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# *Serrasentis sagittifer* Linton, 1889 (Acanthocephala: Palaeacanthocephala: Rhadinorhynchidae) Infecting the Rabbitfish *Siganus rivulatus* (Teleostei, Siganidae) from Hurghada Coasts of the Red Sea: Light and Scanning Electron Microscopy

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**Abstract:** *Serrasentis sagittifer*, an acanthocephalan parasite recovered from the intestine of *Siganus rivulatus* (Siganidae) captured from water locations along the Red Sea at Hurghada coasts, Egypt. The species attach to the intestinal wall via their armed proboscis which is anchored by rows of recurved spines. In the present study, Twenty two out of 50 fish specimens (44.0%) were found to be naturally infected. The parasite was studied morphologically and morphometrically by light and scanning electron microscopy. It possessed a creamy white color, slightly curved with slight tegument annulations. Body was 4±0.20 (3-8) mm long x 0.38±0.020 (0.31-0.65) mm wide in male and 7±0.20 (6-12) mm long x 0.42±0.020 (0.40-0.65) mm wide in female. Proboscis was long, with short neck measured 0.39–0.58 (0.40±0.02) mm long in males and 0.48–0.61 (0.52±0.02) mm in females. It was armed with (9-11) longitudinal rows of hooks which show a distinct dorsoventral asymmetry, with ventral hooks stouter. Two postequatorial contiguous ovoid testes were observed in male worms with four tubular cement glands overlapped at the posterior margin of posterior testis terminated at a seminal vesicle. In female worms, ovarian balls, uterus and a short vagina were observed at the posterior end of the body cavity. The present parasite was compared with the most similar species recorded previously from different hosts which showed that the isolated parasite was concluded to be *Serrasentis sagittifer* as a new host record.

**Key words:** *Siganus Rivulatus* · Red Sea · Rhadinorhynchidae · *Serrasentis Sagittifer*

## INTRODUCTION

Members of phylum Acanthocephala are endoparasites without a digestive tract [ 1]. The adult worms live in the intestinal lumen of the host fish, attached to the wall of intestine and the larvae (Post-cystacanths) encapsulated in fish tissues [2]. They are slender or slightly flattened worms infecting mainly fish, birds and mammals. Phylum diagnostic feature is the organ of attachment consisting of an invaginable proboscis that forms the anterior end [3]. The probo-scis is armed with rows of recurved hooks, thus the common name of spiny-headed worms applied to these parasites [4]. The trunk is a hollow structure that contains excretory, reproductive and nervous systems and is filled with pseudocoelomic fluid [5]. The other unique morphological features of acanthocephalans is a proboscis receptacle at the anterior end of the trunk and the paired lemnisci that extend into the trunk from neck. Taraschewski [6] found that pathogenicity of acanthocephalans is caused mainly by two factors; worms'density and depth of parasite penetration into the host tissues. He added that the pathological effects might be locali- zed around individual worms in low infection, but in the high parasite load, total destruction of the tissue architecture due to the occurrence of collective pathological changes.

Acanthocephalans parasitize the intestines of wild fresh and salt water fish. The irreversible mechanical damage caused by the armed proboscis attachment affects the intestinal tissues architecture leading to pathological changes. Loss/degeneration of intestinal villi, formation of the granular tissues and capsule formation associated with host immune responses that seriously affect animal's digestive and absorptive efficiency.

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In heavy infections they cause occlusion of the gut and invasion and migrate into uncommon locations [7]. Diversity of acanthocephalans is limited to approximately 1150 described species. In Egypt, few studies were carried out on acanthocephalan parasites infecting fish of the Red Sea and Arabian Gulf. Amin *et al*. [8] described two acanthocephalans *Sclerocollum rubrimaris* and *Serrasentis sagittifer*. The two different species *Neoechinorhynchus qatanesis* and *N. dimorphospinus* were described by Amin *et al*. [ 9]. *Serrasentis sagittifer* is one of the most important acanthocephalans parasitizing fish [10]. According to the Integrated Taxonomic Information System [11] eight synonyms were adjusted; these were *Serrasentis socialis* Leidy [12] *Echinogaster sagittifer* Linton [ 13] *Echinorhynchus sagittifer* Linton [13] *Serrasentis longus* Tripathi [14] *S. chauhani* Datta [15] *S. giganticus* Bilqees [16] *S. longiformis* Bilqees [16] and *S. scomberomori* Wang [17]. The present study aimed to describe the acanthocephalan parasite *Serrasentis sagittifer* (Rhadinorhynchidae) isolated from *Siganus rivulatus* (Siganidae) using morphological and morphometric analysis by light and scanning electron microscopy.

