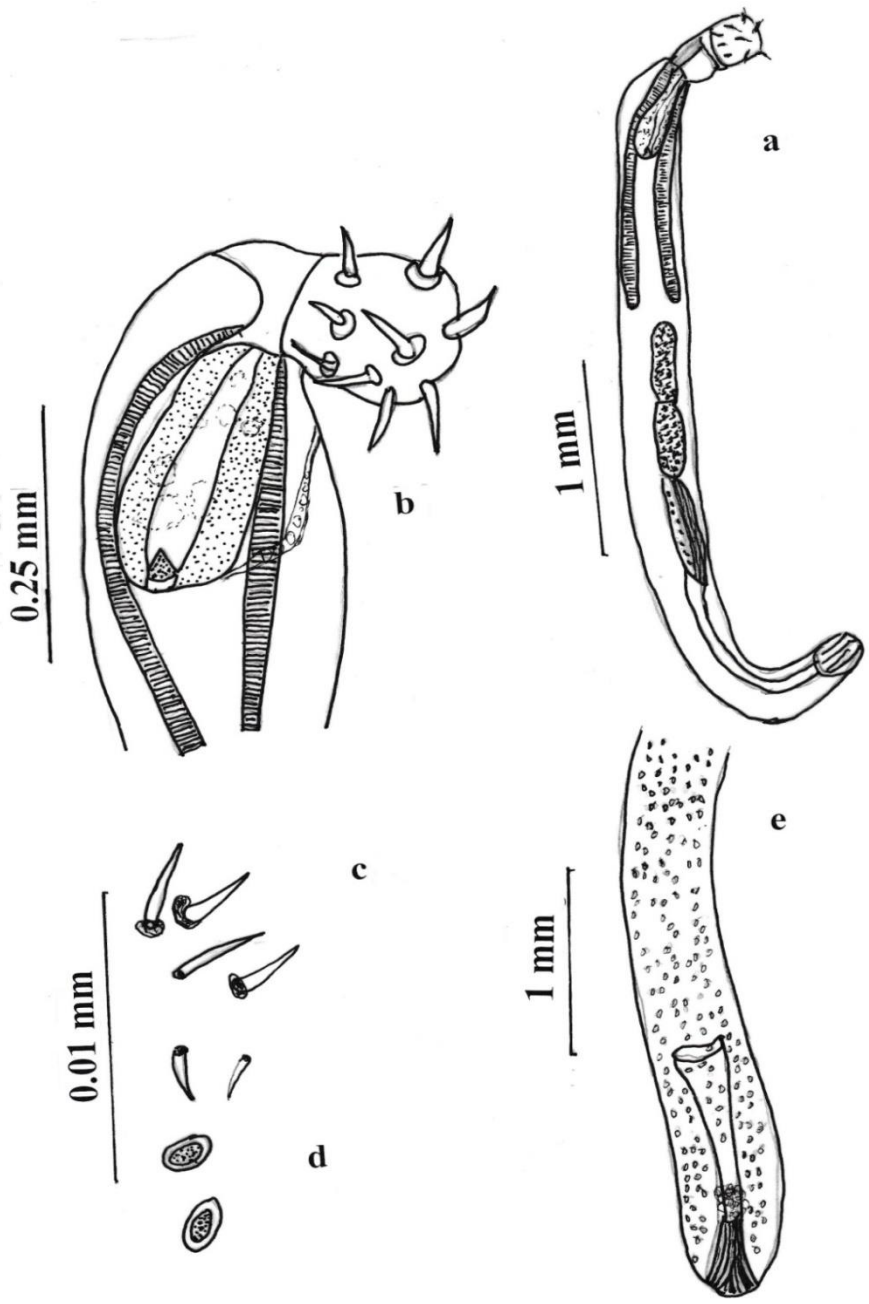


**Fig. 1.** *Neoechinorhynchus rafiae* sp.n., **a.** Entire specimen, holotype; **b.** Anterior end; **c.** Hooks enlarged; **d.** Eggs; **e.** Posterior end of female.

## DESCRIPTION

Neoechinorhynchidae, Neoechinorhynchinae with characters of the genus. Trunk medium size with sexual dimorphism in common characters. Widest in testicular region in males and in females just behind proboscis receptacle. Body medium size and cylindrical. Male posterior end slightly curved. Shared characters slightly larger in females as compared to males. Giant nuclei not marked. Proboscis small in size as compared to trunk. Proboscis hooks in all the three circles with roots. Proboscis hooks of first and second circle almost same in size. Neck short. Proboscis receptacle elongated with single wall with triangular cephalic ganglion at its base. Para-receptacle structure seen along ventral side of proboscis receptacle both in male and female specimens. Eggs without polar prolongation of the fertilization membrane. Lemnisci slightly subequal and elongated.

