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RESEARCH ARTICLE

TAXONOMIC REPORTS OF THE CESTODESOF THE GENUS *NYBELINIA* POCHE, 1926 AND *HETERONYBELINIA* PALM, 1999 (CESTODA: TRYPANORHYNCHA, DIESING, 1863) FROM THE SHARK, *RHIZOPRIONODONACUTUS* RÜPPELL, 1937, FROM NELLORE COAST, BAY OF BENGAL, INDIA

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ABSTRACT

In a parasitic study on *Rhizoprionodonacutus* Rüppell, 1837 caught from the Nellore Coast, Bay of Bengal, 2cestodes of the genus *Nybelinia* Poche, 1926 i.e., *Nybelinialingualis* Cuvier, 1817; *N. indica* Chandra, 1986 and one species *Heteronybeliniaperidareus* Shipley and Hornell, 1906 of the genus *Heteronybelinia* Palm, 1999 were reported for the first time from this coast.

INTRODUCTION

Trypanorhynchids are cosmopolitan group of marinecestodes inhabiting the spiral valves of the marine elasmobranchs while their post larvae infest marine teleosts and invertebrates (Palm, 2004, 2010; Palm *et al*., 2009). Infestation of these cestodeson the flesh or musculature of commercially important fishes results in a profound losses in fish processing industries (Deardorff *et al*., 1984; Palm *et al*., 1997). Trypanorhynchidsportraylow host specificity and a wide host range within a single locality when compared to other parasite taxa (Palm and Caira, 2008, Palm and Walter, 2000). Quite an extensive work on the genus *Nybelinia*has been contributed from all over the world by Heinz and Dailey (1974), Shimazu (1975), Carvajal *et al*., (1976), Shah and Bilquees (1988), Kurshid and Bilquees (1988), Sao clementes and Gomes (1992), Beveridge and Campbell (1994), Palm *et al*., (1994), Jones and Beveridge (1998), Palm (2000), Bray (2001), Hassan *et al*., (2002), Bannai (2008), Purivirojkul *et al*., (2009) and Haseli *et al*., 2010). On an average fishes are generally infected by more than 3 metazoan parasite species throughout their life-time (Palm *et al*., 1999; Klimpel *et al*., 2001) and the presence of diversified teleost and elasmobranch fauna in Nellore Coast, Bay of Bengal makes it a fascinating ecosystem to study. Data on trypanorhynchidcestodes are almost nil from this coast. Most of the work on cestodes of elasmobranchs from Bay of Bengal, India was restricted to Waltair (Visakhapatnam) coast, Andhra Pradesh, Digha coast, Wes Bengal and Madras Coast, Tamil Nadu (Subhaparadha, 1955; Chandra, 1986; Chandra and Rao, 1985; Vijaylakshmi and Sarada, 1993, 1996; Vijayalakshmi *et al*., 1996; Pramanik and Manna, 2006). The genus *Nybelinia*Poche, 1926is considered to be the most species-rich genus with a wide distribution throughout the world (Palm *et al*., 1998) with 55 species described under the genus of which only 30 species are accepted as valid species of the genus while the rest of the 21 species are placed in different genera such as *Heteronybelinia*, *Myxonybelinia*, *Kotorella*, *Tentacularia* and *Parabothrium* and the remaining 4 species is given the status *Taxon inquirendum*(website: WoRMS, World register of marine species, 2015). However, the genus *Heteronybelinia* Palm, 1999 is described with 15 valid species

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(Website: WoRMS, World register of marine species, 2015). In the present study, the parasites of these two genera were reported for the first time from the Nellore Coast, Bay of Bengal.

MATERIALS AND METHODS

Sampling sites: Nellore District 13-30'15-6' (N. latitude, 70-5'80-15' E.Longitude), is the southern-most coastal district of Andhra Pradesh.

Fishes (n=120) procured from several local fish markets during the period December, 2013 to April, 2015were transported to the laboratory in chilled ice boxes. Fish were dissected with a mid-ventral incision for the digestive gut. Spiral intestines set aside in petridishes filled with physiologic saline were incised with a longitudinal incision along the ventral blood vessel and gut contents was collected. The decanted gut contents were inspected under the stereozoom microscope (LM-52-3621 Elegant) for the parasites. Cestodes are indispensable part of the parasitic community of elasmobranchs. Cestodes were placedin between the two slides for proper pressing and stored in FAA fixative (Formalin-10ml, Alcohol-85ml and Acetic acid-5ml). Conventional techniques were employed for permanent slides preparation. The parasites observed and identified under the Lynx trinocular microscope (N-800M) were captured in photographs and line diagrams were drawn with the aid of attached drawing tube. All the measurements were taken with the help of an ocular micrometer in millimeters unless otherwise indicated. The following measurements were made: Scolex length (sl), scolex width at level of pars bothridialis (sw), length of pars bothridialis (pbo), length of pars vaginalis (pv), length of pars bulbosa (pb), length of pars postbulbosa (ppb), velum (vel),appendix (app), bulb length (bl), bulb width (bw), bulb ratio (br), proportions of pbo/pv/pb(sp), tentacle width (tw), and tentacle sheath width (tsw). If possible, the tentacle length (tl)was estimated. In addition, the tentacular armature was described as follows: armature homeomorphous or heteromorphous, hooks per half spiral row (hsr), total hook length (l) and the total length of the base of the hooks (b).