## MATERIALS AND METHODS

Fifty fish specimens of Rabbitfish *Siganus rivulatus* (Teleostei, Siganidae) were collected from from water location along Hurghada coasts along the Red Sea, Egypt during the period from January to September 2016 and examined for acanthocephalan parasites. Worms were isolated from the intestine and pyloric ceca of the fish, transferred to a clean 0.9 % saline solution by using a brush or small pipettes and washed several times to remove any mucous or debris which is usually adhere to body surface. Acanthocephalans were relaxed in tap water, this was important for their proboscis to be fully everted from their bodies [18] then fixed in 10% formalin. After fixation, the collected samples were washed in distilled water for 15 minutes to remove the excess fixative and then processed to staining which is carried out by using acetic acid alum carmine for 5-10 minutes [ 19]. After staining, a differentiation step must be carried out to remove the excess stain by placing the stained worms into a dilute solution of acid alcohol (0.5 ml in 1000 ml alcohol), it is better to carry out this process under a binocular dissecting microscope to detect the end point of differentiation. This is followed by dehydration in an ascending series of ethanol, 30%, 50%, 70%, 90%, 95% and absolute ethanol, leaving the parasites for 2-5 minutes in each grade. The specimens were then cleared in xylene, mounted in Canada balsam, covered with cover glass and left to dry in an oven at 40°C. The prevalence, mean abundance and morphometric measurements followed the guidelines of Bush *et al*. [20] minimum and maximum values were given, followed in parentheses by the arithmetic mean ± SD. For scanning electron microscopy, specimens were fixed in 3% buffered gluteraldehyde, washed in cacodylate buffer and dehydrated in an ascending alcohol series. After passing through an ascending series of the Genosolv-D, they were processed in a critical point drier "Bomer-900" with freon 13 and sputter coated with gold–palladium in a Technics Hummer V and examined with an Etec Autoscan at 20 kV Jeol scanning EM.

## RESULTS

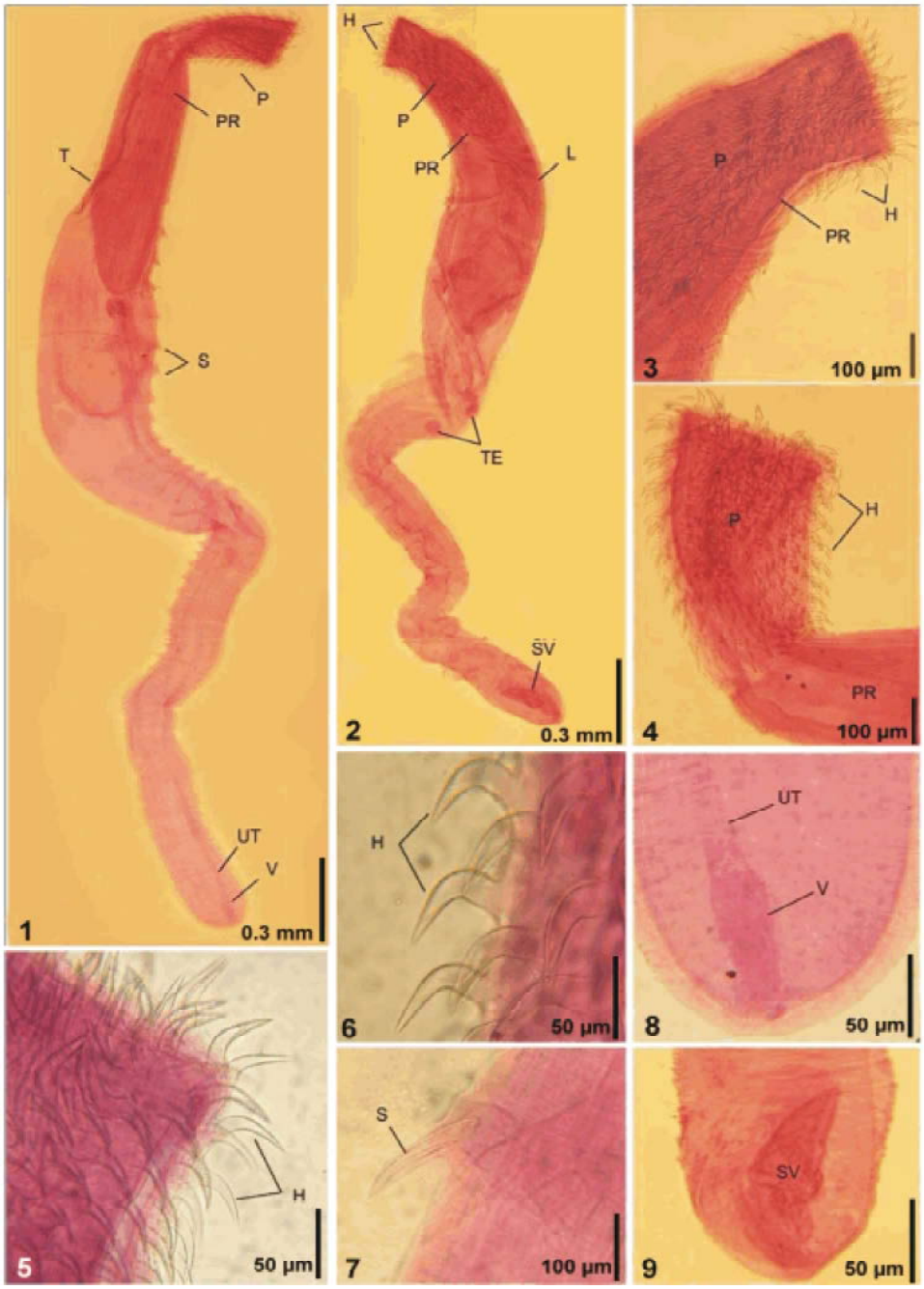
Twenty two (44%) out of fifty fish specimens were found to be naturally infected by an acanthocephalan parasite. The infection was in the intestine and stomach of fish but without visible signs or symptoms. Seasonally, the infection increased during summer 48.15% (13/27) and dropped to 39.13% (9/23) during winter.

