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A new species of *Archinome* (Polychaeta: Archinomidae) from hydrothermal vents on the Pacific–Antarctic Ridge 37°S

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Archinome storchi *sp. nov. is described as the second species of the family Archinomidae. The specimens were collected from a hydrothermal vent site in 2212 m depth on the Pacific–Antarctic Ridge at 37° S. It differs from* Archinome rosacea *mainly in the position of the anus, the first appearance of branchiae and the length of the nuchal cirrus. Additional specimens of* A. rosacea *collected from hydrothermal vent locations in the North Fiji Basin and on the Mid-Atlantic Ridge were used for morphological comparison. A synoptic table of characters is given for* A. rosacea *and* A. storchi *sp. nov. together with a list of records for Archinomidae compiled from the literature.*

Keywords: Amphinomida, taxonomy, deep sea, Pacific Ocean, *Archinome*, new species

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INTRODUCTION

Archinome rosacea (Blake, 1985) was originally described as belonging to the genus *Euphrosine* Savigny in Lamarck, 1818 in the family Euphrosinidae Williams, 1852 and later redescribed by Kudenov (1991), who transferred it to the newly erected genus *Archinome* Kudenov, 1991 and established the new family Archinomidae Kudenov, 1991. According to this author the new family differs in the morphology of the caruncle, the branchiae and the parapodia in comparison to the Euphrosinidae as well as the Amphinomidae Savigny in Lamarck, 1818. However, some authors believe that *Archinome* falls within Amphinomidae and that the erection of a new family was not justified (e.g. Fauchald & Rouse, 1997; Pleijel, 2001; Wiklund *et al.*, 2008). Molecular studies by Wiklund *et al.* (2008) revealed a close phylogenetic relationship of *Archinome rosacea* to *Chloeia flava* and the two species form a sister group to the remaining Amphinomidae. Wiklund *et al.* (2008) opt for inclusion of *Archinome* within Amphinomidae, while the other option would be to include *Chloeia* within Archinomidae. Since there is no new information to decide between the two possibilities, we still consider the position of the genus *Archinome* unsettled and follow the current state of systematic placement for the time being.

According to published records from various locations in the Pacific, Atlantic, and Indian Oceans (Table 3) *Archinome rosacea* appears to be a cosmopolitan species, in contrast to most hydrothermal vent species which usually show a much more restricted distribution. However, the majority of these records is not supported by a detailed description based on the respective specimens and should therefore be regarded as tentative or preliminary identifications. A thorough study of morphological characters of specimens available to us from various locations in the Pacific and on the Mid-Atlantic Ridge (MAR) revealed significant differences for specimens collected from the Pacific–Antarctic Ridge (PAR). Specimens of *A. rosacea* collected from the North Fiji Basin fit to the original description while those from the Logatchev site on the MAR showed slight variations in some characters. *Archinome storchi* sp. nov. is described as new to science based on specimens collected from the PAR at 37°S.

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MATERIALS AND METHODS

The specimens examined in this study have been collected during various cruises of RV 'Sonne' and RV 'Meteor' to hydrothermal vent sites in the Pacific Ocean, i.e. So 99, Hyfiflux I: North Fiji Basin (Halbach *et al.*, 1996); So 134, Hyfiflux II: North Fiji Basin (Halbach *et al.*, 1998); So 157, Foundation 3: PAR (Stoffers *et al.*, 2001), and to the MAR, i.e. Me 60/3, Hydromar I: MAR (Kuhn *et al.*, 2004) (Table 1).

Benthic samples were taken using Van Veen grabs with integrated TV camera (TVG), and remotely operated vehicles (ROVs) and sieved on board. Specimens were fixed in 10% formaldehyde–seawater solution and later transferred to 70% ethanol. Preserved specimens were examined using stereo and compound microscopes.

For SEM investigations specimens were dehydrated via graded ethanol series, critical point dried using CO_2, coated with Au–Pd and examined in a CamScan CS 24 SEM equipped with ORION digital image capture. Light microscopical pictures were taken with a Nikon Coolpix 4500 or Canon G7 camera adapted to a Leica/Wild MZ 8 stereomicroscope. Drawings of specimens were made using a camera lucida and

Table 1. List of stations (abbreviations: MAR, Mid-Atlantic Ridge; PAR, Pacific–Antarctic Ridge; Me, RV 'Meteor'; So, RV 'Sonne'; TVG, TV grab; ROV, remotely operated vehicle; HV, hot vent).