RESULTS

In this study, the 3cestodesof the genus *Nybelinia* Poche, 1926 were reported of which *Nybelinialingualis* Cuvier,1817, *N.indica* Chandra, 1986 were redescriptions with slight variations in their measurements; however, *Nybeliniaacutus* is considered to be new species.Only one species, *Heteronybeliniaperidareus* Shipley et Hornell, 1906 was described from the genus *Heteronybelinia* Palm, 1999.

***Nybelinialingualis*(Cuvier, 1817) Dollfus, 1927 (Plate-1, Figs.1-7)**

Super family: TentacularioideaPoche, 1926
Family: TentaculariidaePoche, 1926
Genus: NybeliniaPoche, 1926
No. of hosts infected: 18
No. of specimens:24
Site of infection: Spiral intestine
Locality: Nellore Coast, Bay of Bengal, Andhra Pradesh

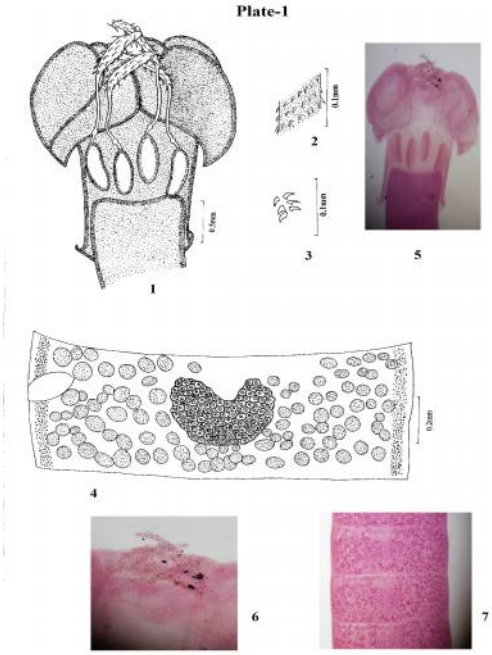

Plate-1 *Nybelinialingualis*(Cuvier, 1817) Dollfus, 1927

Fig-1: Scolex
Fig-2: Hooks arrangement on Tentacles
Fig-3: Hooks Enlarged
Fig-4: Mature Proglottid
Fig-5: Scolex 4X
Fig-6: Tentacles 10X
Fig-7: Mature Proglottid 10X

Measurements: Worms (2.5-6.8cm) length.Scolex0.52-1.32×0.83-1.66,Pars bothridialis (pbo)- 0.47-0.5, bothridia- 4, two dorsal and two ventral,0.4-1.03× 0.2-0.6, Pars vaginalis (Pv) shorter than pbo- 0.28-0.79. Pars bulbosa- 0.23-0.47, with 4 muscular, elongate sac like bulbs. Tentacles- 0.14-0.45×0.04-0.05, four, slender, muscular, club shaped, armed with simple, delicate, rose-thorn like hooks of equal size arranged in spiral rows. Each row with 12 hooks-0.025-0.03. Armature homeoacanthous and homeomorphous. Velum- 0.22-0.39×0.35-0.92.Neck- 0.53-0.75×0.31-0.79.Strobila with 30-60 acraspedote and anapolyticproglottids. All proglottids broader than longer. Immature proglottids- 0.26-0.35×0.55-1.1, mature proglottids- 0.47-1.32×0.58-1.92.Testes 60-95, round to slightly oval, occupy entire proglottid except in pre-ovarian space, 0.07-0.1.Cirrus sacconspicuous, oval- 0.03-0.15×0.03-0.05.Genital pore irregularly alternate and open anterior to mid margin of proglottid. Ovary large- 0.02-0.35×0.35-0.38 crescent shaped, lies in centre of proglottid. Vitellaria granular, on lateral margins of the proglottids.

