

## Description of the aquatic nematode *Adorus astridae* sp.n., with notes on the systematic position and geographical distribution of *Adorus* species.<sup>1</sup>

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Jensen, P. 1979: Description of the aquatic nematode *Adorus astridae* sp.n., with notes on the systematic position and geographical distribution of *Adorus* species. — Ann. Zool. Fennici 16: 84—88.

From the southern archipelago of Finland a new free-living nematode is described: *Adorus astridae* sp. n. *Oxystomina islandica* (De Coninck, 1943) is transferred to *Adorus*, and a differential diagnosis is given for *Adorus* species.

A historical review of the systematic position of *Adorus* is given; the present description shows that *Adorus* belongs to the Oxystominidae within the Enoplida (reproductive systems, position of caudal gland cells and structure of excretory pore).

The global distribution of *Adorus* species is pointed out. Their local habitat preferences are correlated with rather low salinity and muddy sediments. The phenomenon of rarity in aquatic nematodes is discussed.

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### 1. Introduction

During an intensive study on the importance of the meiofauna at two brackish-water localities in the southern archipelago of Finland (Keynäs & Keynäs 1979), I had the opportunity to visit the Zoological Station of Tvärminne in November-December 1977. In samples collected in that period I found an underscribed male nematode belonging to a rare genus; the specimen is here described as *Adorus astridae* sp.n. During the same visit Mr. P. Skult handed over to me nematode material collected by himself from Fortuna Bay, Greenland. This material included a female, which I cannot distinguish from *A. astridae* sp.n.; because of lack of a male from this locality I describe the specimen here as *A. aff. astridae*.

Since the systematic position of *Adorus* has hitherto been problematic, the distinct anatomical features I recognize in both specimens provide new evidence of its systematic position

and further make a valuable contribution to the phylogeny of aquatic nematodes. These features are described here and also the geographical distribution and habitat preference of *Adorus* species, together with a discussion about rarity in aquatic nematodes.

### 2. Material and methods

The specimens were fixed in 4 % formalin and mounted in glycerol. The holotype is deposited in the Zoological Museum of the University of Helsinki, Finland.

The animals were studied in detail under a Leitz Dialux microscope with a 100 x apochromatic oil immersion objective, n.a. 1.32. All drawings were made with a camera lucida.

For abbreviations and values used in the formula, see Jensen 1976.

### 3. Description

*Adorus astridae* sp. n.

Fig. 1 a-f, Fig. 3. Table 1.

Material: Storfjärden, southern archipelago of Finland; 32 m, mud, 5—7 ‰ S; collected 2. XII. 1977; 1 male (♂<sub>1</sub> holotype, slide No. Tv 121 m SF).

<sup>1</sup> Report No. 596 from the Tvärminne Zoological Station, University of Helsinki, 10850 Tvärminne, Finland.