Cruise	Station	Region	Location	Coordinates	Depth (m)	Date	Habitat
So 99	48 TVG	North Fiji Basin	SO 99	16°57.58′ S 173°55.06′E	1967	16.1.1995	HV
	93 TVG	North Fiji Basin	LHOS	16°59.44′S 173°54.82′E	1984	23.1.1995	HV
	115 TVG	North Fiji Basin	LHOS	16°59.65′S 173°54.73′E	2003	26.1.1995	HV
So 134	33 TVG	North Fiji Basin	White Lady	16°59.454′S 173°55.016′E	1996	20.8.1998	HV
	35 TVG	North Fiji Basin	LHOS Area A	16°59.426′S 173°54.819′E	2002	20.8.1998	HV
	66 TVG	North Fiji Basin	LHOS Area A	16°59.447′S 173°54.937′E	1997	25.8.1998	HV
	99 TVG	North Fiji Basin	Near Mussel Hill Area A	16°59.486′S 173°54.910′E	1999	03.9.1998	HV
So 157	30 TVG	PAR	Central Axial High	37°47.467′S 110°54.868′W	2212	28.6.2001	HV
Me 60/3	23 ROV 10	MAR, Logatchev HF 1, north-western end	Near HV site Quest	14°45.209′N 44°58.823′W	3038	22.1.2004	HV
	35 TVG	MAR, Logatchev HF 1	Irina II	14°45.19′N 44°58.75′W	3019	25.1.2004	HV
	38 ROV	MAR, Logatchev HF 1	Irina II	14°45.18′N 44°58.75′W	3033	26.1.2004	HV
	56 ROV	MAR, Logatchev HF 1	Irina II, Anja's Garden	14°45.13′N 44°58.91′W	3049	31.1.2004	HV
	66 ROV	MAR, Logatchev HF 1	Irina I and II	14°45.082′N 44°58.69′W	2960	03.2.2004	HV

finalized according to the method described by Coleman (2003). Illustrations were assembled using Adobe Photoshop and Adobe Illustrator.

Specimens are indicated in the text as: cs (complete specimen) and af (anterior fragment). In this description we follow Fauchald & Rouse (1997) and Pleijel (2001) using the term palps for the slender, digitiform prostomial appendages called palpal cirri by Kudenov (1991). Likewise we prefer the term peristomial lips for the flat pads around the mouth (s.a. Fauchald & Rouse, 1997; Pleijel, 2001) described as palps by Kudenov (1991). For the definition of dorsal, lateral, ventral cirri and nuchal cirrus we follow Kudenov (1991). Since it appears uncertain whether the darkly pigmented spots on the prostomium represent eyes (Kudenov, 1991: eyes non lenticulate) we follow Ward *et al.* (2003) in using 'eyespots'.

Type and other specimens are deposited in the Senckenberg Museum Frankfurt (SMF).

Table 2. Synoptic table of characters of *Archinome storchi* sp. nov. and *Archinome rosacea*.

	***Archinome rosacea* (Blake, 1985) holotype USNM 81788**	***Archinome storchi* sp. nov. holotype SMF 17876**
Number of chaetigers	18	23
Length (excluding prostomial appendages)	12 mm	15 mm
Width (excluding chaetae)	5.5 mm	4.5 mm
Shape	Fusiform, short	Fusiform, short
Cross-section	Trapezoidal	Trapezoidal
Dorsomedial antennae	Cirriform	Cirriform
Palps	Cirriform	Cirriform
Midventral groove	Present	Present
'Eyespots'	2 pairs on prostomium	2 pairs on prostomium
Caruncle	Elongate, to chaetiger 5 free from body wall from chaetiger 2	Elongate, to chaetiger 4 free from body wall from chaetiger 1
Nuchal cirrus	Short	Long
1st chaetiger	Reduced	Reduced
Parapodia	Biramous	Biramous
Notopodia	Low, conical	Low, conical
Neuropodia	Mound-shaped, dorsally pointed	Mound-shaped, dorsally pointed
Ventral/lateral/dorsal cirri	With/with/without cirrophore	With/with/without cirrophore
Branchiae	Starting on chaetiger 2 (1–2 filaments) palmate, up to 6 filaments	Starting on chaetiger 3 (3 filaments) palmate, up to 7 filaments
Chaetae	Simple, hollow, bifurcate tip	Simple, hollow, bifurcate tip
Ringent chaetae	Absent	Absent
Pygidial cirrus	Thick, elongate	Thick, elongate
Position of anus	Dorsally on 2nd terminal segment (reduced posteriormost segment not observed)	Dorsally on 5th terminal segment (including reduced posteriormost segment)
Colour	Light brown or tan; in life blue transverse band of dark pigment on pygidial cirrus discontinuous	Light yellow; chaetae light yellow to transparent Transverse band of dark pigment on dorsal side of pygidial cirrus continuous
Distribution	East Pacific, ?Atlantic	South-east Pacific

