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## A new species of *Loxosoma* from north-western Finistère, France

(Spiralia, Kamptozoa (= Entoprocta), Solitaria, Loxosomatidae)

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A new species of solitary Kamptozoa is described from the intertidal near Saint-Pol-de-Léon, France. The species is associated with the annelid *Petaloproctus terricola* and is characterized by long, spine-like processes of the calyx. For the species the name *Loxosoma nielsenii*, spec. nov. is proposed.

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### Introduction

The genus *Loxosoma* Keferstein, 1862 currently contains 25 species (Nielsen 1996) of exclusively marine kamptozoans characterized by a round sucking disc at the end of the stalk and by a solitary mode of life. All species live in association with annelids, except for *Loxosoma isolata* Salvini-Plawen, 1968, which seems to be living interstitial in middle-coarse sand, and *Loxosoma jaegersteni* Nielsen, 1966 for which the adult habitat is unknown. Here, the find of a new and remarkable species of *Loxosoma* is reported.

### Material and Methods

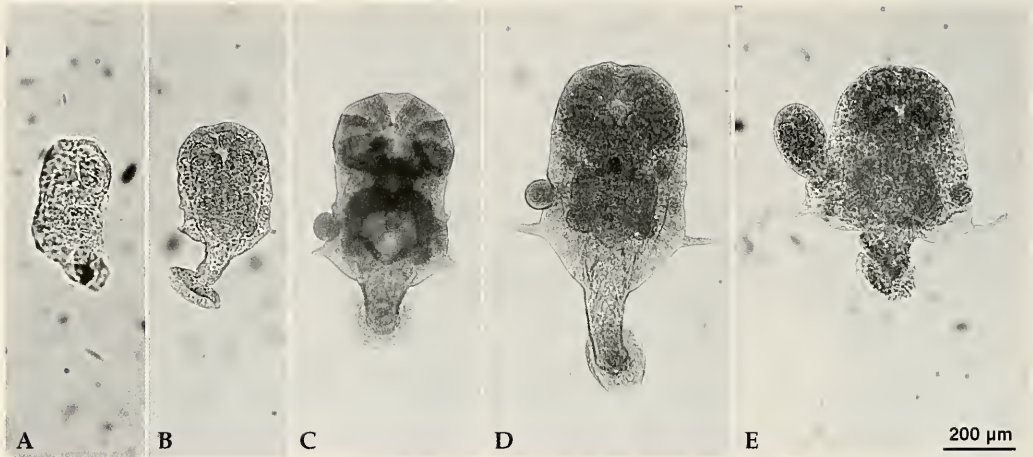
The material was collected by Claus Nielsen at Plage de Pempoul, a beach near Saint-Pol-de-Léon, France on June 17th, 2000. It comprises one host annelid specimen and about 50 kamptozoans, all belonging to the new species. Host and epizoa were narcotized with  $MgCl_2$  (7.5% in distilled water) and fixed in Bouin's fixative. Single specimens were then transferred to microscope slides and mounted in pure Aquatex (Merck). Prior to this treatment live animals were studied in seawater.

### Description of the new species

*Loxosoma nielsenii*, spec. nov.

Figs 1-3

**Types.** Holotype: One specimen of almost maximum size with one bud (Figs 1D, 2A); Plage de Pempoul, Saint-Pol-de-Léon, France, holotype (on microscopical slide) deposited at Zoological Museum, University of Copenhagen, Denmark (registration number: ZMUC-ENT0024). – Paratypes: Nine specimens of different age, from same locality, also on slides and deposited in ZMUC (registration numbers: ZMUC-ENT0025a-i).



**Fig. 1.** Ontogenetic stages of *Loxosoma nielsenii*, spec. nov. All panels are to the same scale (scale bar in E: 200 µm). The specimen in E has been deformed during preparation, causing the stalk to be pushed into the calyx. Without this deformation the specimen would have approximately the same size as the specimen in D. All specimens are paratypes, except for the one in D, which is the holotype, and all are fixed.

**Etymology.** The specific epithet refers to Claus Nielsen, in appreciation of his past and current contributions to our knowledge of the taxonomy, systematics and phylogeny of the Kamptozoa.

