

Report of *Thecacineteta calix* (Ciliophora: Suctorea) as an epibiont of harpacticoid copepods from Caribbean mesophotic reefs

TAPAS CHATTERJEE¹*, GREGORIO FERNANDEZ-LEBORANS² AND NIKOLAOS V. SCHIZAS³

¹Department of Biology, Indian School of Learning, I.S.M. Annexe, P.O. – I. S. M., Dhanbad 826004, Jharkhand, India

²Department of Zoology, Faculty of Biology, Pnta 9, Complutense University, 28040 Madrid, Spain

³Department of Marine Sciences, University of Puerto Rico at Mayagüez, Call Box 9000, Mayagüez, PR 00681, Puerto Rico, USA

*Corresponding author: drtchatterjee@yahoo.co.in

ABSTRACT.—The present study reports a new record of the suctorian ciliate *Thecacineteta calix* (Schröder, 1907) as an epibiont of harpacticoid copepods from the mesophotic coral ecosystems of Puerto Rico and U.S. Virgin Islands (St. John). Morphological measurements of the epibionts are presented. Distribution and host specificity of *T. calix* is also discussed.

KEYWORDS.—epibionts, suctorians, *Thecacineteta calix*, mesophotic reefs, Caribbean.

INTRODUCTION

Many crustaceans (eg. cladocerans, copepods, cirripedes, isopods, amphipods, and decapods) are hosts for suctorian ciliate epibionts (Collin 1912, Swarczewsky 1928a, b, c, Gajewskaja 1933, Matthes and Guhl 1973, Green 1974, Bierhof and Roos 1977, Henebry and Ridgeway 1979, Matthes et al. 1988, Batisse 1992, Hudson and Lester 1994, Zhadan and Mikrjukov 1996, Fernandez-Leborans and Gómez del Arco 1996, Fernandez-Leborans et al. 1996, 2006, Mayen-Estrada and Aladro-Lubel 1998, Fernandez-Leborans and Tato-Porta 2000, Fernandez-Leborans 2009, Chatterjee et al. 2013a, b, c). A number of ectocommensals suctorian ciliates have been observed on the cuticle of various species of copepods (Collin 1912, Kahl 1934, Sewell 1951, Dovgal 1985, Henebry and Ridgeway 1979, Fernandez-Leborans and Tato-Porta 2000).

Mesophotic Coral Ecosystems (MCEs) are a habitat largely unexplored for ciliate ectocommensals. MCEs are found at depths from between 30–40 m to 100 m in the tropics (Locker et al., 2010) and are dominated by macroalgae, sponges and reef-building corals. In the U.S. Caribbean (Puerto Rico and U.S. Virgin Islands), the area for potential mesophotic coral habitat (30-100 m) is 3,892 km² and could rival in importance the known shallow water coral habitats (0-30 m) of 4,630 km² (Locker et al. 2010). Therefore, it is not surprising that

this previously undersampled depth zone has recently yielded new species and new records of macrofauna and meiofauna (Pesic et al. 2012, Petrescu et al. 2012, 2013, Corgosinho and Schizas 2012). In the present study, specimens of *Thecacineteta calix* were recovered as epibionts on harpacticoid copepods from different mesophotic habitats of two Caribbean islands.

MATERIALS AND METHODS

The copepod hosts that harbored suctorians described in this study were collected from Puerto Rico and St. John, U.S. Virgin Islands. Harpacticoid copepods were collected during research activities related to the Deep CRES Program of the Department of Marine Sciences, University of Puerto Rico at Mayagüez. Substrata (loose rubble, corals, sponges, algae) were collected by hand through technical diving (Tri-Mix Rebreathers) and placed in plastic bags. Within minutes of collection, the substrata were placed over a 1 mm and 0.125 mm sieve and washed with filtered seawater. Infested organisms were isolated from samples using an Olympus SZH10 binocular dissecting stereomicroscope. The ciliates were identified using an Image Analysis (Zeiss K 300) system with a Zeiss compound microscope. Measurements of ciliates were made using the computer program ScopePhoto 2.0 for processing the digital images. For slide

preparations, the material was stained with Boehmer's hematoxylin and mounted in Canada balsam. The permanent slides of infested organisms have been deposited in the Museum für Naturkunde (Invalidenstr. 43, Berlin).