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Table 3. Records of Archinomidae from the literature, including tentative or preliminary identifications (abbreviations: EPR, East Pacific Rise; PAR, Pacific–Antarctic Ridge).

Locality	Depth (m)	Taxon	Reference
Mid-Atlantic Ridge (MAR)			
Rainbow 36°N	2260–2350	*Archinome* sp.	Desbruyères *et al.*, 2001
		Archinomidae	Khripounoff *et al.*, 2001
Lost City 30°N	750–900	*Archinome rosacea*	Galkin *et al.*, 2004
		Archinome rosacea	Galkin *et al.*, 2006
Broken Spur 29°N	3050–3875	*Archinome rosacea*	Galkin *et al.*, 2006
Snake Pit 23°N	3480	*Archinome rosacea*	Ramirez-Llodra *et al.*, 2004
		Archinomidae	Gebruk *et al.*, 1997
		Archinomidae	Mironov *et al.*, 2002 in Tarasov *et al.*, 2005
Logatchev 14°N	2930–3020	*Archinome rosacea*	Van Dover & Doerries, 2005
		Archinome rosacea	Fiege & Bock, 2007
		Archinome cf. *rosacea*	Lackschewitz *et al.*, 2005
		Archinome sp. aff. *rosacea*	Gebruk *et al.*, 2000
		Archinomidae	Mironov *et al.*, 2002 in Tarasov *et al.*, 2005
Wideawake Mussel Field 5°S	3000	Archinomidae	Haase *et al.*, 2005
West Pacific			
Lau Basin	1764–2703	*Archinome rosacea*	Blake, 2006
North Fiji Basin	2000–2700	*Archinome rosacea*	Blake, 2006
		Archinome rosacea	Fiege & Bock, 2007
East Pacific			
Guaymas Basin	2000	*Euphrosine rosacea*	Blake, 1985
		Archinome rosacea	Ramirez-Llodra *et al.*, 2004
EPR 13°N	2635	*Euphrosine rosacea*	Jollivet, 1996: figure 2
		Archinome rosacea	Ramirez-Llodra *et al.*, 2004
EPR 11°N	2500	*Archinome rosacea*	Ramirez-Llodra *et al.*, 2004
EPR 9°N	2500	*Archinome rosacea*	Van Dover *et al.*, 2001a
		Archinome rosacea	Jenkins *et al.*, 2002
		Archinome rosacea	Micheli *et al.*, 2002
		Archinome rosacea	Van Dover, 2003
		Archinome rosacea	Kicklighter *et al.*, 2004
		Archinome rosacea	Ramirez-Llodra *et al.*, 2004
		Archinome rosacea	Mullineaux *et al.*, 2005
		Archinome rosacea	Govenar & Fisher, 2007
Galapagos Rift	2450–2490	*Euphrosine rosacea*	Blake, 1985
		Archinome rosacea	Kudenov, 1991
		Archinome rosacea	Ramirez-Llodra *et al.*, 2004
		Archinome rosacea	Desbruyères *et al.*, 2006
EPR 17-18°S	2575–2680	*Archinome rosacea*	Van Dover, 2002a
		Archinome rosacea	Ward *et al.*, 2003
EPR 31-32°S	2330	*Archinome rosacea*	Blake, 2006
		Archinome rosatica	Hey *et al.*, 2006
PAR 37°S	2220	*Archinome storchi* sp. nov.	This paper
PAR 38°S	2216	*Archinome rosacea*	Blake, 2006
Indian Ocean			
Kairei Field	2415–2460	*Archinome* sp.	Van Dover *et al.*, 2001b
		Archinome cf. *rosacea*	Van Dover, 2002b

