Harry W. Palm · Robin M. Overstreet

**Otobothrium cysticum** (Cestoda: Trypanorhyncha) from the muscle of butterfishes (Stromateidae)

Received: 12 August 1999 / Accepted: 24 August 1999

**Abstract** On the basis of the tentacular armature, surface ultrastructure, and morphological measurements of plerocerci obtained from the musculature of butterfishes (Stromateidae), we corroborate an earlier proposal that *Otobothrium crenacolle*, a commonly reported trypanorhynch cestode from the northwestern Atlantic coast, is a junior synonym of *O. cysticum*. This action exemplifies at least an Atlantic Ocean and Indian Ocean distribution for *O. cysticum*. The infection in commercially important butterfishes shows that an otobothrid trypanorhynch may heavily infect fish flesh and influence the market value of some fish species yet also be restricted to the body cavity of other fish intermediate hosts. Infections of *O. cysticum* in the flesh of *Peprilus burti* (Gulf butterfish) and *P. alepidotus* (harvestfish) from the Gulf of Mexico has varied annually since 1970, with samples ranging in prevalence between 20% and 100% and in mean intensity between 1 and 3,500 or more plerocerci per fish. Comparative infections in *P. burti* from the Gulf of Mexico and *P. triacanthus* (butterfish) from the Atlantic Ocean demonstrate a present geographic difference in infections. The prevalence and mean intensity in 4 collections of butterfishes ranged from 9% to 98% of the fish and from 1 to 678 plerocerci in a subsample of tissue, respectively, with prevalent and heavy infections being observed in the Gulf of Mexico fish and relatively few individuals being infected with few worms in the Atlantic fish. A slight host response in the butterfishes involving some fatty infiltration and inflammatory infiltration was associated with the metacestode. In some larger fish, encapsulations were yellow, and in a few cases, worms had degenerated. This finding and an increase in intensity with fish weight suggest a continual accumulation of the worms in association with little host resistance.

**Introduction**

*Otobothrium crenacolle* Linton, 1890 is one of the most abundantly reported trypanorhynch cestodes off the North American Atlantic coast. Since its original description by Linton (1890) from the smooth hammerhead shark, *Sphyra zygaena*, from Woods Hole, Massachusetts, the plerocerci of this trypanorhynch have been reported from numerous teleosts, elasmobranchs, and a squid, and the adult is reported to infect several elasmobranch hosts (e.g., Linton 1924; Dollfus 1942; Stunkard 1977; Reimer 1984). Linton (1907a, 1910, 1913) directed special attention to the muscle infection of the butterfish, *Peprilus triacanthus* (as *Rhombus triacanthus* and *Poronotus triacanthus*) but included infections from other sites in various other fishes from Woods Hole, the Dry Tortugas, and Bermuda (Linton 1901, 1905, 1907a, b, 1909). Heavy infections affected the market for this food fish because of the unappetizing appearance and presumed poor quality of infested specimens and due to the prejudice against eating wormy meat (Linton 1907a, 1913; Smith and Youngberg 1982).

During recent investigations on trypanorhynch cestode fauna from West African and Brazilian localities, Palm et al. (1994) and Palm (1997a) collected specimens from the mesentery of ten teleost species and identified them as *O. cysticum* (Mayer, 1842) Dollfus, 1942. *O. cysticum* is known only in the larval form and was redescribed from the type host *Chelonia mydas* (green turtle) off the African coast by Dollfus (1942). On the basis of similar scolex and hook morphology, Palm
(1995) proposed in a dissertation that *O. crenacolle* was a junior synonym of *O. cysticum*. However, he did not examine pleroceri of *O. crenacolle* from butterfishes, which Linton considered to be the main intermediate hosts for the species.

The purpose of the present study was to compare pleroceri reported as *O. crenacolle* and *O. cysticum* and to reconsider the synonymy of *P. burti* under a Zeiss DSM 940 scanning electron microscope operating at 15 kV. Coated with gold-palladium in an argon atmosphere, and examined mounted with double-sided adhesive tape onto SEM stubs, sputter-microscopy (SEM), transferred to distilled water, and dehydrated.

Parasite counts for the four NMFS samples represent the number of muscle-dwelling specimens from butterfishes and their hosts for the species. The purpose of the present study was to compare pleroceri reported as *O. crenacolle* and *O. cysticum* and to reconsider the synonymy of *P. burti* under a Zeiss DSM 940 scanning electron microscope operating at 15 kV.

