

TAXONOMIC REPORTS OF HOMEACANTHOIDEA (EUCESTODA: TRYPANORHYNCHA) IN LAMNID AND SPHYRNID ELASMOBRANCHS COLLECTED OFF THE COAST OF SANTA CATARINA, BRAZIL

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Summary:

Elasmobranch specimens of lamnid and sphyrnid captured in 1999 in the State of Santa Catarina, Brazil, were parasitized with homeacanthoid trypanorhynch cestodes: *Isurus oxyrinchus* Rafinesque, 1810 with *Nybelinia lingualis* (Cuvier, 1817) Dollfus, 1929; *Sphyrna zygaena* (Linnaeus, 1758) with *Heteronybelinia rougetcampanae* (Dollfus, 1960) Palm, 1999. New details of internal morphology and/or scolex and/or proglottid surface ultrastructure are given. Adults of *N. lingualis* are reported for the first time in the Brazilian coast.

KEY WORDS: Eucestoda, Trypanorhyncha, Homeacanthoidea, elasmobranchs, Brazil.

Résumé: OBSERVATIONS TAXONOMIQUES D'HOMÉACANTHOÏDEA (EUCESTODA: TRYPANORHYNCHA) CHEZ LES ÉLASMOBRANCHES LAMNIDES ET SPHYRNIDES RÉCOLTÉS SUR LA CÔTE DE SANTA CATARINA, BRÉSIL

Des spécimens d'élasmobranches lamnides et sphyrnides capturés en 1999 dans l'État de Santa Catarina, Brésil, étaient parasités par des cestodes trypanorhynches, homéacanthés: *Isurus oxyrinchus* Rafinesque, 1810 avec *Nybelinia lingualis* (Cuvier, 1817) Dollfus, 1929; *Sphyrna zygaena* (Linnaeus, 1758) avec *Heteronybelinia rougetcampanae* (Dollfus, 1960) Palm, 1999. De nouveaux détails de la morphologie interne et/ou de l'ultrastructure du scolex et/ou des proglottides sont fournis. Pour la première fois, des adultes de *N. lingualis* sont signalés sur la côte brésilienne.

MOTS CLÉS: Eucestoda, Trypanorhyncha, Homeacanthoidea, élasmobranches, Brésil.

INTRODUCTION

During an extensive parasitological survey, numerous specimens of parasites were collected from 90 elasmobranch fishes of the Southern coast off Brazil. Recently, several taxonomic and parasitological indices on elasmobranch parasites of Brazil have been published on nematodes (Knoff *et al.*, 2001a), on digeneans and acanthocephalans (Knoff *et al.*, 2001b), on prevalences and intensities of infections of trypanorhynch cestodes (Knoff *et al.*, 2002), and on otobothrioid trypanorhynch cestodes (Knoff *et al.*, 2004). The present paper continues this study and relates to Homeacanthoidea (Eucestoda, Trypanorhyncha) recovered from Lamnidae and Sphyrnidae.

Nybelinia lingualis (Cuvier, 1817) Dollfus, 1929, parasitizing the spiral valve of *Isurus oxyrinchus* Rafinesque, 1810, had already been reported from the spiral valves of *Mustelus asterias* Cloquet, 1821 in Mauritania (Dollfus, 1942), *Carcharbinus leucas* (Müller & Henle, 1839) in Texas, USA (Henson, 1975) and *I. oxyrinchus* in Spain (Gómez Cabrera, 1990). This species has also been reported from several teleosts and cephalopods from the Mediterranean and Atlantic Ocean (North, Tropical and South) (Dollfus, 1942, 1958; Bates, 1990; Orts *et al.*, 1988; Anato *et al.*, 1991; Sewell & Lester, 1995; Costa *et al.*, 1996; Tanzola *et al.*, 1997; Schuhgalter, 1998). Recently, Palm (1999), examined unidentified specimens deposited in the British Museum of Natural History, and expanded the known the range of *N. lingualis* in teleosts to Adelaide, Australia and English Channel. Previous reports of plerocercoids of this species in Brazil were those of Mendes (1944) in *Cynoscion* sp. in the littoral waters of Santos, State of São Paulo, Saciloto (1980), in *Cynoscion leiarchus* (Cuvier, 1830) off the State of Paraná, São Clemente & Gomes (1989), from the spiral valve of *Mustelus canis* (Mitchill, 1815) in waters off the State of Rio Grande do Sul and by Palm (1997) from the abdominal cavity of Carangidae, Haemulidae and Mullidae teleost fishes, captured in the vicinity of Recife, State of Pernambuco.