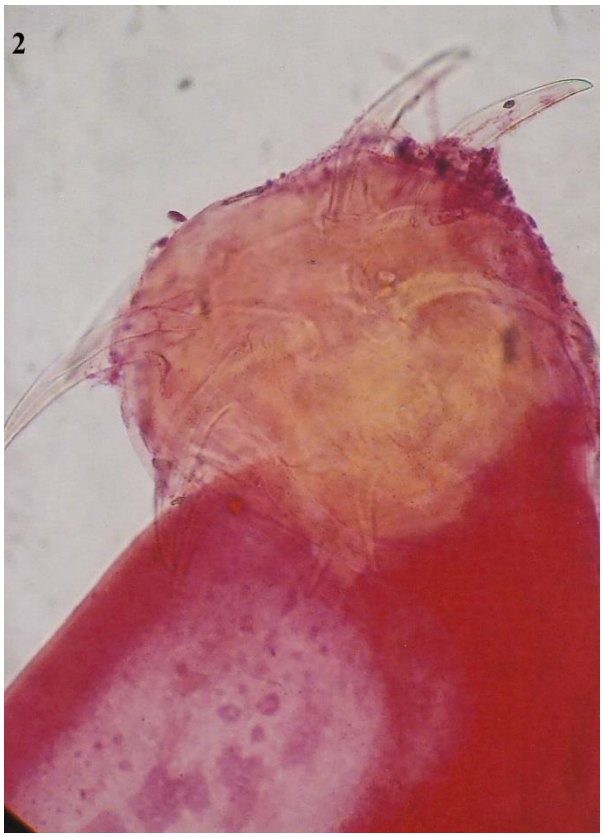



**Fig. 2:** Photomicrograph showing rows of hooks (x 400).
**Fig. 3:** Photomicrograph showing anterior region of the thorny-headed worm (x 100).

**Male (based on six mature specimens).** Body size 4.0-4.6 by 0.22-0.27. Proboscis small in size measuring 0.24-0.27 by 0.20-0.22. Hooks of first row measuring 0.013-0.015 by 0.0017-0.0019; second row 0.013-0.015 by 0.0017-0.0018 and third row 0.0076-0.0078 by 0.0014-0.0017. Neck 0.072-0.015 by 0.18-0.23. Proboscis receptacle 0.30-0.42 by 0.18-0.22. Lemnisci left 1.25-1.29 by 0.08-0.11. Lemnisci right 1.25-1.28 by 0.08-0.11. Testis anterior 0.31-0.38 by 0.14-0.18. Testis posterior 0.31-0.38 by 0.14-0.18. Cement gland elongated measuring 0.38-0.42 by 0.07-0.08. Saeftigen's pouch measuring 0.36-0.41 by 0.07-0.08. Cement reservoir elongated measuring 0.75-0.78 by 0.09-0.12. Bursa eversible measuring 0.25-0.28 by 0.16-0.19.

**Females (based on two mature specimens).** Body size 5.4-5.8 by 0.47-0.59. Proboscis 0.25-0.27 by 0.22-0.23. Hooks of the first row measuring 0.014-0.016 by 0.0017-0.0019; hooks of second row measuring 0.014-0.015 by 0.0017-0.0019 and the third row measuring 0.0077-0.0078 by 0.0015-0.0018. Neck 0.079-0.16 by 0.18-0.23. Proboscis receptacle 0.30-0.42 by 0.21-0.23. Lemnisci left 1.26-1.28 by 0.08-0.11. Lemnisci right 1.26-1.28 by 0.08-0.11. Uterus length measuring 0.90-0.95; vaginal funnel width 0.40-0.42; vulval sphincter 0.30-0.32; vaginal bulb measuring 0.36-0.39 by 0.10-0.14. Sub-terminal gonospore. Mature eggs ovoid and no polar prolongation 0.30-0.34 by 0.15-0.18.

## DISCUSSION

Neoechinorhynchid life cycle in Mullets include ostracods (seed shrimp) as intermediate hosts along with crayfish and snails presumably acting as paratenic host (Merritt and Prat, 1964). Cable and Dill (1967) studied that life cycles for those neoechinorhynchids infecting mullet after considering the constituency in Acanthocephalan life cycle, probably acquire helminths from feeding on snails, ostracods and copepods.