***Serrasentis sagittifer* Linton [13]**

**Figs: (1-9 &10-14)**

**Description (Based on 5 Specimens):** It possessed a creamy white color, slightly thinner posteriorly with slight tegument annulations. Body was 4±0.20 (3-8) mm long x 0.38±0.020 (0.31-0.65) mm wide in male and 7±0.20 (6-12) mm long x 0.42±0.020 (0.40-0.65) mm wide in female. The proboscis was club shaped, broad anteriorly measured 0.39–0.58 (0.40±0.02) mm in males and 0.48-0.61 (0.52±0.02) µm in females. It was armed with 9-11 longitudinal rows of hooks which show a distinct dorsoventral asymmetry, with ventral hooks stouter. Hooks of anterior rows were larger than the remaining rows. They are strongly curved at their bases with backwardly pointed blade. Proboscis receptacle elongated and double walled. Lemnisci were two, tubular, elongated on the sides of the proboscis receptacle. Trunk was elongated, sub-cylindrical and spinose anteriorly with transverse rows of comb-like spines, which are 15 in number followed by 9 small spines posteriorly.

*Male:* Genitalia occupied posterior half of trunk. Testes were two ovoid to elongated, tandem, contiguous with four long tubular cement glands overlapped at the posterior margin of posterior testis terminated at a seminal vesicle.




Figs. 1-9: Photomicrographs of *Serrasentis sagittifer*. 1 Whole mount preparation of female worm with proboscis (P), trunk (T), proboscis receptacle (PR), uterus (UT) and Vagina (V). 2 Male worm, Lemnsci (L), two testis (TE), seminal vesicle (SV), (H) abbreviated for proboscis hooks while (S) for trunk spines. 3-9 High magnifications of: 3, 4 Proboscis (P) and its hooks (H). 5,6 Proboscis hooks (H). 7 A trunk spine (S). 8, 9 Posterior ends of: 8 female, uterus (UT) and vagina (V). 9 Male, seminal vesicle (SV)

*Female:* Reproductive system simple and consisted of ovarian balls at the posterior end of the body cavity, uterus and a short vagina. No immature or mature eggs were seen. Genital pore was sub terminal.