Heteronybelinia rougetcampanae (Dollfus, 1960) Palm, 1999, from the spiral valve of *Sphyrna zygaena* (Lin-

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naeus, 1758) was originally described on the basis of a single plerocercoid collected from the teleost *Liosaccus cutaneus* from Dakar, Senegal (Dollfus, 1960). It has subsequently been reported from the teleost *Hoplostethus mediterraneus* (Val., 1928) (= *H. mediterraneus* Cuvier, 1829) in the eastern Mediterranean (Reimer, 1975) and by Pereira Jr. (1998) in sciaenid fishes from the littoral region of the State of Rio Grande do Sul, with the addition of the new hosts, *Menticirrus americanus* (Linnaeus, 1758) and *Umbrina canosai* Berg, 1895. Adults of the species were described on the basis of specimens recovered from *Sphyrna lewini* also off the State of Rio Grande do Sul (São Clemente & Gomes, 1992).

MATERIALS AND METHODS

In March 1999, nine elasmobranchs, four females of *Isurus oxyrinchus*, 165-221cm in total length (tl), and five specimens (one male, four females) of *Sphyrna zygaena*, 190-250 cm tl, were caught about 190 miles off the coast of the State of Santa Catarina (27° 08' S - 28° 38' S; 45° 30' W - 46° 53' W) in waters approximately 25 m in depth by professional fishermen of the Kiyomã tuna fishing vessel. On board, spiral valves were collected, labelled and placed on ice before examination. Cestodes alive and dead were recovered, fixed, stained and mounted according to the technique of Amato *et al.* (1991). Taxonomic classification is in accordance with Campbell and Beveridge (1994) and Palm (1999) for superfamily and generic levels, respectively. Synonymy of *Nybelinia lingualis* is not provided, as it is available in detail in Dollfus (1942). Synonymy is provided for *Heteronybelinia rougetcampanae*, which was not treated in Dollfus (1942). Scolex, hooks and segment measurements and terminology follow Dollfus (1942), Campbell & Beveridge (1994) and Palm (1999), and the terminology of metacestodes follows Chervy (2002). Measurements are in millimeters (mm) unless otherwise indicated as means followed by the range of variation in parentheses. In the taxonomic summaries, the total number of parasitized specimens and the infrapopulation of each host are indicated. NH refers to new hosts; drawings were made with the aid of a drawing tube connected to a brightfield Olympus BH-2 light microscope (LM). Some specimens were observed under a LEO 435 Variable Pressure Scanning Electron Microscope (VPSEM); other samples were routinely prepared and analyzed with a JEOL Scanning Electron Microscope (SEM). Representative specimens have been deposited in the Coleção Helminológica do Instituto Oswaldo Cruz, Rio de Janeiro, Brazil (CHIOC); samples for comparison were also obtained from the CHIOC. At least one host spe-

cimen of each investigated fish species was deposited as a symbiotype *sensu* Brooks (1993) in the collection of the Instituto de Pesca, Santos, SP, Brazil and listed by Knoff *et al.* (2001b).

