

***Cryptostylochus hullensis* sp. nov. (Polycladida, Acotylea, Platyhelminthes): a possible case of transoceanic dispersal on a ship's hull**

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ABSTRACT: In July 1993, the car carrier "Faust" entered Bremerhaven after a voyage from the North-American Atlantic coast to Europe. In a dockyard, five living specimens of the order Polycladida were collected from the hull of the ship. This could be a possible case of trans-atlantic dispersal of plathelminths living as fouling organisms of ships. The specimens found represent a new species of the genus *Cryptostylochus* Faubel, 1983, *Cryptostylochus hullensis* sp. nov.

INTRODUCTION

Observations on the dispersal of benthic macro- and meiofauna were already made a long time ago (for references see Young & Young, 1976; Gerlach, 1977). Most macro-benthic species develop planktonic larvae (known also from species of the order Polycladida) that drift in water currents and can settle in new areas. In contrast, meiofaunal organisms as a rule lack planktonic larvae; colonization of new areas is brought about by other mechanisms (Palmer, 1988).

Dispersal mechanisms are, for example, aerial transport by birds and wind, floating on ice (Steinböck, 1931) and driftwood (fouling), transport in the ballast of sailing ships (cf. Young & Young, 1976; Gerlach, 1977), plate tectonics (Sterrer, 1973), water-column pathways (Butman, 1986; Palmer, 1988), and transport of non-indigenous species for aquaculture (Hedgpeth, 1980; Reise, 1993).

Records of turbellarians introduced to a new habitat by human impact were published by Maurin & Le Dantec (1979), Carlton (1985), and Lipton et al. (1992). There are no records of turbellarians living on the hulls of ships. In 1993 the co-author collected aufwuchs from a ship's hull docked in Bremerhaven, Germany. The specimens provide evidence that individuals may be dispersed by ships, in this case possibly even on transoceanic seaways. The specimens belong to a new species described below.

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MATERIAL AND METHODS

Five specimens were collected from the hull of the vessel "Faust", a car carrier, on July 23rd 1993, after docking. The ship left Jacksonville, Florida, USA, at the beginning of July. Before crossing the Atlantic, the ship stopped at Charleston, South Carolina, Baltimore, Maryland, and New York, respectively. The European ports entered successively were Southampton (Great Britain), Le Havre (France), Antwerp (Belgium) and Bremerhaven (Germany). The ship was docked at Bremerhaven harbour at the end of July.

During the ship's voyage the organisms on the ship's hull were exposed to changing environmental conditions. Salinity decreased from 35.10 PSU in the Atlantic pelagial to 11.10 PSU in the Weser river estuary at Bremerhaven. The water temperature at Bremerhaven was 18.7 °C. After docking, the fouling community was exposed to 15.3 °C air temperature (direct radiation of sunlight for about 1 hour).

The organisms were collected at 1.00 p. m. and afterwards transported to the laboratory, where they were transferred to seawater of 33 PSU. Next day they were fixed in 70 % ethanol. For histological observation, specimens were embedded in Paraplast plus, cut sagittally at 6.5 µm, and stained with haematoxylin-eosin according to Mayer (Romeis, 1968).

DESCRIPTION

Superfamily Stylochoidea Poche, 1926
Family Pseudostylochidae Faubel, 1983
Gattung *Cryptostylochus* Faubel, 1983
Cryptostylochus hullensis sp. nov.

(Fig. 1)

Locality: Hull of the car carrier "Faust" docked in the harbour of Bremerhaven, 5 specimens, July 23rd 1993. The faunal fouling association, consisting of turbellarians, polychaetes, amphipods, decapods, cnidarians and cirripedes, covered nearly 10 % of the ship's hull. The polyclads were found inside empty shells of cirripedes.

Material examined: Sagittally sectioned specimen, 6.5 µm sections mounted on 44 slides, deposited in the Zoological Museum, University of Hamburg, Germany, V 13213 [holotype]. 3 whole mounts, V 13214 [paratypes].

Living specimens of *Cryptostylochus hullensis* 1.1 cm long by 0.6 cm wide. In fixed specimens body shape more or less round of firm consistency (Fig. 1A) with smooth dorsal surface. Basic colour whitish in incident light; diffuse, light brown dots speckled through the dorsal body wall.