Remarks

The genus *Nybelinia*was erected by Poche in 1926 with *Tetrarhynchuslingualis* Cuvier, 1817 as its type-species from *Sepia filliouxi*, *S.officinalis* and *Mullusbarbatus*from Atlantic Oceans (Dollfuss, 1942).*Nybelinialingualis* Cuvier, 1817 is cosmopolitan species with low host specificity has been recorded from Atlantic (Dollfuss, 1942), South Australia

(Palm, 1999) and Indian Oceans (Vijayalakshmi, Vijayalakshmi & Gangadhram, 1996). Several elasmobranch hosts such as *Carcharhinusleucas, C. melanopterus, C. obscures, Dasyatisviolacea, Hexacanthusgrisues, isurusoxyrhynchus* and *Thunnusthynnus* were final hosts for this cestode (Dollfuss, 1942, Bates, 1990, Palm, 1999, Palm and Walter, 2000). In the present study, *Rhizoprionodonacutus* is added to the new host record for the parasite. The present parasite resembles *N. lingualis* Cuvier, 1817 in terms of scolex form except for slight variations in the measurements.

***Nybeliniaindica*Chandra, 1985 (Plate-2, Figs.1-9):**

No. of hosts infected: 3
No. of specimens: 4
Site of infection: Spiral intestine
Locality: Nellore Coast, Bay of Bengal, Andhra Pradesh

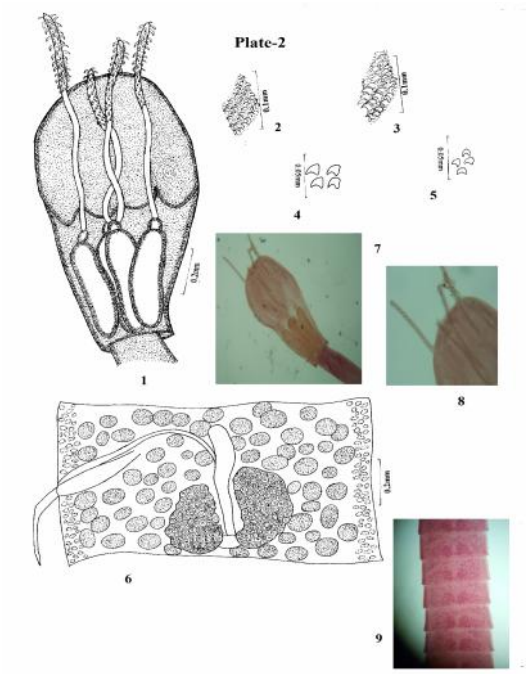

Plate-2 *Nybeliniaindica* Chandra, 1986

Fig-1: Scolex
Fig-2-3: Hooks arrangement on Tentacles
Fig-4-5: Hooks Enlarged
Fig-6: Mature Proglottid
Fig-7: Scolex10X
Fig-8: Tentacles Enlarged 40X
Fig-9: Mature Proglottid 10X

Measurements: Parasites 13-15cm. Scolex 1.20-1.24 in length, 0.44-0.47 in width below bothridia, 0.31-0.37 at mid region of pars bulbosa and 0.26-0.29 at posterior extremity of scolex. Pbo- 0.55-0.61 with 4 bean shaped long, narrow and sessile bothridia- 0.60-0.61×0.11-0.17. Pars vaginalis- 0.65-0.68.Tentacular sheaths with distinct prebulbular organs- 0.04-0.05, at the junction of attachment of bulbs. Pars bulbosa- 0.42-0.47, with 4 long, elliptical, straight muscular bulbs- 0.44-0.47×0.10-0.11.Small pars post bulbosa present0.027-0.03. Tentacles short (0.27-0.36×0.03) without basal swelling. Armature homeoacanthous and homeomorphous. Hook sizes of basal and metabasal regions varies. Basal hooks of 4-5 rows are smaller in size (0.01-0.013) followed by large sized hooks of metabasal region (0.015-0.017). Hooks solid, uncinate type with broad base arranged in spiral rows ascending from left to right. Scolex with a small velum- 0.03-0.04×0.27-0.29 over hanging on the neck. Neck short- 1.0-1.4×0.21-0.23.Strobila-360-380 proglattids. Proglottids broader than long. Immatureproglottid-0.20-0.24×0.48-0.55.Mature proglottid-0.26-0.38×0.53-0.82 and gravid proglottid- 0.66-0.79×1.84-2.05.Testes40-60, spherical 0.06-0.1occupying entire proglottid on either side of the ovary and beneath the ovarian lobes. Cirrus sac conspicuous, elongated in anterior half and inclined posteriorly, 0.10-0.12×0.25-0.38. Cirrus unarmed, 0.50-0.65×0.03-0.033. Genital pores irregularly alternate and open in mid margin of proglottid. Ovary large, bilobed with lobes connected by a narrow isthmus. Each ovarian lobe measure 0.30-0.33×0.28-0.31.Vitellaria large, follicular lying on either margin of the proglottid. Uterus long, blind tube extending anteriorly.