RESULTS

HOMEACANTHOIDEA DOLLFUS, 1942

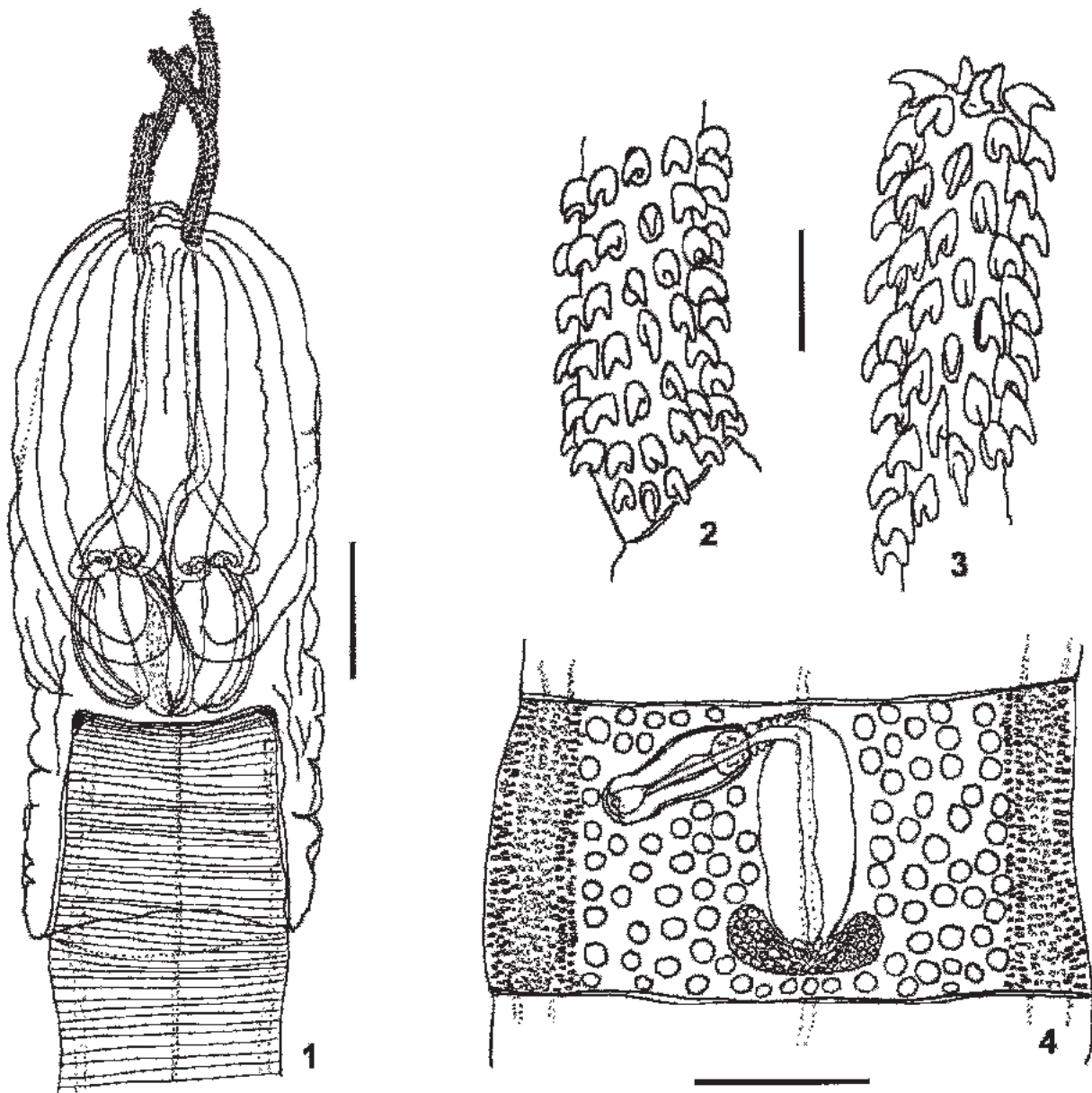
TENTACULARIIDAE POCHE, 1926

NYBELINIA POCHE, 1926

NYBELINIA LINGUALIS

(CUVIER, 1817) DOLLFUS, 1929 (Figs 1-9)