SYSTEMATICS

Family ARCHINOMIDAE Kudenov, 1991
Genus *Archinome* Kudenov, 1991
Archinome storchi sp. nov.
(Figures 1A, B, 2A & B, 3A–C, 4A–E; Table 2)

TYPE MATERIAL

Holotype (cs), SMF 17876, south-east Pacific. RV 'Sonne' 157, Foundation 3, PAR: Central Axial High, Station 30 TVG, 37°47.467′ S 110°54.868′ W, 2212 m, 28.6.2001, sample containing glassy silica-rich lava and other vent related fauna (crabs, mussels, barnacles and polychaetes).

Paratype (cs) as SEM stub 884, with chaetae removed, SMF 17877, same locality as holotype. 1 additional specimen (cs), in two fragments as SEM stubs 872, 874, SMF 17878, same locality as holotype.

COMPARATIVE MATERIAL EXAMINED

Archinome rosacea (Blake, 1985): Holotype (cs), USNM 81788, East Pacific, Galapagos Rift geothermal vents, Alvin Dive 984, Rose garden, 00°48.3′ N 86°13.5′ W, 2447–2460 m, 1.12.1979, mussel washings.

Archinome rosacea (Blake, 1985): North Fiji Basin, RV 'Sonne' 99, Hyfiflux I: Station 48 TVG, 1 spm (SMF 17679); Station 115 TVG, 2 spms (SMF 17880)—RV 'Sonne' 134, Hyfiflux II: Station 33 TVG, 31 spms (SMF 17881); Station 35, many (SMF 17903); Station 66 TVG, 4 spms (SMF 17882); Station 99 TVG, many (SMF 17883)—MAR, RV 'Meteor' 60/3, Hydromar I: Station 23 ROV 10, 1 spm (SMF 17884),

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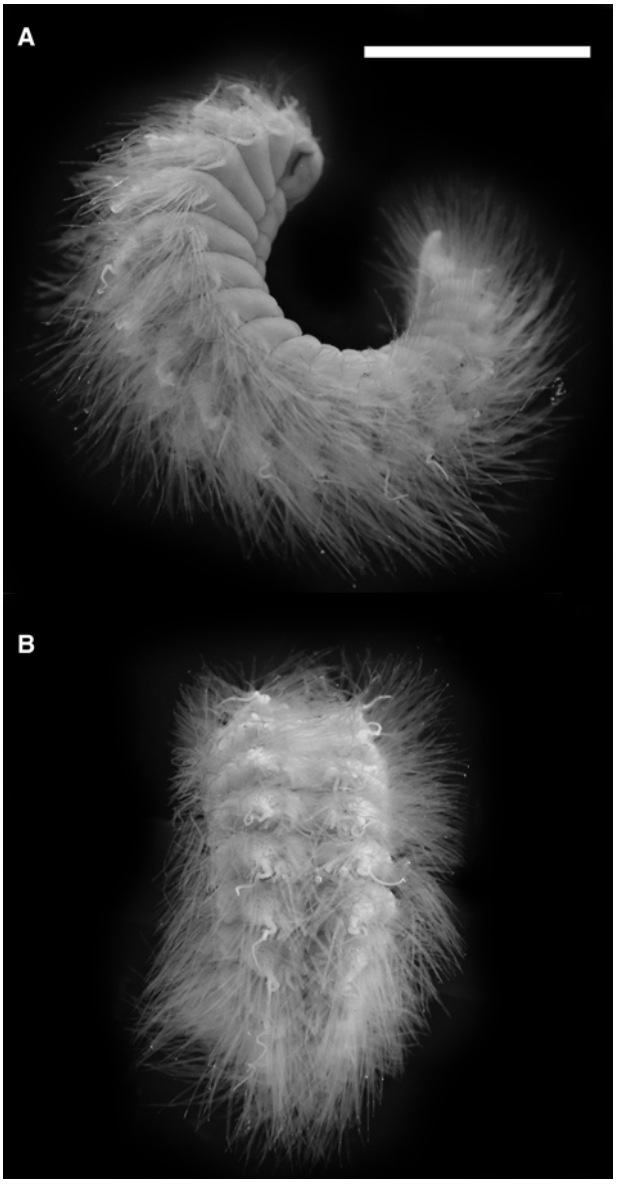

Fig. 1. *Archinome storchi* sp. nov. Holoype (SMF 17876): (A) Lateral view, right side; (B) dorsal view. Scale bar: 5 mm.