RESULTS AND DISCUSSION

Systematics

Class Suctorea Claparede et Lachmann, 1859

Subclass Vermigenia Jankowski, 1978
 Order Spelaeophryida Jankowski, 1978
 Family Thecacinetidae Matthes, 1956
 Genus *Thecacineta* Collin, 1909
Thecacineta calix (Schröder, 1907)
 (Figure 1A-D)

Materials Examined

Three individuals on a harpacticoid copepod, east St. John (18°13.31160', -064°40.56000'), U.S. Virgin Islands (Slide deposited in Museum für Naturkunde accession number: ZMB Protoz. slide 61); depth 53 m, collected on 8 May 2012; collected by the University of Puerto Rico at Mayagüez, Department of Marine Sciences (UPRM-DMS) Trimix Rebreather diving team during the 2012 mesophotic cruise (Sherman et al. 2013) organized by the Caribbean Coral Reef Institute (CCRI) with the commercial vessel Spree.

One individual on a harpacticoid copepod west of Caja de Muertos Island near Ponce, Puerto Rico (17°51.19800', -066°34.86000') (Slide deposited in Museum für Naturkunde accession number: ZMB Protoz. slide 62) depth 52 m, collected on 19 October, 2010, collected by the University of Puerto Rico at Mayagüez, Department of Marine Sciences (UPRM-DMS) Trimix Rebreather diving team.

Two individuals on a harpacticoid copepod from Buoy 17°53.29920', -066°59.88540', La Parguera, Puerto Rico (Slide deposited in Museum für Naturkunde accession number: ZMB Protoz. slide 63); depth 46 m, collected on

9 November, 2007 collected by the University of Puerto Rico at Mayagüez, Department of Marine Sciences (UPRM-DMS) Trimix Rebreather diving team.

DIAGNOSIS

Marine loricate suctorian. Cell body entirely fills the lorica and attaches to its base. Lorica ribbed with a series of transverse annular ridges that become progressively closer toward the base. Apical part of body protrudes beyond lorica aperture. Up to 30 clavate tentacles with length about 90 µm arise from apical surface of body. Macronucleus large, ovoid, located in the basal region of the cell body. Large contractile vacuole located in basal region of body usually near macronucleus. Table 1 shows morphometric measurements of the specimens of *Thecacineta calix* observed in the present study.

TABLE 1. Morphometric measurements of *Thecacineta calix* on harpacticoid copepods collected from mesophotic zones of coral reefs in Puerto Rico and U.S. Virgin Islands.

Characters	Minimum	Maximum
Length of lorica (µm)	87	96.8
Width of lorica (µm)	31.7	47
Length of body (µm)	31.8	79
Width of body (µm)	11.6	23.5
Diameter of macronucleus (µm)	8.7	10.6
Number of annular ridges in lorica	7	19
Number of tentacles	15	17
Length of stalk (µm)	6.3	21.6
Maximum width of stalk (µm)	5.7	9.8