Description based in 18 adults, 10 mounted and measured, two under VPSEM and six under SEM. Scolex acraspedote, sub-cylindrical 1.90 (1.24-2.36) long, including velum, widest at level of pars bothridialis, 0.93 (0.47-1.20). Pars bothridialis 1.04 (0.80-1.38) long, 0.92 (0.47-0.20) wide. In some of the specimens preserved as whole mounts, among grooves near and mainly in distal margins of bothridia, hook-like microtriches, were detected (confirmed by SEM). Pars vaginalis with sheaths slightly sinuous, sometimes straight, 0.83 (0.53-1.07) long. Pars bulbosa 0.37 (0.30-0.54) long, 0.42 (0.29-0.50) wide. Individual bulbs 0.35 (0.29-0.42) long, 0.13 (0.09-0.15) wide. Origin of retractor muscle at bottom of bulbar cavity. Pars post-bulbosa short, 0.06 long. Velum well developed, 0.54 (0.28-0.76) long. Diameter of unarmed tentacles: basal region 0.037 (0.020-0.044), metabasal region 0.030 (0.020-0.034). Tentacular armature homeoacanthous; hooks solid, homeomorphous. Hooks of external face of basal region 0.009 (0.007-0.011) long, base 0.009 (0.006-0.010) wide. At beginning of external face of the metabasal region, hooks 0.011 (0.009-0.013) long, base 0.010 (0.009-0.011) wide. Hooks at apical region of external metabasal region 0.015 (0.013-0.017) long, base 0.013 (0.011-0.014) wide. Number of hooks per row in basal region 12-14, 16-20 per row near apical end. Tentacles partially everted, up to the 41st row. Strobila anapolytic, maximum length 16, with numerous proglottids, most