*Taxonomic summary*
*Family:*Rhadinorhynchidae Travassos [21]
*Host:* Rabbitfish *Siganus rivulatus* (Teleostei, Siganidae)
*Infection site:* Intestine, pyloric ceca

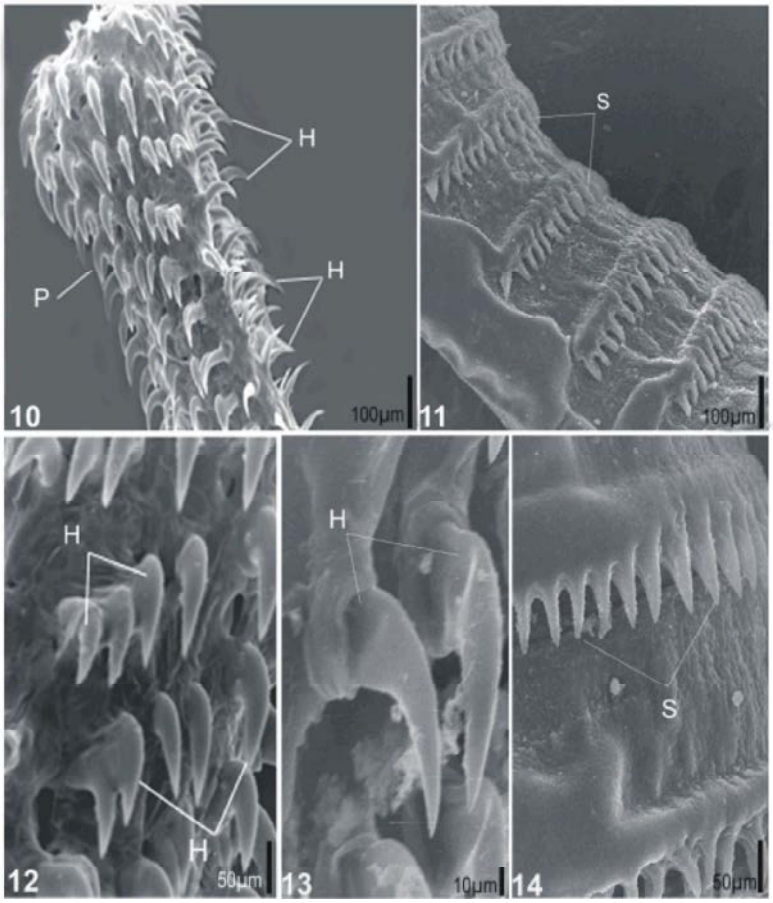



Fig. 10-14: Scanning electron micrographs showing high magnifications of: 10 Proboscis (P) with proboscis hooks (H). 11 Trunk with combs of spines (S). 12, 13 Magnified proboscis hooks (H). 14 Trunk spines (S).

*Type locality:* Hurghada coasts along the Red Sea, Egypt
*Prevalence:* 22 out of 50 (44%) fish specimens were found to be naturally infected.

## DISCUSSION

Genus *Serrasentis* was erected by Van Cleave [22]. The acanthocephalan genus *Serrasentis* is peculiar in having variable number of comb-like trunk spines [23]. There is no other acanthocephalan genus with this peculiar type of trunk spines. Fifteen valid species of this genus were documented, which included *Serrasentis sagittifer* as one of the most important pathogenic parasites infecting the digestive system of fish, especially intestine [10]. This species have a wide range of hosts, they were reported from 13 fish species from the Arabian Gulf, especially from the coasts of Iran, Kuwait and Emirates [24], from five fish hosts of Karachi coast [25] from 20 species of Atlantic ocean [26] and from six species of Brazililian coasts [27, 28].

Several acanthocephalan species of family Rhadinorhynchidae were previously reported from the Red Sea and Persian Gulf. These were *Sclerocollum rubrimaris* [8], *Siganus luridus* from the coast of Sharm El-Sheikh, South Sinai, *Neoechinorhynchus qatanesis* [9], *Nemipterus japonicas* from Bushehr coasts (Tropical and sub-tropical-Indo west Pacific region), *Neoechinorhynchus rutili* [29] from Nigeria coasts, *Neoechi norhynchus dimorphospinus* [9], *Dorodoma nasus* in pisces from Kuwait and *Serrasentis sagittifer* [8] from *Thunnus tonggol*, *Sphyraena barracuda*, *Pomadasys argenteus*, *Lutjanus gibbus* from coast of Yamen, Red Sea. The same species was reported from the spotted lizard fish *Saurida undosquamis* from the Arabian Gulf, Emirati Coasts [24] and from the gilthead Sea bream *Sparus aurata* [30]. Morphologically, the present parasite re-sembled *S. sagittifer* previously recorded from *Thunnus tonggol* from the coasts of Hodeidah, Yemen by Al-Zubaidy and Mhaisen [31]. and from *Saurida undosquamis* from the Arabian Gulf by