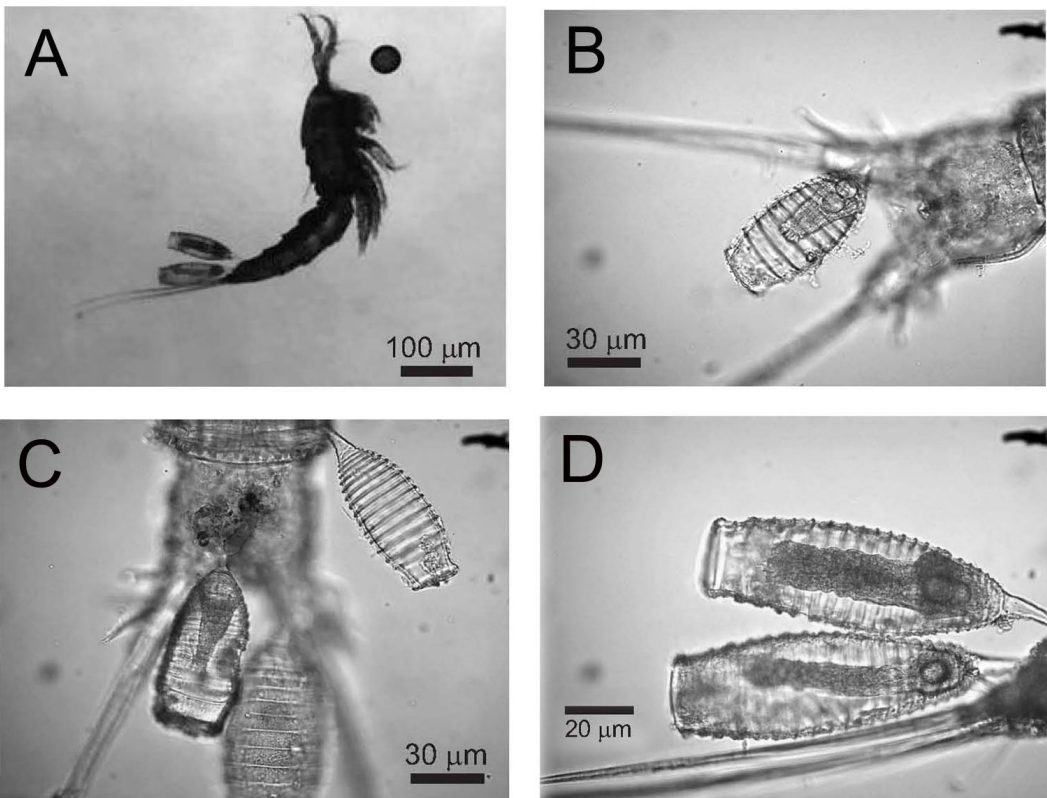


FIG 1. A. *Thecacineta calix* attached on posterior part of a harpacticoid copepod; B-D. Magnified view of *T. calix*.

DISTRIBUTION AND HOST SPECIFICITY

Earlier reports have established *Thecacineta calix* as widespread epibiont of nematodes, crustacean copepods, and halacarid mites from the Atlantic, Pacific, Antarctic and Indian Oceans (Schröder 1907, Allgen 1949, 1952, 1955, Matthes 1956, Gelmboldt and Dovgal 2005, Dovgal et al. 2008, Ingole et al. 2010, Chatterjee et al. 2012). *Thecacineta calix* has been reported as epibiotic on the nematodes *Desmodora campbelli*, *D. microchaeta*, *D. odhneri*, *D. pontica*, *D. reducta*, *D. sphaerica*, *D. stateni*, *Acanthopharynx japonicas*, *Epsilonema symbioticum*, *E. pocillothrix* and *Paradesmodora* sp.

(Schröder 1907, Schulz 1931, Steiner 1931, Allgen 1949, Matthes 1956, Susetiono 2006, Jankowski 2007, Ingole et al. 2010). Among halacarid mites *T. calix* has been reported as epibiotic on *Halacarellus* sp. in Odessa Gulf of the Black Sea, *Halacarellus micropectinatus* in the Black Sea near Sevastopol, *Copidognathus fabricii* from the North Sea, *Actacarus octocetus* in the Northwest Pacific Ocean off Hokkaido, Japan, and on *Agauopsis* sp. from Taiwan (Gelmboldt and Dovgal 2005, Dovgal et al. 2008, Chatterjee et al. 2012). Matthes (1956) investigated *T. calix* as epibionts on the harpacticoid copepod *Laophonte cornuta* from the Mediterranean Sea.

The present record of *T. calix* is the first record on harpacticoid copepods from the mesophotic coral ecosystems of Puerto Rico and U.S. Virgin Islands (St. John).

This species has been reported from a widely distributed area, whether all these records belong to the same species or comprise of a closely related species complex should be resolved with detailed morphological analysis and molecular markers.

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