wider than long, largest proglottid 33.6 long/wide. Mature proglottids acraspedote, 0.24 long, 0.40 wide. Terminal proglottids slightly longer than wide. Vas deferens coiled, anterior to cirrus pouch, somewhat median, in anterior 1/4 of proglottid. Cirrus pouch tubular, directed antero-medially, reaching middle of proglottid, 0.080 long, 0.024 wide. Genital pores ventral, irregularly alternate, pre-equatorial, sub-marginal. Testes 180-210 in number, rounded, 0.016-0.020 in diameter, occupying almost entire intervacular region of segment, including post-ovarian region. Ovary with four lobes in transverse view, bi-lobed in dorso-ventral views, separated by a



Figs 1-4. – *Nybelinia lingualis*. 1. Scolex. 2. Tentacle, basal region, bothridial face. 3. Tentacle, metabasal region, bothridial face. 4. Mature proglottid, ventral view. Bars of figs: 1 = 0.25 mm; 2-3 = 0.025 mm; 4 = 0.125 mm.

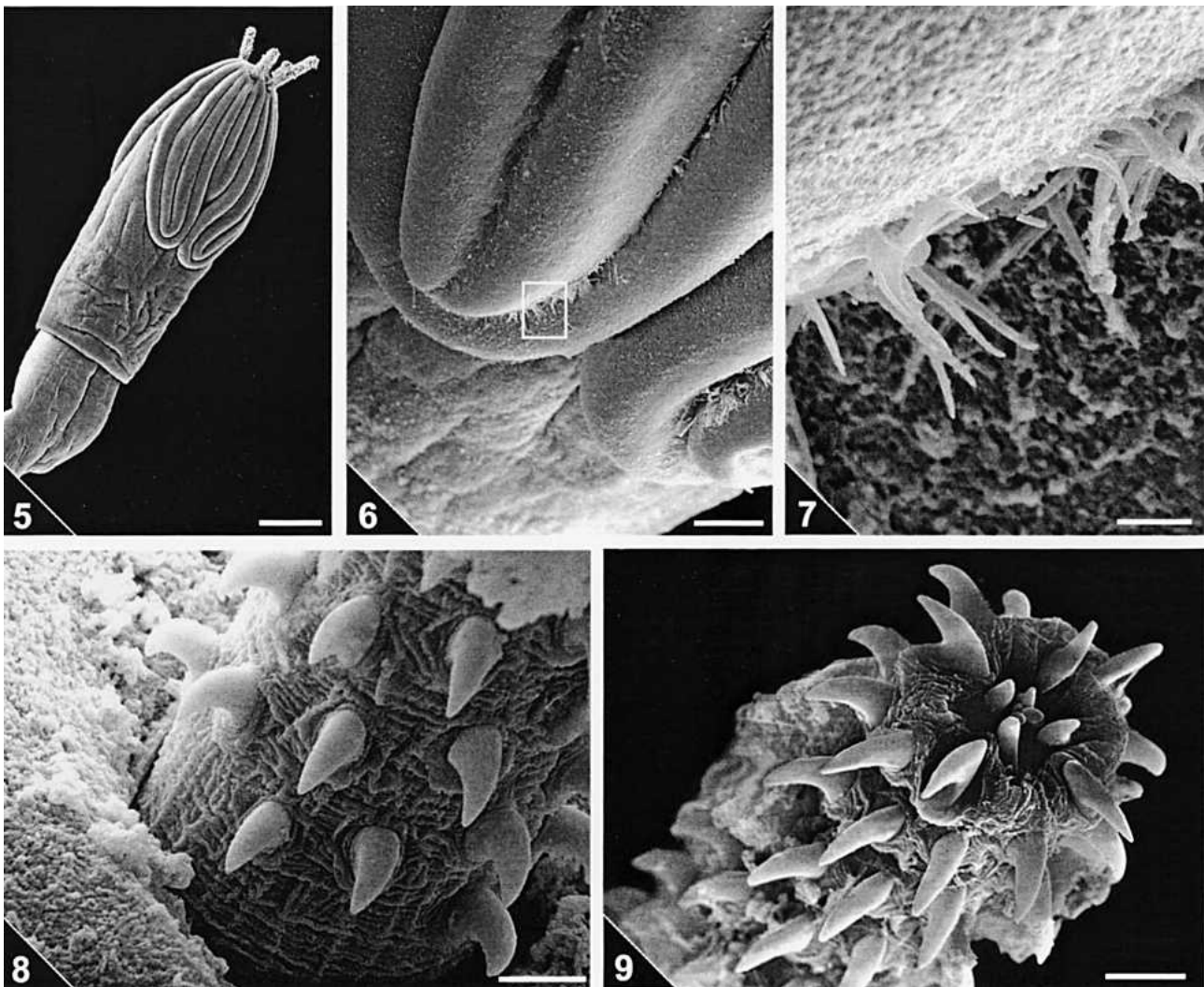
few testes from posterior region of proglottid; ovaries 0.024 long, 0.080 wide. Mehlis gland ventral to ovarian isthmus. Uterus saccate reaching near anterior extremity of proglottid. Uterine pore conspicuous in youngest proglottids. Median groove at junction of proglottids at site of origin of uterine pore. Vagina runs along posterior margin of cirrus pouch, opening at genital atrium. Vitellaria follicular circumcortical, extending throughout the length of proglottid, sometimes laterally surpassing osmoregulatory canals. Eggs not observed.