### Description

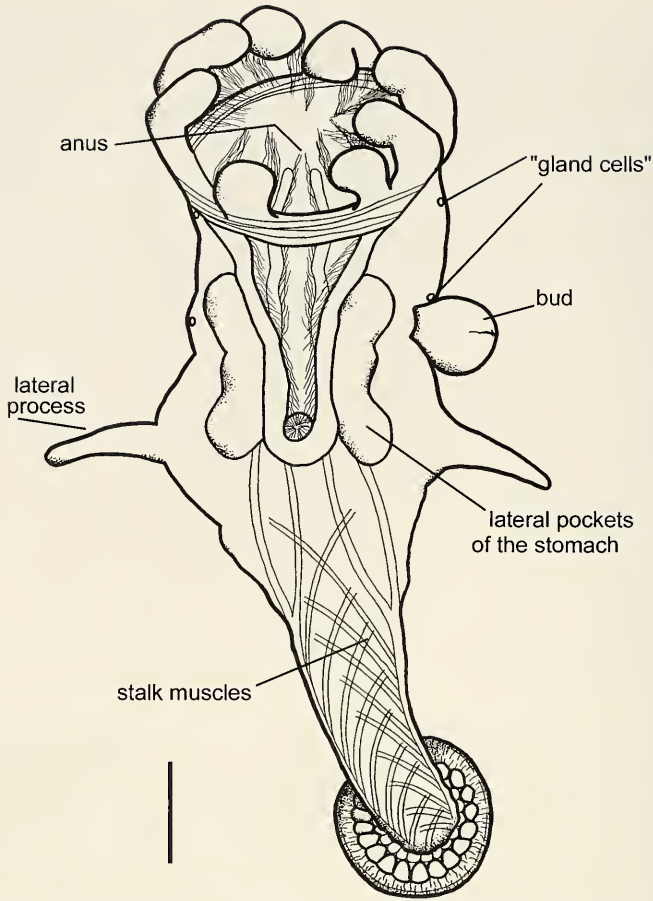
The tallest specimens measure about 950 µm (300 µm stalk and 650 µm calyx), while the smallest specimens are only about 400 µm in length. All specimens possess a round sucking disc at the end of the stalk with which they adhere to the host annelid. This is the basis for their assignment to the genus *Loxosoma*. There are always eight short tentacles; even older buds, that already form an atrium, possess eight tentacle buds (Fig. 2B, arrow). The stomach is almost V-shaped, but has very conspicuous lateral pouches. On each side of the calyx there are two small structures with a refraction index much different from that of the remaining body. These possibly unicellular surface epithelial structures look like beads and are known as “gland cells”, although their function is not well understood (Emschermann 1972). They have been found in many kamptozoans, so far. Their value for species characterization is deemed to be low (Emschermann 1972), but in *Loxosoma nielsenii* their number, location and size (see Figs 2A, 3) is constant. The stalk has a strong musculature consisting of longitudinal and diagonal muscles, that together form a dense muscle layer which only at the stalk-calyx border dissolves into single muscle bands.

The most prominent trait of the new species are the lateral spine-like protrusions of the calyx, one on each side. The smallest individuals do not possess these protrusions and they also lack any signs of bud formation (Fig. 1A). Only in animals of about 500 µm the outgrowths can be seen, but there are still no buds (Fig. 1B). Individuals of about 700 µm show clearly visible “spines” protruding from small wing-like extensions of the calyx. Only on one side of the body, right below one of these “wings”, a small and mouthless bud can be seen in most individuals of this size (Fig. 1C). In the tallest specimens bud size is increased (Figs 1D,E) and in specimens having very large buds already with an atrium and tentacle buds, the formation of a second bud on the other side, but otherwise in the identical position as the first one, can be observed (Fig. 1E). The lateral protrusions are very long in these specimens, reaching a maximum of 150 µm (Fig. 2A, inset).

The different phenotypes are here interpreted as different ontogenetic stages of the new species (Figs 1A-E). In this interpretation the series of different specimens reveals a very stereotypic way of bud formation starting when the growing animal reaches a length of 700 µm. The site of bud formation is restricted to a point below and slightly anterior to the base of the lateral processes. Also timing and sequence of the budding seem to be tightly regulated: budding occurs first only on one side of the calyx. Budding on the opposite side is initiated only when the first bud is almost ready for detachment. Also



**Fig. 2.** Morphology of *Loxosoma nielseni*, spec. nov. **A.** Composite microphotograph of the holotype. Note the "gland cells" (arrowheads). Inset in 2A: detail of a lateral process of the specimen shown in 1E, demonstrating the maximum length of this structure. **B.** Specimen (paratype) with an older bud (arrow), already showing an atrium and a forming tentacle crown with eight tentacle buds. All panels are to the same scale (scale bar in A: 150 µm). All specimens are fixed.