Kardousha [24]. Similarities between these species include body dimensions, rows of spines surrounding proboscis and the combs of trunk spines. In comparison to the other species belonging to genus *Serrasentis*, the present species differed from *S. longus* Tripatti [14] in the number of trunk spines which were 12 in number followed by 3 small spines posteriorly compared to the present species which had 16-20 rows. Proboscis equipped by longitudinal rows of spines which are 6 each with 15-16 spines in *S. longus* compared to 9-11 rows each with 15-18 in the present species. Morphological assessment led to incongruent conclusion due to difficulties in their characters that distinguish taxa [32].

## CONCLUSION

The morphological and morphometric com-parison between the present acanthocephalan parasite from Rabbitfish *Siganus rivulatus* and the previously recorded species prove that it was *Serrasentis sagittifier* with new host record in Egypt.

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## REFERENCES

1. Mehlhorn, H., H. Taraschewski, M. Franz, V. Walldorf and W.P. Voigt, 1988. Reproduction. In: Mehlhorn H (ed) Parasitology in Focus. Facts and trends. Springer, Berlin Heidelberg New York.
2. Tingbao, Y. and L. Xianghua, 2001. Seasonal population dynamics of Neoechinorhynchus quinghai-ensis in the carp, Gymnocypris przewalskii prze-walskii from Qinghai Lake, china. Journal of Helminthology, 75: 93-98.
3. Herlyn, H., O. Piskurek, J. Schmitz, U. Ehlers and H. Zischlera, 2003. The syndermatan phylogeny and the evolution of acanthocephalan endoparasi-tism as inferred from 18S rDNA sequences. Molecular Phylogenetics and Evolution, 26: 155-64.
4. Hyman, L.H., 1951. The invertebrates-Acanthocephalan Aschelminthes and Entroprocta, Mc, Graw Hill Publisher, USA.
5. Martins, M.L., F.R. Moraes, R.Y. Fujimoto, E.M. Onaka and C.I.F. Quintana, 2001. Prevalence and histopathology of *Neoechinorhynchus curemai* Noronha, 1973 (Acanthocephala: Neoechino-rhynchidae) in *Prochilodus lineatus* Valenciennes, 1836 from Volta Grande Reservoir MG Brazil. Brazilian Journal of Biology, 61: 517-22.
6. Taraschewski, H., 2000. Host-parasite interactions in Acanthocephala: a morphological approach. Advances in Parasitology, 46: 1-179.
7. Nickol, B.B., 2006. Phylum Acanthocephala, In: Woo, P.T.K. (Ed.), Fish Diseases and Disorders, 2nd Edition: Protozoan and Metazoan Infections, Vol. I. CAB International, Wallingford, UK.
8. Amin, O.M., F.H. Nahhas, F. Al-Yamani and R. Abu-Hakima, 1984. On three acanthocephalan species from some Arabian Gulf fishes off the coast of Kuwait. Journal of Parasitology, 70: 168-170.
9. Amin, O.M., M.F.A. Saoud and K.S.R. Alkuwari, 2002. *Neoechinorhynchus qatarensis* sp. n. (Acanthocephala: Neoechinorhynchidae) from blue-barred flame parrot fish, Scarus ghobban Forsskal, 1775, in Qatari waters of the Arabian Gulf. Parasitology International, 51: 171-176.
10. Seyed, S.G.M., K. Majid and K. Mahnaz, 2008. Serrasentis sagittifer (Acanthocephala: Rhadinorhy-nchidae) from the Japanese thread fin bream, Nemipterus japonicus, in Bushehr water of Persian Gulf. Journal of Animal Veterinary Advances, 7: 1430-1433.
11. Integrated Taxonomic Information System (ITIS), 2011. http://www.itis.gov.
12. Leidy, J., 1851. Contributions to Helminthology. Proceedings of the Academy of Natural Sciences of Philadelphia, 5: 205-210.
13. Linton, E., 1889. Notes on Entozoa of marine fishes of New England with description of several new species. Report of the U.S. Commisioner of Fish and Fisheries for 1886, 14: 453-511.
14. Tripathi, Y.R., 1959. Studies on parasites of Indian fishes. V. Acanthocephala. Records of the Indian Museum, 54: 61-99.
15. Datia, M.N., 1954. On a new species of acanthocephalan parasite from fishes of Bombay. Records of the Indian Museum, 51: 51-55.
16. Bilqees, F.M., 1971. Parasites of the cat fish Arius serratus. I. Acanthocephala. Pakistan Journal of Zoology, 3: 57-65