Host/site of infection: 27 adults (1; 2; 5; 19) from the spiral valves of four females of *Isurus oxyrinchus*.

Locality: coast of the State of Santa Catarina, Brazil. Specimens deposited: CHIOC n^os 34397-8 and 34399 a-d.

Material examined: Plerocercoid, from *Mustelus canis*, Rio Grande do Sul, Brazil (CHIOC n^o 32568).

Remarks: the reported specimens are in agreement with previous descriptions (Dollfus, 1942; São Clemente & Gomes, 1989; Palm, 1999). The measurements of the scolex length and the hooks of the basal



Figs 5-9. – *Nybelinia lingualis*, SEM. 5. Scolex. 6. Distal bothridial region, showing hook-like microtriches along the grooves near bothridial margins. Rectangle indicates region from which fig. 7 was obtained. 7. Hook-like microtriches along the grooves near bothridial margins. 8. Tentacle, basal region, external face. 9. Tentacle, metabasal region, external face. Bars of figs 5 = 250 μm ; 6 = 40 μm ; 7 = 4 μm ; 8 = 9 μm ; 9 = 10 μm .

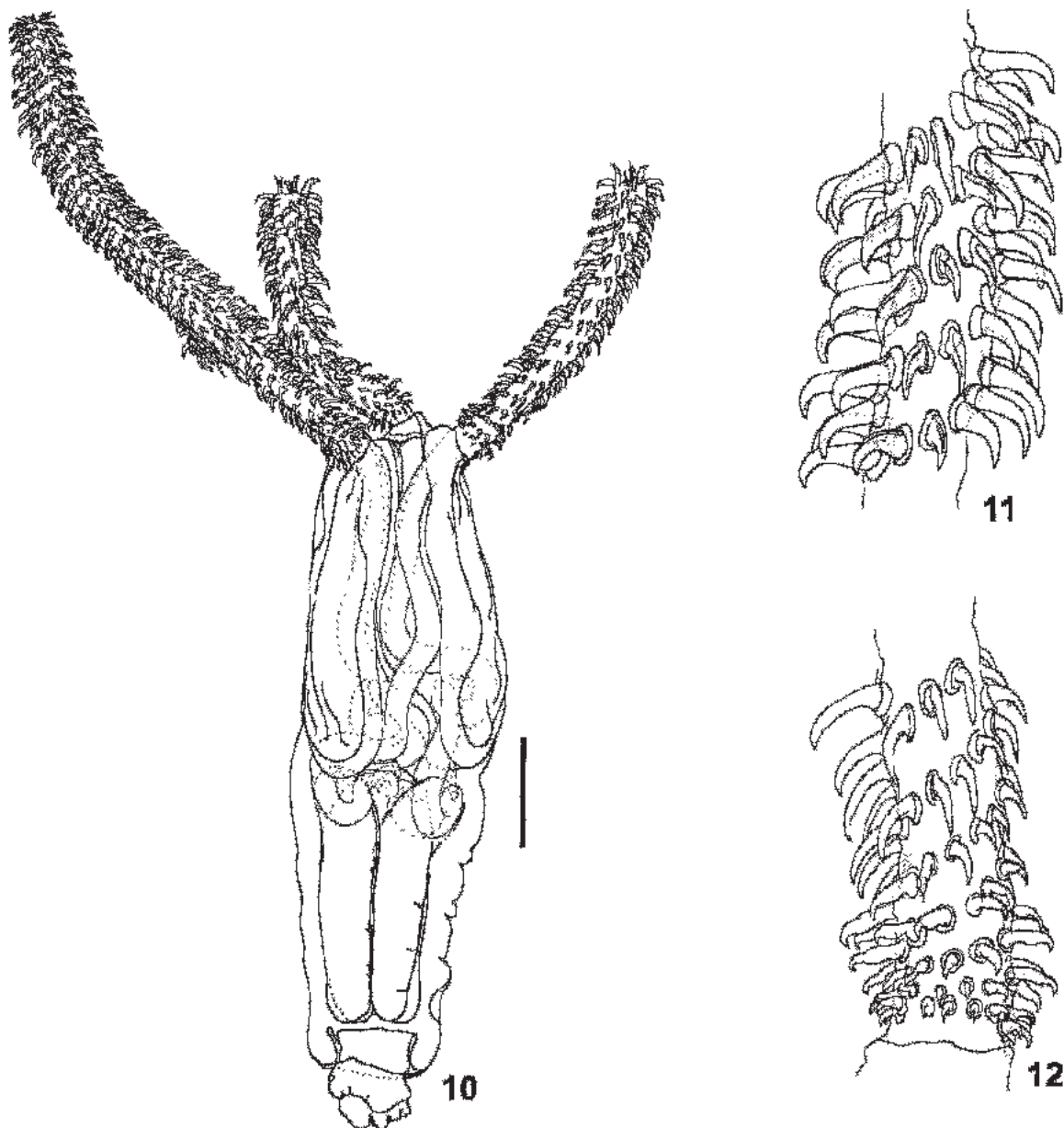
and metabasal regions are smaller when compared to those obtained by Dollfus (1942), but are comparable with the data of São Clemente & Gomes (1989) and Palm (1999). Also, the format of the scolex and the pattern of the tentacular hooks are in accordance with the figures of *N. lingualis*. According to Dollfus (1942), specimens of this species possess remarkably short bulbs and the tentacular sheaths make 1-2 coils near the bulbs, as also observed by São Clemente & Gomes (1989) and Palm (1999). The pars bothridialis, in its varying extension partially covers a small portion of the pars bulbosa at its anterior region or may extend to its middle. Dollfus (1942) stated that this species varies in the length of the scolex and of

the pars bothridialis in different hosts. Specimens of *N. lingualis* observed with LM and SEM, have hook-like microtriches in the grooves near the bothridial margins; also the surface of the scolex possesses refringent filiform microtriches, as described for *T. coryphaenae*, *N. queenslandensis* and *N. lingualis* (Palm, 1995, 2000; Jones & Beveridge, 1998). Adults of *N. lingualis* have been collected in Spain from *Isurus oxyrinchus* by Gómez Cabrera (1990), and this is the first report of the adult form of the species from specimens captured in the Brazilian littoral waters. This report further confirms that *T. coryphaenae* and *N. lingualis* have a wide geographical distribution and low host specificity.