Remarks

The species *Nybeliniaindica* was first proposed by Chandra, 1986 from teleosts fishes off Waltair coast Bay of Bengal. Later, Vijayalakshmi, Vijayalakshmi and Gangadharam (1996) reported a new species, *Nybeliniascoliodoni* from *Scoliodonpalasorrah*which was synonymised with *N.indica*by Palm (1999). Though the present parasites shows strong similarity with the descriptions of Vijayalakshmi, Vijayalakshmi and Gangadharam (1996) except for a few minor difference in measurements, keeping the synonymy into consideration, they are considered as *Nybeliniaindica* Chandra, 1986.

***Heteronybeliniaperideraeus* Shipley et Hornell, 1906 (Plate-3, Figs.1-7):**

Super family: TentacularioideaPoche, 1926
Family: TentaculariidaePoche, 1926
Genus: *Heteronybelinia* Palm, 1999

No. of hosts infected: 43
No. of specimens: 56
Site of infection: Spiral intestine
Locality: Nellore Coast, Bay of Bengal, Andhra Pradesh

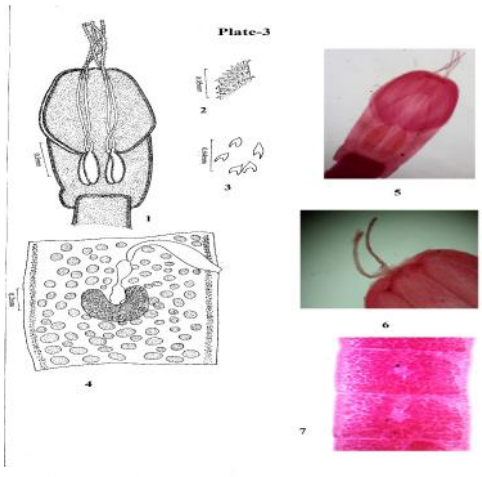

Plate-3 Heter*onybeliniaperideraeus* Shipley et Hornell, 1906

Fig-1: Scolex
Fig-2: Hooks arrangement on Tentacles
Fig-3: Hooks Enlarged
Fig-4: Mature Proglattid
Fig-5: Scolex 10X
Fig-6: Hooks Enlarged 10X
Fig-7: Mature Proglottid 10X

***Measurements**:* Parasites acraspedote, apolytic in nature, 6.1-8.3cm. Scolex-1.63-1.95×0.84-1.0.Pars bothridialis-0.97-1.18 with 4 sessile bothridia-0.97-1.10×0.32-0.39.Pars vaginalis shorter than pars bothridis (pbo)-0.18-0.50. Pars vaginalis with long and slender tentacular sheaths. Pars bulbosa with banana shaped bulbs, 0.18-0.50 with 4 muscular bulbs. 4 tentacles armed with simple, delicate, minute, curved and spirally planned hooks. Each row with twelve hooks.Armature homeoacanthous and homeomorphous.Neck-0.53-0.58 ×0.47-0.53.Stobila with 164-170 proglottids. All proglottids broader than longer. Immature proglottids-0.50-0.76 × 0.55-1.00.Mature proglottids-1.00-1.08×1.34-1.45. Testes 50-86, spherical-0.06-0.11. Cirrus sac conspicuous, elongate, pear shaped 0.05-0.2×0.11-0.14. Genital pores irregularly alternate and open anterior to mid margin of proglottid. Ovary large, crescent shaped, lies in centre of proglottid, 0.3-0.5×0.15-0.25. Vitelline glands very scanty, and lies along lateral margins of the proglottid. Uterus appears like 2 pouches in connected to each other.

Remarks

The genus *Heteronybelinia*was erected by Palm(1999) with *Nybeliniaestigmena* Dollfuss, 1960 as its type species (Palm and Walter, 2000). According to the World register of marine species, 2015, there are nearly 15 valid species in the genus. *Nybeliniaperideraeus* was reported by Shipley *et* Hornell (1926). *Nybeliniaperideraeus* Shipley *et* Hornell, 1926, currently accepted as *Heteronybeliniaperideraeus* Shipley et Hornell, 1926 was reported by Vijayalakshmi *et al*., (1996) from *Scoliodonpalasorrah* of Visakhapatnam coast, Bay of Bengal, The present parasites are in concordance with the *Heteronybeliniaperideraeus* except for a few variations in measurements.

DISCUSSION

In the present study, 3 species *Nybelinialingualis*, *N. indica*and *Heteronybeliniaperideraeus*were described from the Nellore Coast, Bay of Bengal for the first time suggesting their wide geographical distribution along the coast. It was also observed that the parasitization of fishes from this coast is low when compared to the other coasts of Bay of Bengal which may be attributed to the less human invasion and less pollution along the coast.

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