1 spm on SEM stub 886 (SMF 17885); Station 35 TVG, many (SMF 17886), 3 spms on SEM stubs 870 (SMF 17887), 871 (SMF 17888), 877 (SMF 17889); Station 38 ROV, many (SMF 17890), 1 spm (SMF 17891), 3 spms on SEM stubs 883 (SMF 17892), 885 (SMF 17893), 887 (SMF 17894); Station 56 ROV, 11 spms (SMF 17895), 5 spms on SEM stubs 875 (SMF 17896), 876 (SMF 17897), 878 (SMF 17898), 880 (SMF 17899), 881 (SMF 17900); Station 66 ROV, >11 spms (SMF 17901), 1 spm on SEM stub 873 (SMF 17902).

DESCRIPTION

Holotype short, fusiform with a median row of ventral glandular pads. Length 15 mm for 23 chaetigers (including reduced posteriormost chaetiger, only visible in SEM); width 4.5 mm at widest part, appendages and chaetae not included. Body trapezoidal in cross-section (Figure 1A, B). Colour of body in alcohol light yellow; chaetae light yellow to transparent.

Prostomium extending anteroventrally into peristomial lips. Two pairs of 'eyespots'; one pair of oblong mid-dorsal 'eyespots' in front of dorsomedial antennae and two elongate 'eyespots' situated ventrolaterally of chaetiger 1. One pair of dorsomedial antennae arising from a small pit posterior to dorsal pair of 'eyespots'. A pair of slender ventrolateral palps present. Antennae and palps cirriform, similar in shape and size. Peristomium consisting of 2 large cushion-like lips separated by a midventral groove leading to mouth. Caruncle elongate extending posteriorly from chaetiger 1 to chaetiger 4, with median keel, lateral, longitudinal, ciliated ridges and ciliated groves (Figures 2A, 3A); caruncle of K-1 category according to Kudenov (1987). Long nuchal cirrus inserting at anterior end of caruncle, without cirrophore (Figure 2B).

All parapodia biramous. Parapodia of first segment strongly reduced and projecting anteriorly. Parapodia of segment 2 and the following segments with low, conical notopodia, projecting dorsally (Figure 3B). Dorsal cirri long, slender, without cirrophores, inserting anteriorly to branchiae on dorsomedian border of notochaetal field (Figure 4A). Lateral cirri shorter, arising behind apex of notopodia; long, cirriform and basally coiled; thick cirrophore present (Figure 4B).

Neuropodia mound-shaped, dorsally pointed and projecting laterally. Ventral cirri slender, cirriform inserting midventrally, oriented posteriorly and upwards; with very short cirrophore. Chaetal field surrounded by epidermal bulge (Figure 4C).

Branchiae starting on chaetiger 3 with three filaments, palmate with short common trunk inserting on posterodorsal border of notopodial chaetal field (Figure 4A). Six filaments at chaetiger 4, seven filaments at chaetiger 7.

All chaetae simple and hollow. Neurochetae and notochaetae bifurcate with tines varying greatly in length. Ringent notochaetae absent. Notochaetae slightly stronger than neurochaetae (Figure 3C).

Single, thick, elongate, median pygidial cirrus with short transverse band of dark pigment on dorsal side (Figure 4D). Anus dorsally on chaetiger 19 (5th terminal chaetiger) surrounded by a thick, glandular epidermis (Figure 4E). Last chaetiger strongly reduced and projecting posteriorly, lacking cirri.