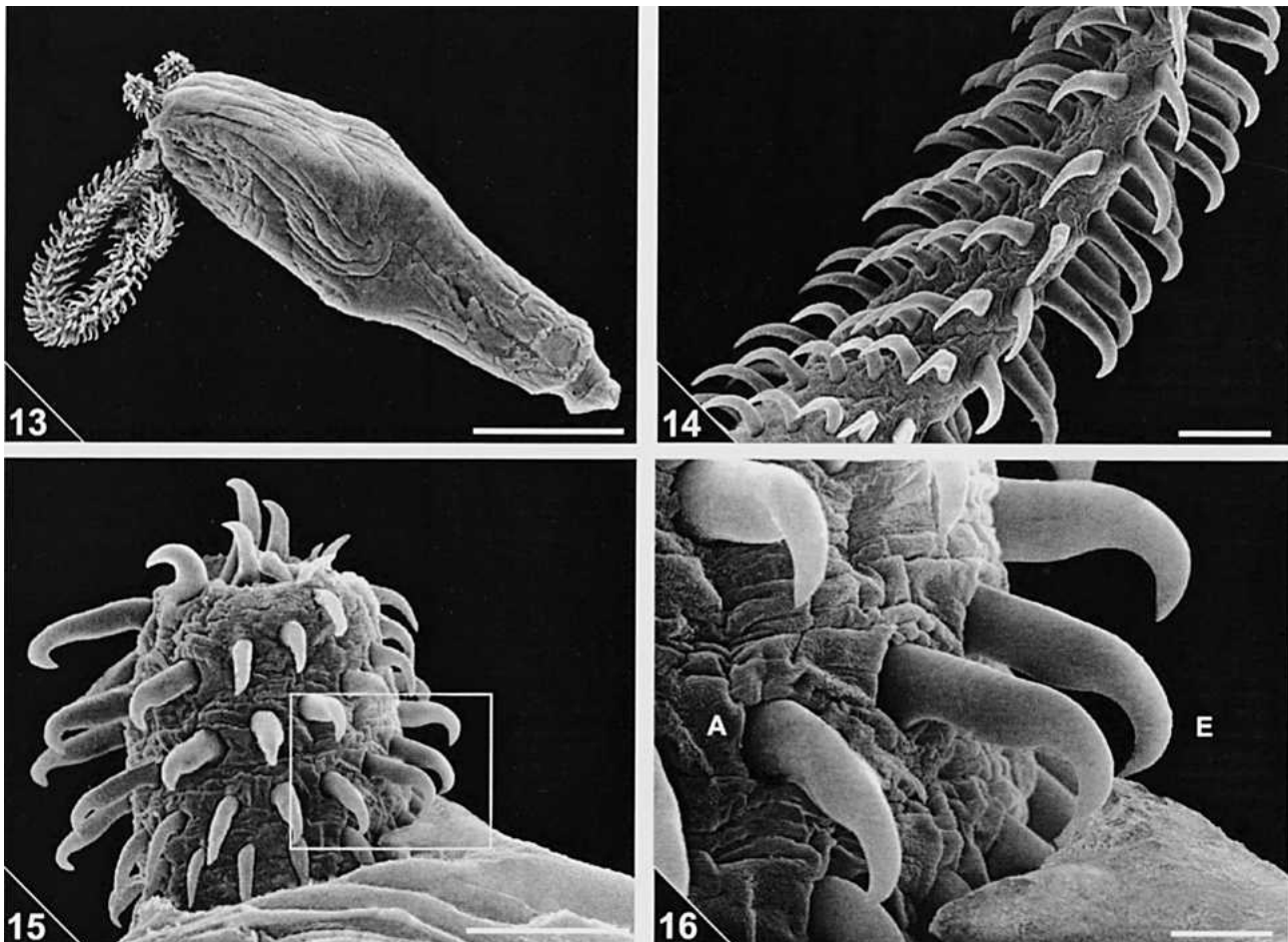
HETERONYBELINIA PALM, 1999
HETERONYBELINIA ROUGETCAMPANAE
 (DOLLFUS, 1960) PALM, 1999 (Figs 10-16)
 SYNONYM:
NYBELINIA ROUGETCAMPANAE DOLLFUS, 1960

Description based on three plerocercoids uncompresssed, two mounted and measured and one observed with SEM. Scolex subcylindrical, 1.66 (1.64-1.68) long, greatest width of scolex at level of pars bothridialis 0.62 (0.52-0.62) (including velum without appendix). Pars bothridialis 0.835 (0.83-0.84) long,