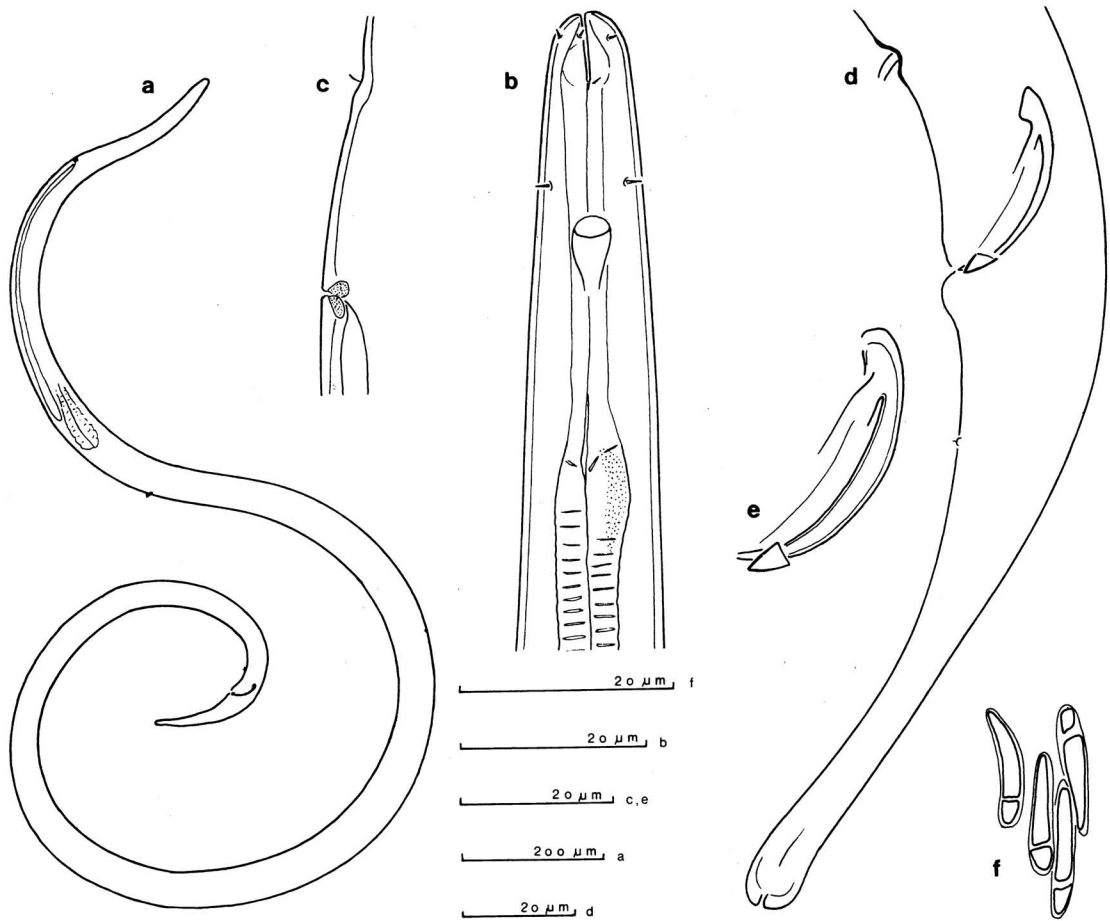


Fig. 1. *Adorus astridae* sp. n. Left lateral views of male (holotype): a whole worm; b anteriormost oesophageal region; c region of excretory pore; d tail; e copulatory apparatus; f sperm.

Measurements: L = 2.88 mm, a = 56, b = 4.2, c = 22.8.

—	?	663	M	2658	2884 µm
16	—	38	52	29	

Body slender, tapering towards the ends (Fig. 1a). Cuticle 1.5 µm thick. Cephalic sense organs in two crowns of setae, each sunk in a depression, six setae 1 µm long around the front end and four setae 2 µm long situated 19 µm posterior to the front end (Fig. 1b). Amphids pocket-like, 4.5 µm in diameter, i.e. 35 % of body diameter; anterior borders 22 µm posterior to the front end (Fig. 1b). Differentiated setose structures present; ventrally in cervical region as a single seta 2 µm long, situated 27 µm anterior to the excretory pore; seta enlarged terminally and located in an oval depression (Fig. 1c). Pair of setae 3 µm long inserted 33 µm ventrally anterior to the cloaca in oval depression with prominent sclerotized border (Fig. 1d). Small papilla with

seta at the end inserted in cuticle 30 µm posterior to cloaca (Fig. 1d).

Oesophagus differentiated into two main portions: Anteriormost portion reaching from front end and 50 µm backwards to where a granular gland opens at dorsal margin (? dorsal oesophageal gland) and where the musculature is enlarged; musculature of this portion characteristically homogeneous and without interruptions. I interpret the lumen of this portion as the buccal cavity (Fig. 1b). Posterior portion of oesophagus 613 µm long, slightly enlarged at junction with buccal cavity, then cylindrical with posteriormost part enlarged; musculature of this portion characteristically grouped into bunches with interruptions (Fig. 1a—b). No nerve ring observed. Renette cell large and located at base of oesophagus (Fig. 1a); excretory pore at 33 % of length of oesophagus and accompanied by two granular gland cells (Fig. 1a, c).

Testes opposite, outstretched. Sperm two-partite, enclosed in membrane (Fig. 1f). Ductus ejaculatorius and rectum separate. Spicules 40 µm, bent at dorsal