17. Wang, P.Q., 1981. [Notes sur quelques especes dacanthocephales de poissons de Chine]. Acta. Zootax. Sinica, 6: 121-130.
18. Gibson, J.W., 1985. Satisfaction with Upward and Downward Organizational Communications: Another Perspective. Proceedings of the Southwest Academy of Management (March): 150.
19. Carleton, H., 1976. Carleton's histopathological technique 4th Ed. Oxford University Press, New York, Toronto.
20. Bush, A.O., K.D. Lafferty, J.M. Lotz and W. Shostak, 1997. Parasitology meets ecology on its own terms: Margolis *et al*. revisited. Journal of Parasitology, 83: 575-583.
21. Travassos, L., 1923. Informações sobre a fauna helminthologica de Matto Grosso (II nota). Folha Medica, 4: 12.
22. Van Cleave, H.J., 1923. Telosentis, a new genus of Acanthocephala from southern Europe. Journal of Parasitology, 9: 174-175.
23. Yamaguti, S., 1963. Synopsis of digenetic trematodes of vertebrates. Keigaku Publishing Co. Tokyo, Japan, pp: 1073.
24. Kardousha, M.M., 2005. Helminth parasite larvae collected from Arabian Gulf fish. IV: Description of four larvae including two metacercariae, one didymozoid and one acanthocephalan from Emirati coast. Arab Gulf Journal of Scientific Research, 23: 23-27.
25. Bilqees, F.M. and A. Khan, 1993. Paraechinorhynchus kalriai n. g, n. sp. (Neoechinorhynchidea: eoechinorhynchinae) from Labeo rohita (Ham). Pakistan. Journal of Agriculture Science, 20: 116-20.
26. Meyers, T.R., 1978. Prevalence of fish parasitism in Raritan Bay, New Jersey. Proceedings of the Helminthological Society of Washington, 45: 120-128.
27. Luque, J.L. and R. Poulin, 2004. Use of fish as intermediate hosts by helminth parasites: A comparative analysis. Acta Parasitologica, 49: 353-361.
28. Alves, D.R., A.R. Paraguassú and J.L. Luque, 2005. Community ecology of the metazoan parasites of the grey triggerfish, Balistes capriscus Gmelin, 1789 and queen triggerfish B. vetula Linnaeus, 1758 (Osteichthyes: Balistidae) from the State of Rio de Janeiro, Brazil. The Revista Brasileira de Parasitologia Veterinária, 14: 71-77.
29. Abba, A.M., M.C. Emere and J. Appah, 2018. Comparative Study on Helminth Parasites of *Oreochromis niloticus* and *Clarias gariepinus* in Ajiwa Earth Dam Katsina State, Nigeria. World Journal of Fish and Marine Sciences, 10: 05-11.
30. Abdel-Ghaffar, F., K. Morsy, R. Abdel-Gaber, H. Mehlhorn, S. Al-Quraishy and S. Mohammed, 2014. Prevalence, morphology and molecular analysis of Serrasentissagittifer (Acanthocephala: Palaeacanthocephala: Rhadinorhynchidae), a parasite of the gilthead sea bream Sparus aurata (Sparidae). Parasitology Research, 113: 2445-2454.
31. Al-Zubaidy, A.B. and F.T. Mhaisen, 2012. A record of two species of Acanthocephala (Echinorhynchida: Rhadinorhynchidae) from Red Sea fishes, Yemeni coastal waters. Mesopotamian Journal of Marine Science, 27: 15-28.
32. Taraschewski, H., 2005. Acanthocephala (Thorny or spiny-headed worms). In: Rhode K, ed. Marine Parasitology, CSIRO Publishing, Collingwood.