The most striking feature in the present specimens is that in both sexes the size of first and second circle hooks are same in size. While in other species are unequal namely *N. aminulhaquei* Chandra, 1983; *N. argentatus* Chandra

*et al.,* 1987; *N. bangoni* Tripathi, 1959; *N. chilkaensis* Podder, 1937; *N. brayi* Bilqees *et al.,* 2011; *N. cirrhinae* Gupta and Jain, 1979; *N. dattai* Golvan, 1994; *N. devdevi* (Datta, 1936) Kaw, 1951; *N. elongatus* Tripathi, 1959; *N. glyptosternumi* Fotedar and Dhar, 1977; *N. formosanus* (Harada, 1938) Kaw, 1951; *N. gibsoni* Khan and Bilqees, 1989; *N. hutchisoni* Datta, 1936; *N. johnii* Yamaguti, 1939; *N. kallarensis* George and Nadakal, 1978; *N. karachiensis* Bilqees, 1972; *N. macrorchis* Shaikh *et al.,* 2011; *N. nawazi* Naqvi *et al.,* 2012; *N. nickoli* Khan *et al.,* 1999; *N. nematalosi* Tripathi, 1959; *N. nickoli* Khan *et al.,* 1999; *N. ovalis* Tripathi, 1959; *N. rigidus* (Van Cleave, 1928) Kaw, 1951; *N. roonwali* Datta and Soota, 1963; *N. sootai* Bhattacharya, 1999; *N. topseyi* Podder, 1937 while in *N. cyanophlyctis* Kaw, 1951 they are all of equal length 0.014-0.025 long.

The present specimens comes close to *N. oreini* Fotedar, 1968 reported from *Oreinus sinuatus* from Arapat stream, Anant Nag Jammu and Kashmir, India in having equal size of first and second row of hooks but *N. oreini* differs in having larger hooks size (0.078-0.088 by 0.073-0.085). Body size (8.0-11.75 by 0.9-1.45 male and female 11.5-16.8 by 1.2-1.7) is also larger as compared to the present species. Proboscis in present specimens is larger as compared to *N. oreini* (0.13-0.18 by 0.10-0.16). Lemnisci in present specimens are smaller as compared to *N. oreini* (1.59-2.9 by 1.32-2.68). In *N. oreini* the difference in the testes anterior testis size (0.80-1.5 by 0.56-0.70) and posterior testis (0.69-1.4 by 0.49-0.6) have a lot of difference while in the present specimens they are almost of the same size anterior testis (0.31-0.38 by 0.14-0.18) and posterior testis (0.31-0.38 by 0.14-0.18).

In body size the present specimens are larger as compared to *N. aminulhaquei* Chandra, 1983; *N. cirrhinae* Gupta and Jain, 1979; *N. cyanophlyctis* Kaw, 1951; *N. ovalis* Fotedar, 1968; *N. sootai* Bhattacharya, 1999; *N. nematalosi* Tripathi, 1959; *N. ovale* Tripathi, 1959; and *N. zacconis* Yamaguti, 1935.

The proboscis in present specimens is smaller as compared to *N. idahoensis* Amin and Heckmann, 1992; *N. dimorphospinus* Amin and Sey, 1996; *N. pimelodi* Brasil-Sato and Pavanelli, 1998; *N. didelphis* Amin, 2001; *N. iraqensis* Amin *et al.,* 2001; *N. qatarensis* Amin *et al.,* 2002; *N. zabensis* Amin *et al.,* 2003; *N. buckneri* Amin and Heckmann, 1992; *N. longinucleatus* Amin *et al.,* 2011; *N. colastinensis* Arredondo and Gil de Pertierra, 2012; *N. vittiformis* Smales, 2013; *N. bryanti* Smales, 2013; *N. veropesoi* Melo *et al.,* 2013 and *N. yamagutii* Tkach *et al.,* 2014.

Giant-Hypodermic nuclei are present in *N. daleri* Khan *et al.,* 2020; *N. rigidis* (Van Cleave, 1928) Kaw, 1951; *N. roonwali* Datta and Soota, 1963; *N. devdevi* (Datta, 1936) Kaw, 1951; *N. chilkaensis* Podder, 1937; *N. oreini* Fotedar, 1968; *N. dattai* Golvan, 1994; *N. formosanus* (Harada, 1938) Kaw, 1951; *N. tylosuri* Yamaguti, 1939; *N. inermis* Brito-Porto *et al.,* 2017; *N. personatus* Tkach *et al.,* 2014; *N. ponticus* Amin *et al.,* 2020; *N. daleri* Khan *et al.,* 2020 and *N. qatarensis* Amin *et al.,* 2002 while were not observed in present specimens.

At higher magnification the para-receptacle structure (PRS) was observed which was first described by Amin *et al.* (2002) in *Neoechinorhynchus qatarensis* from the marine blue-barred flame parrot fish, *Scarus globban* Forskal, 1775 in Qatari waters of Arabian gulf. The para-receptacle structure (PRS) prominent along ventral side of receptacle, connecting anteriorly to body wall as earlier described by Amin *et al.* (2007) later reported that PRS as an oblong capsule enclosing a column of nucleated core (NC) cells appeared lighter coloured as compared to darker walls of PRC. It is believed that in North American continent has the largest number of species known in this genus (Amin, 2002).

Due to morphological and morphometric differences between the present specimens and earlier described species of the genus *Neoechinorhynchus* Stiles and Hassall, 1905 a new species *N. rafiae* is proposed. Name of the new species is in honour of Dr. Rafia Rehana Ghazi a distinguished Parasitologist of Pakistan.

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