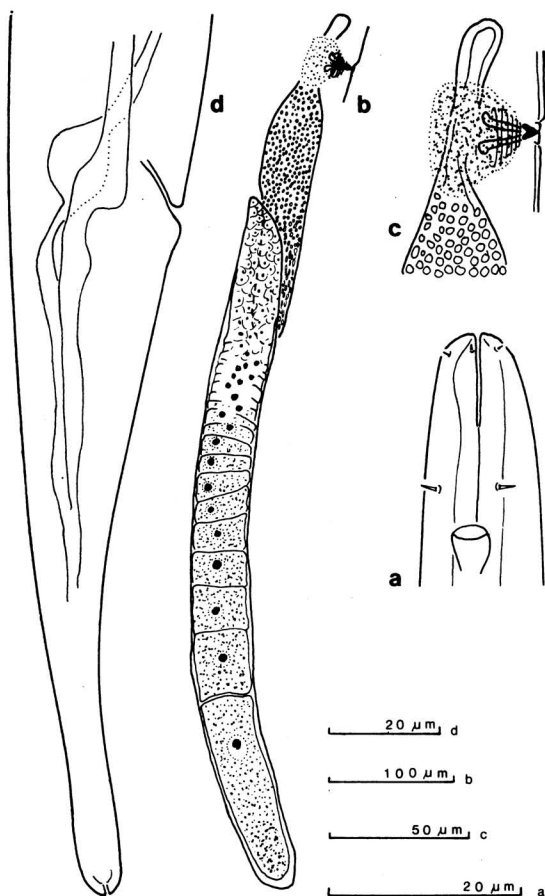


Fig. 2. *Adorus* aff *astridae*. Right lateral views of female from Fortuna Bay, Greenland: a head; b reproductive system; c vulvar region; d tail.

margin; ventral margin with alae and interruptions; gubernaculum plate-like, strongly sclerotized and surrounding distal parts of spicules (Fig. 1d–e). Tail conical with posteriormost portion cylindrical and tip enlarged; length of tail 4 times anal diameter (Fig. 1d).

Female not found in the Storfjorden localities. In the single female from Fortuna Bay, Godhavn, Greenland (*Adorus* aff *astridae*), I could further establish that caudal gland cells are located anterior to the anus (Fig. 2d). Reproductive system with a single gonad, directed posteriorly and reflexed; spermatheca present (Fig. 2b–c). Vulva situated at 31 % of total body length and surrounded by a strongly sclerotized plate (Fig. 2c). Vagina sclerotized, especially in distal portion. Vaginal muscles distinct; a granular gland is situated laterally on either side of vagina (Fig. 2b–c). Shape of sperm in spermatheca indistinguishable from those in testes of *Adorus astridae* sp.n. General shape and details of head and oesophagus similar to *Adorus astridae* sp.n. (Fig. 2a). Cuticle without differentiated setae.

**Differential diagnosis:** I regard *Adorus* as containing three species, *A. tenuis* (the type species), *A. islandica* (see below) and *A. astridae* sp.n. The two former species are closely related in actual measurements, but distinguished by the cephalic sense organs and spicules (see Lorenzen 1969: 231). *A. astridae* sp.n. (and *A. aff astridae*) is significantly distinct from the two other species in actual measurements and shape of tail.

#### 4. Systematic position of *Adorus*

*Oxystomina islandica* (De Coninck, 1943) has all characters of *Adorus* Cobb given by Thorne, 1939 (diagnosis p. 175; see also Gerlach 1957: 136), and I have no hesitation in transferring it to *Adorus* (see above).

In 1939, in a monograph on the dorylaimoid species, Thorne published the genus diagnosis of *Adorus* based on notes left by N. A. Cobb together with the description of the type species *A. tenuis*. Thorne placed *Adorus* in the family Alaimidae within the order Dorylaimida. In Gerlach's (1957) redescription of the type species, new information is given about the female reproductive system. On the basis of this character, together with the presence of a preanal papilla, and the shape of the amphids and spicules, Gerlach concluded that *Adorus* belongs to the Oxystominidae (Enoplida). De Coninck (1965) did not agree; he regarded the genus as a member of the Alaimidae (as did Thorne), but stressed the problematic systematic position of the members of Alaimina (see De Coninck 1965: 680–681). Gerlach (1966) was convinced that *Adorus* belonged to the Oxystomininae, but considered that the two other genera, *Alaimus* and *Amphidelus* of the Alaimidae (sensu De Coninck 1965), were members of Alaiminae within the Oxystominidae. These transferences of *Adorus* and the two other genera in question were not, however, adopted by Gerlach & Riemann (1974); here all three genera are reincluded in the Alaimidae (Enoplida) without discussion (see Gerlach & Riemann 1974: 455).