Tentacular, frontal, and marginal eye spots present. Tentacular ones arranged at base of tentacles (Fig. 1B) and in distal parts of both nerve tracts ascending from the ventral brain to the tentacles. Few frontal eyes scattered between brain and anterior margin. Marginal eyes small, confined to a single irregular anterior row.

Epidermis, 13.0 µm high, with intraepithelial nuclei, rhabdites, and mucus glands, covered with 14.8 µm long cilia; mucus glands dorsal more numerous than ventral. Pigment cells are located between basement membrane and muscle wall of body. Dorsal and ventral muscle walls of body different. Dorsal wall with weak and smooth layers consisting of outer circular and inner longitudinal muscle fibres; ventral wall with strong lay-

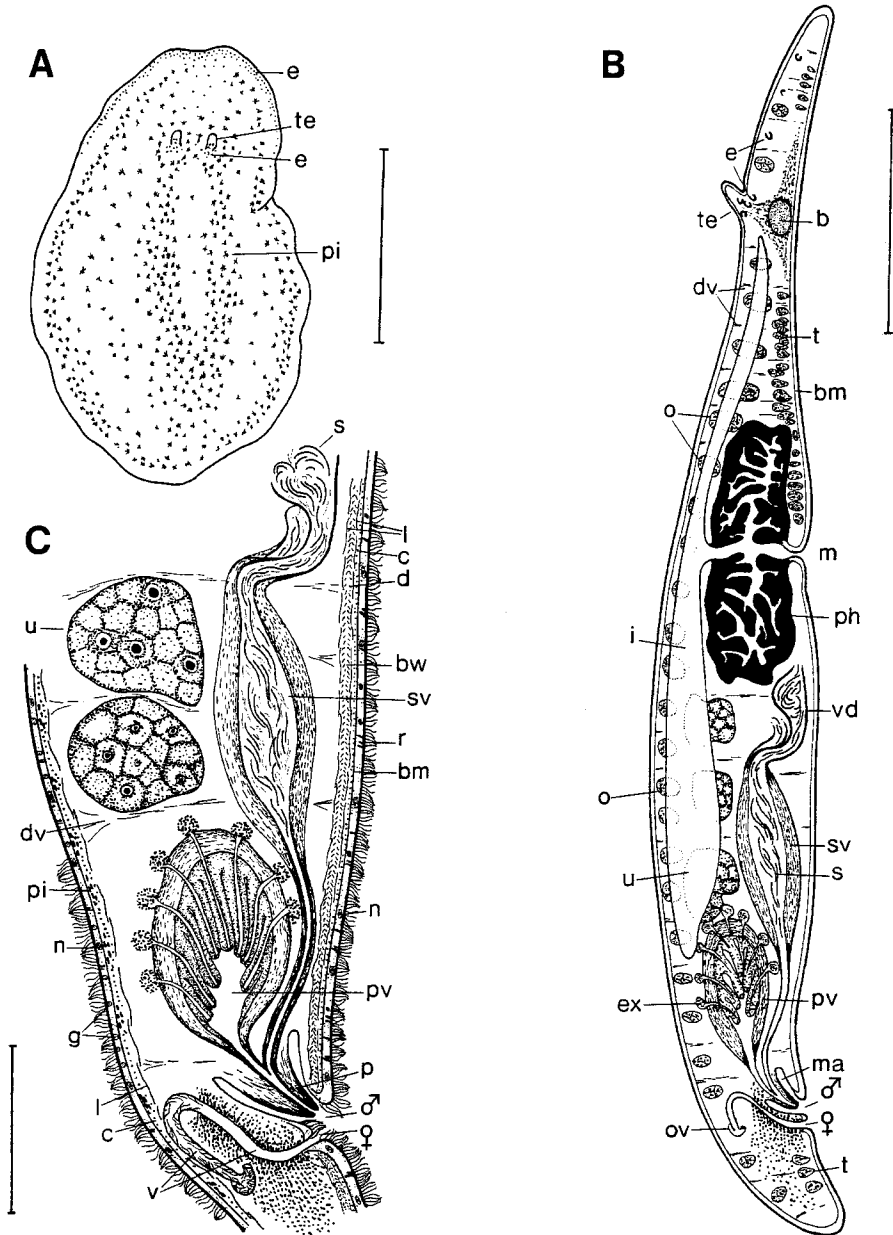


Fig. 1. *Cryptostylochus hullensis* sp. nov. A: Dorsal view (bar = 0.5 cm). B: Diagrammatic sagittal reconstruction of the male and female copulatory apparatus (bar = 200 μ m). C: Sagittal reconstruction of the male and female copulatory apparatus (bar = 100 μ m). b, brain; bm, basement membrane; bw, body muscle wall; c, circular muscle fibres; e, eyes; ex, extravascular glands; dv, dorsoventral muscle fibres; g, mucus gland; i, intestine; l, longitudinal muscle fibres; m, mouth; ma, male atrium; n, nucleus; o, ovary; ov, oviduct; p, penis papilla; ph, pharynx plicatus; pi, pigment; pv, prostatic vesicle; s, sperm; sv, seminal vesicle; t, testes; te, tentacle; u, uterine vesicles; v, vagina; vd, vas deferens; δ , male gonopore; ϱ , female gonopore

ers of circular, and longitudinal fibres, two layers diagonally crossing each other, and a layer of longitudinal fibres in inward succession. Dorso-ventral muscle fibres present.

Pharynx plicatus well ruffled with many much-coiled folds located somewhat anterior to centre of body. Mouth opening at the centre of the pharyngeal cavity. Main intestine arises directly above the mouth opening, extending dorsally forwards to the level of the brain and backwards to the prostatic vesicle of the male genital complex.

Reproductive system (Fig. 1B, C). Testes and ovaries dispersed throughout whole body parenchyma; testes ventrally located and ovaries dorsally. Male and female genital complex located in posterior half of body, well behind the pharyngeal cavity. Genital pores very close to each other, but distinctly separated.

Male complex directed backwards (Fig. 1C). Vasa deferentia terminate by joining the seminal vesicle. The copulatory organ consists of a voluminous seminal vesicle, a free prostatic vesicle tubularly chambered, and a distal unarmed penis papilla housed in a male atrium. Prostatic and ejaculatory ducts unite halfway between opening of penis papilla and base of papilla. Seminal and prostatic vesicles invested by thick monolayered muscular housings. Prostatic glands extraventricular. Their granular secretion ducts penetrate the muscular housing.