**Fig. 3.** Schematic representation of the anatomy of *Loxosoma nielsenii*, spec. nov. The figure has been made after a living specimen. The bases of the oral tentacles are omitted. The digestive tract is shown from the rear aspect and "semi-transparent" in order to demonstrate the shape of the stomach. Of the ascending branch only the end and the anus is shown, the descending branch (mouth slit and esophagus) is omitted. The view into the U-turn can be seen as a heavily ciliated circle in the middle of the living animal. Scale bar: 100  $\mu\text{m}$ .

the lateral processes show a constant growth during ontogeny. Although the growth of the body comes to a rest at approximately 950  $\mu\text{m}$ , this point does not mark the end of process growth and bud formation (compare figs 1D and 1E); it seems that growth of the processes continues until the formation of the first bud is finished. The function of the processes is not known.

**Habitat.** *Loxosoma nielsenii* has been found living on a single specimen of *Petaloproctus terricola* (det. Claus Nielsen, pers. comm.), collected in the lower intertidal. Substratum: coarse sand and shell debris.

**Differential diagnosis.** The combination of body size, number of tentacles and the lateral projections of the calyx readily distinguish *Loxosoma nielsenii* from every other species of *Loxosoma*. Lateral processes are known from *Loxosoma loxalina* Assheton, 1912, *Loxosoma davenporti* Nickerson, 1898 and *Loxosoma saltans* Assheton, 1912. Only in the latter species these processes reach a significant length, but are still visibly shorter than in *Loxosoma nielsenii*. Additionally, *Loxosoma saltans* has many more tentacles. Species similar in habitus to *Loxosoma nielsenii* are: *Loxosoma claparedei* Bobin & Prenant, 1953, *Loxosoma jaegersteni* Nielsen, 1966, *Loxosoma significans* Nielsen, 1964 and *Loxosoma agile* Nielsen, 1964, all of which have more tentacles (except for *Loxosoma agile*) and lack the lateral processes. The host annelid

*Petaloproctus* spec. is reported only for two *Loxosoma* species (*Loxosoma annelidicola* Van Beneden & Hesse, 1864 and *Loxosoma spathula* Nielsen, 1966), both differing from the new species in lacking lateral processes and having not the correct number of tentacles. Additionally, *Loxosoma annelidicola* has a balloon-shaped calyx and almost no stalk, and therefore not in any way is resembling the new species.

## Discussion

The unique trait of the new species are the extremely long processes of the calyx, the function of which remains to be investigated. Not unique, but exceptional at the least, are the stereotypical mode of budding and the strictly constant number of tentacles across all developmental stages available for study.

The scattered range of occurrence of *Loxosoma* species (see map in Nielsen (1996)) suggests that most existing species of the genus remain to be discovered. The same probably is true for kamptozoans in general. This is very unfortunate, since kamptozoans play an important role in the discussion about metazoan phylogeny (Emschermann 1996, Nielsen 1977, 1995, Mackey et al. 1996, Zrzavý et al. 1998). The knowledge about plasticity of both their bauplan and life cycle, which could shed light on their affinities to other phyla and on phylogeny in general, critically depends on the discovery, description and subsequent study of all existing species. *Loxosomella brochobola* Emschermann, 1993, for example, possesses extrusive organs that resemble cnidarian nematocysts in appearance and function (Emschermann, 1993). This throws a critical light on the base of the metazoan tree, since it shows, that nematocyst-like organs can evolve convergently.

Another example for the plasticity of the kamptozoan bauplan may be *Symbion pandora* Funch & Kristensen 1995. Although this species is not entoproct, but ectoproct and thus shows some similarities to Bryozoa (Funch & Kristensen 1995), and although molecular studies seem to advocate affinities to Rotifera (Winnepeninckx et al. 1998), *Symbion pandora* in fact may be a highly derived solitary kamptozoan (see data in Funch & Kristensen (1995) and Funch (1996)). It thus could demonstrate the impacts on the bauplan and life cycle of solitary Kamptozoa in case of transition from a tube-dwelling, non-moulting host (polychaete) to a free-living, moulting one (crustacean).

## Acknowledgements

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