The present description of *Adorus astridae* sp.n. and *A. aff astridae* gives information for the first time about the male gonad and the position of the caudal cells, as well as details of the female reproductive system in *Adorus* species. The structure of the reproductive system in nematodes I regard as a significant distinguishing character at a higher taxonomic level (see Jensen 1978 b, 1979; Lorenzen 1978). The reproductive systems

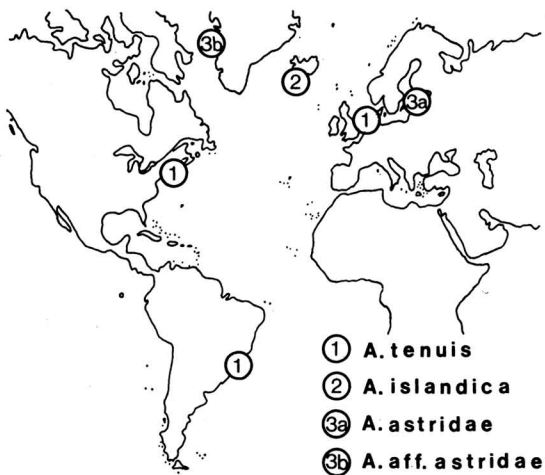


Fig. 3. Global distribution of *Adorus* species (Nematoda, Oxystominidae).

of *Adorus* are similar to those found in the Oxystominidae. The characteristic association of two glands at the excretory pore in *Adorus* is a further feature shared with members of the oxystominids, as are both the situation of the caudal gland cells in front of the cloaca and the bunching of the oesophageal muscle layer (Enoplida characters). I thus conclude that *Adorus* is a member of the Oxystominidae (Enoplida). *Adorus* is closely related to *Oxystomina* Filipjev, 1921; it is distinguished by the shape of the amphids and the reduced cephalic sense organs.

In *A. astridae* sp.n. I describe the buccal cavity as 50  $\mu$ m surrounded by smooth muscu-

lature and with its base situated at an oesophageal swelling where a granular gland empties (Fig. 1b). This condition is apparently not typical in the Oxystominidae, where the buccal cavity is mostly described as "absent" or "reduced". However, these terms are in my opinion used because no one has been able to determine the base of the buccal cavity where it joins the oesophageal lumen in oxystominids. I have no doubt about the situation of the buccal cavity in *Adorus*, and it may further be added that the anteriormost 7- $\mu$ m-long part is slightly more sclerotized than the remaining portion.

The present description of the differentiated oesophageal structures in *Adorus* as a representative of the Oxystominidae affords new evidence about the homology of structures between the primitive members of the Enoplida (Oxystominidae, Tripyloidea) and the members of the Araeolaimida (see Gerlach 1963; Riemann 1968; Jensen 1976 and Jensen 1978a).

## 5. Geographical distribution of *Adorus*

Fig. 3 shows the global distribution of the three *Adorus* species distinguished, *A. tenuis* (type species), *A. islandica* and *A. astridae* sp.n. As no male is available from Fortuna Bay, Greenland, I regard the female specimen as an "affinity"; i.e. *A. aff. astridae*. The three species have been found in widely separated environments, but in muddy sediments and low salinity (Table 1).

Each of the species reports (Table 1) is based on a small number of individuals, which may reflect their rarity. But it may equally well mean

Table 1. Geographical distribution of finds of *Adorus* species (Nematoda, Oxystominidae) and their habitat preferences.

Species	Author	Geographical region	Environmental factors		Sediments	Remarks
			Salinity	Depth		
<i>A. tenuis</i>	Cobb in Thorne 1939	Northeast Atlantic	?	?	?	Salt marsh
	Gerlach 1957	Southeast Atlantic (Brazil)	?	?	mud	Mangrove
	Lorenzen 1968	North Sea (Fed. Rep. Germany)	22–28 ‰	littoral	mud	
<i>A. islandica</i>	De Coninck 1943	North Atlantic (Iceland)	Brackish	?	?	Hot spring
<i>A. astridae</i>	present study	Baltic (Finland)	5–7 ‰	32 m	mud	
<i>A. aff. astridae</i>	present study	Denmark Strait (Greenland)	5–7 ‰	3 m	mud	

that no samples have been taken at their distribution centre (Jensen in prep.) or that their population density is generally low, as in other oxytominids and also ceramonematids. Since aquatic nematodes are sedentary animals and have a low rate of locomotion, one has to look for mechanisms that allow such creatures to reproduce and so survive at low densities. The presence of a spermatheca(e) associated with the female reproductive system, such as I found in *Adorus*, is one such anatomical feature to guarantee fertilization of eggs, even if copulation takes place only once a year because of the small chances of finding a partner in the habitat.

Unfortunately, in earlier descriptions of nematodes reproductive systems have often been neglected and the presence or absence of a spermatheca(e) has seldom been mentioned; in the light of taxonomic and phylogenetic discussions, but also in relation to the dynamic aspects of aquatic nematodes, more attention should be focused on these structures.

*Acknowledgements.* I am grateful for support from the Nordic Council for Marine Biology. Mrs. Jean Margaret Perttunen, B.Sc. (Hons.) kindly revised the English language.

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Received 5. IX. 1978

Printed 25. V. 1979