The female complex lies close behind male one (Fig. 1C). Lang's vesicle lacking. Proximal oviducts widened and filled with oocytes. Distal oviducts ciliated, joining the vagina dorso-caudally. Proximal part of the vagina ciliated, directed frontad. Distal vagina running dorso-ventrad, without cilia in these parts surrounded by masses of eosinophilous mucous glands.

Remarks: *Cryptostylochus hullensis* is the second species of the genus described. Diagnostic distinctions are arrangement of eyes, a small pharyngeal cavity with central mouth opening and the non-ciliated lining of the distal vagina.

Etymology: The specific epithet refers to the locality where species was found, i.e. a ship's hull.

DISCUSSION

According to Faubel (1983), the family Pseudostylochidae Faubel, 1983 is characterized by a combination of the following features: male copulatory apparatus directed backwards and free prostatic vesicle with tubularly chambered interior lining. At present 7 genera of the family are known, distinguished mainly on the basis of the female apparatus.

The generic feature of the genus *Cryptostylochus* Faubel, 1983 is the lack of Lang's vesicle. *Cryptostylochus hullensis* sp. nov. differs markedly from the only known representative of the genus, *Cryptostylochus coseirensis* (Bock, 1925), in the arrangement of frontal and marginal eyes, in the pharyngeal system and the ciliated lining of the proximal vagina.

C. hullensis represents a new species, but we have no information on its environmental preferences and where the species comes from. Nevertheless, we are convinced that *Cryptostylochus hullensis* is from subtropical or warm temperate waters of the western North Atlantic. The reason for this assumption is that the polyclad fauna of the western North Atlantic and the Caribbean Sea is not well known despite the work of Hyman (1940, 1955), in contrast to the extensive knowledge of the polyclads of temperate European Seas.

There are few reports on the recruitment of plathelminths. Maurin & Le Dantec (1979) and Lipton et al. (1992) documented the introduction of *Koinostylochus ostreophagus* (Hyman, 1955) by importing Japanese oysters to France and British Columbia (Canada), respectively. Carlton (1985) collected a species of the order Acoela in ballast water taken in Wilmington, Delaware, USA. Evidence that new immigrants have established new populations was provided by Hauer (1950) for *Euplanaria tigrina* in Germany and by Ball (1969) for *Dugesia polychroa* in the Great Lakes, USA. As means of dispersal these authors assume transport in ballast water of ships.

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