0.62 (0.52-0.72) wide. Pars vaginalis with sinuous tentacle sheaths, 0.89 (0.85-0.93) long. Pars bulbosa 0.71 (0.65-0.77) long, 0.35 (0.34-0.42) wide. Individual bulbs 0.65 (0.60-0.76) long, 0.135 (0.13-0.14) wide. Pars post-bulbosa 0.15 (0.14-0.16) long. Appendix 0.17 (0.10-0.24) long. Velum 0.105 (0.09-0.12) long. Diameter of unarmed tentacles: basal region 0.086 (0.080-0.096); metabasal region 0.081 (0.076-0.092). Tentacular armature homeoacanthous, hooks heteromorphous. Hooks of basal region, 1st and 2nd rows: bothridial hooks longer and with less prominent curvature, 0.022 long, 0.014 wide; antibothridial hooks shorter and uncinat,



Figs 10-12. – *Heteronybelinia rougetcampanae*. 10. Scolex. 11. Tentacle, metabasal region, external face. 12. Tentacle, basal region, external face. Bars of figs: 10 = 0,25 mm; 11-12 = 0,1 mm.



Figs 13-16. – *Heteronybelinia rougetcampanae*, SEM. 13. Scolex. 14. Tentacle, metabasal region, external face. 15. Tentacle, basal region, antibothridial face. Rectangle indicates region from which fig. 16 was obtained. 16. Details of bill-hooks on the basal region, two bill-hooks of antibothridial face (A) and three of external face (E). Bars of figs: 13 = 500 μ m; 14-15 = 50 μ m; 16 = 10 μ m.

0.016-0.018 long, 0.012-0.013 wide; in the 3rd row, characteristic bill-hooks present; arrangement persists to 6th row; bothridial hooks long with less prominent curvature, 0.036-0.042 long, 0.014-0.018 wide; antibothridial hooks uncinata, 0.028-0.030 long, 0.011-0.012 wide; 4th and 5th rows: bothridial hooks, tip of hooks directed downwards in an angle of 90°, 0.052-0.058 long, 0.016-0.020 wide; antibothridial hooks with less prominent curvature, 0.026-0.036 long, 0.012-0.014 wide; 6th row: bothridial hooks similar to those of 4th and 5th rows but straighter, 0.058 long, 0.020 wide; antibothridial hooks with very curved tips, 0.036 long, 0.014 wide. Hooks of metabasal region loose characteristic bill-hooks format, 7th and 8th rows: beginning of metabasal region bothridial hooks 0.060-0.066 long, 0.016-0.020 wide, antibothridial hooks 0.038-0.040 long, 0.014-0.016 wide; 12th and 13th rows: bothridial hooks 0.060-0.064 long, 0.016-0.028 wide, antibothridial 0.048-0.050 long, 0.024-0.026 wide. Apical rows, near the 45th-46th rows, hooks tend to become shorter: bothri-

dial hooks 0.044 long, 0.016-0.018 wide, antibothridial hooks 0.034 long, 0.012 wide. Metabasal tentacular armature on antibothridial face presents stouter and more markedly curved hooks, with wide basis; on bothridial face, tentacular armature consists of more slender hooks, slightly curved at distal end and with stout base, losing characteristic bill-hooks shape. Number of hooks/row, 12-14.

Host/site of infection: three plerocercoids from the spiral valve of one female of *Sphyrna zygaena* (NH). Locality: coast of the State of Santa Catarina, Brazil. Specimen deposited: CHIOC n°34500.

Material examined: adults, from *Sphyrna lewini*, Rio Grande do Sul, Brazil (CHIOC n°32657 a-d).

Remarks: the three plerocercoids recovered from *S. zygaena* in the littoral region of Santa Catarina, are larger compared to the original description on the basis of specimens obtained from *L. cutaneous*, from Dakar, Senegal (Dollfus, 1960). Nevertheless, the dimensions are closer to those reported by the latter author than

those presented either by São Clemente & Gomes (1992), on the basis of adults recovered from *S. lewini* or postlarvae collected in *M. americanus* and *U. canosai* (Pereira Jr., 1998), from the State of Rio Grande do Sul, Brazil. Dimensions of the structures of the scolex are also similar to those of the original description, except for the diameter of the tentacles which is twice as large in the basal and metabasal regions. In addition, the range of variation was larger in the basal, metabasal and distal hooks, in spite of the characteristic armatures. In the specimen examined under LM and SEM, microtriches were absent both on the scolex surface and in the grooves of the bothridial margins, in disagreement with data of Pereira Jr. (1998).

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