Materials and methods

From February 1970 to May 1998, pleroceri of *Otobothrium cysticum* were collected from stromatied fishes, *Peprilus alepidotus* (harvestfish), *P. burti* (Gulf butterfish), and *P. triacanthus* (butterfish) from the northern Gulf of Mexico. *P. burti* and, in some cases, *P. alepidotus* were caught either from inshore and near-shore (as far as 10 km south of Horn Island) waters in Mississippi in trawls or offshore with trawls and purse seines along the continental shelf and slope by the National Marine Fisheries Service (NMFS) using RV OREGON II or commercial fishing boats conducting butterfish surveys for the NMFS. The latter samples came from various offshore locations throughout the Gulf off the coasts of Florida, Mississippi, and Texas, some locations being at least 145 m deep. Two trawl collections (July 1988, May 1989) were made south of Mississippi River and Mobile Bay. Fishes from inshore Mississippi waters were maintained alive until examined; those from offshore waters were quick-frozen aboard vessels. Samples of *P. triacanthus* from the New England United States Atlantic coast came from a commercial dealer in Point Judith, Rhode Island, and from a groundfish survey conducted by the NMFS Northeast Fisheries Center, Woods Hole Laboratory, in September 1988. Fish from that survey included grouped samples from an area extending from the Gulf of Maine to Cape Hatteras. Parasite counts for the four NMFS samples represent the number counted in four combined 1-cm² sites per fish near the vertebral column, two above and two below. As based on photographs and representative counts in several fish, the number of parasites from the four sites represents about 30% of the total number of worms per fish (therefore, counts can be multiplied by 3.3 for approximate total values). The condition [length-weight relationship expressed as the fork length (FL) in millimeters and the weight (W) in grams: \( K = W \times 10^{0.7/FL} \)] of *P. burti* was determined for 18 pairs of heavily and lightly infected fish having nearly identical lengths as well as for 9 pairs of lightly infected and noninfected individuals of *P. triacanthus* from the United States Atlantic coast.

Tryptanorhynch specimens isolated from butterfishes were killed in hot water or cold 5% buffered formalin. Parafin sections were cut to a thickness of 4 μm and then stained in hematoxylin and eosin (H&E). The scolices of eight specimens fixed in Karnovsky’s solution were transferred to 0.1 M sodium cacodylate (NaCaC) buffer, postfixed in 1% osmium tetroxide for scanning electron microscopy (SEM), transferred to distilled water, and dehydrated in a graded ethanol series. They were then critical-point-dried and mounted with double-sided adhesive tape onto SEM stubs, sputter-coated with gold-palladium in an argon atmosphere, and examined under a Zeiss DSM 940 scanning electron microscope operating at 15 kV.

In addition to morphometric data on specimens obtained from *P. burti* and *P. triacanthus*, those on specimens identified as *O. crenacolle* from the United States National Parasite Collection (USNPC, Beltsville, Md.), namely, USNPC 7695 (adult from *Sphyraena zygaea*, coll. E. Linton) and 35923 (larva from *T. triacanthus*, coll. G.A. MacCallum), were examined for purposes of comparison. The orientation of bothridial surfaces follows that of Richmond and Caira (1991), and the terminology follows that of Palm (1997b). We used the following abbreviations: scolex length, SL; scolex width at the level of the pars bothridialis, SW1; scolex width at the level of the pars bulbialis, SW2; pars bothridialis, pbo; pars vaginalis, pv; pars bulbialis, pb; and appendix, app. Measurements are given in micrometers unless otherwise indicated; ranges are given in parentheses.

Results

Description

*Otobothrium cysticum* (Mayer, 1842)

1. Synonyms: *Tetrarhynchus cysticus* Mayer, 1842; *Echinococcus corollatus* Mayer, 1842 (*alterum nomen*); *Tetrarhynchus* sp. Wagener, 1851; *Uranoscoepi scabri* (Wagener, 1851) Diesing, 1863; *Tylochlaenias vadigo* (Wagener, 1854) Diesing, 1863; *Otobothrium crenacolle* Linton, 1890; *Tetrarhynchus* sp. Linton, 1897, in part; *T. crenacolle* (Linton, 1890) Vailliegeard, 1899; *T. testudinis* (Meyer, 1840) Vailliegeard, 1900; *Rhynchobothrium* sp. Linton, 1901; *R. curtum* Linton, 1909; *O. crenacolle* Linton, 1890 [= type species of genus]; *O. curtum* (Linton, 1909) Dollfus, 1942; and *O. cysticum* (Mayer, 1842) Dollfus, 1942 (also see Dollfus 1942; Palm 1995).

2. Supplemental data (based on eight specimens from *Peprilus burti* and two from *P. triacanthus*): scolex and tentacle features correspond to descriptions by Dollfus (1942), Palm et al. (1994), and Palm (1995) for *O. cysticum*. The SL (\( n = 5 \)) is 478 (415–583), the SW1 (\( n = 8 \)) is 245 (201–291), the SW2 (\( n = 6 \)) at its narrowest is 114 (81–139) and at its widest is 130 (94–161). There are two elongated bothridia, which occupy nearly half the length of the scolex (Fig. 1). The pbo (\( n = 8 \)) is 234 (193–278), with a posterior notch, the bothridial margins are not fused with the scolex peduncle. The pv is variable in size (\( n = 5 \)), measures 408 (316–522) and contains spirally coiled tentacle sheaths. The tentacle bulbs are ovoid and extend to the posterior margin. The bulbular length (\( n = 7 \)) is 77 (74–83), the width (\( n = 7 \)) is 55 (44–65), and the bulb length: width ratio is 1.4:1. The scolex proportions correspond to pbo:pv: pb = 3:5:3:1; the app (\( n = 8 \)) length is 92 (774–114) and the width is 138 (121–165).