REMARKS

The species *Archinome storchi* sp. nov. differs from *A. rosacea* in the position of the anus, the length of the nuchal cirrus and the first appearance of branchiae (Table 2). The anus of *A. storchi* sp. nov. is positioned on the 5th terminal chaetiger (including reduced posteriormost chaetiger) while in *A. rosacea* it is situated on the 2nd terminal chaetiger with the pygidial cirrus arising directly behind the anus (Figure 4F) (reduced posteriormost segment not observed in holotype of *A. rosacea* under stereomicroscope). The nuchal cirrus of *A. storchi* sp. nov. is about twice as long as in *A. rosacea* (Figure 2B, C). Branchiae appear first on chaetiger 3 with three filaments in *A. storchi* sp. nov., while they appear on chaetiger 2 with 1–2 filaments in *A. rosacea*. Transverse band of dark pigment on dorsal side of pygidial cirrus is continuous in *A. storchi* sp. nov. and discontinuous in *A. rosacea* (s. Kudenov, 1991: figure 28). Moreover, appendages such as prostomial antennae, parapodial cirri and palps appear more delicate in *A. storchi* sp. nov. than in *A. rosacea*.

The specimens of *Archinome* collected from Logatchev (MAR) differ from *A. rosacea* and *A. storchi* sp. nov. by the presence of a shorter, minute nuchal cirrus (Figure 2D).

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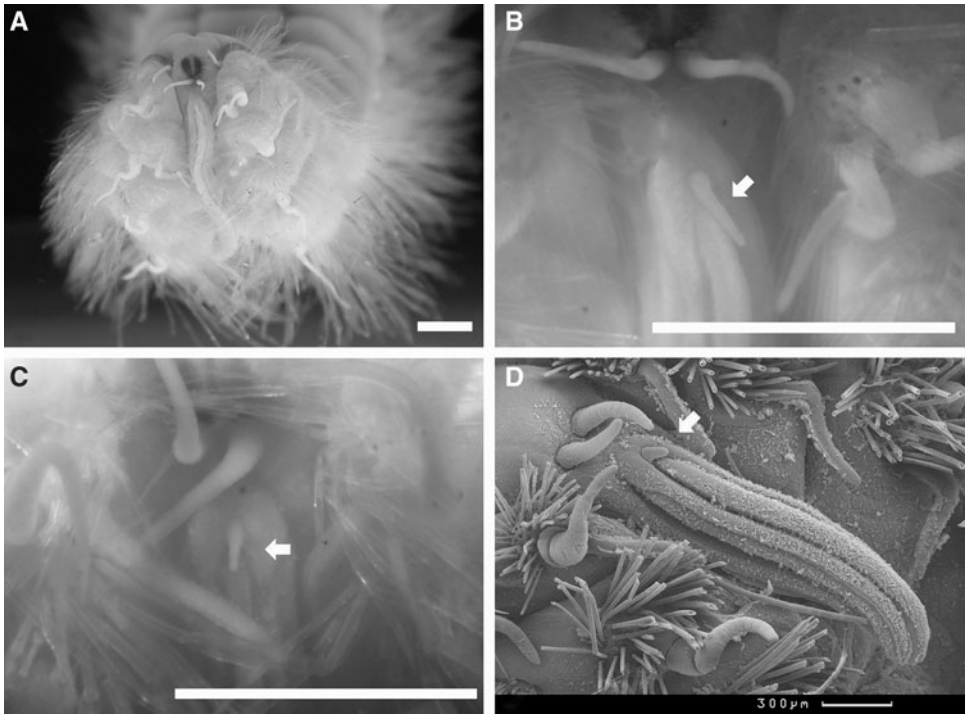

Fig. 2. *Archinome storchi* sp. nov. Holotype (A, B: SMF 17876). (A) Anterior region, dorsal view; (B) detail of (A). Nuchal cirrus (arrow); *Archinome rosacea*. Holotype (USNM 81788); (C) anterior region, dorsal view. Nuchal cirrus (arrow); *A. rosacea* from Logatchev (MAR) (SMF 17893); (D) anterior region, dorsal view; upper part of chaetae removed. Nuchal cirrus (arrow). Scale bars: A–C, 1 mm.

Branchiae appear first on chaetiger 3 with 2–3 filaments. Whether this combination of characters indicates the presence of another undescribed species of *Archinome* on the MAR or simply represents intraspecific variability can only be solved by genetic studies of populations from various areas.

ETYMOLOGY

The species is named after Professor Dr Dr Volker Storch (Heidelberg), a distinguished German zoologist, who made important contributions to our knowledge of the anatomy, ultrastructure and taxonomy of Polychaeta.

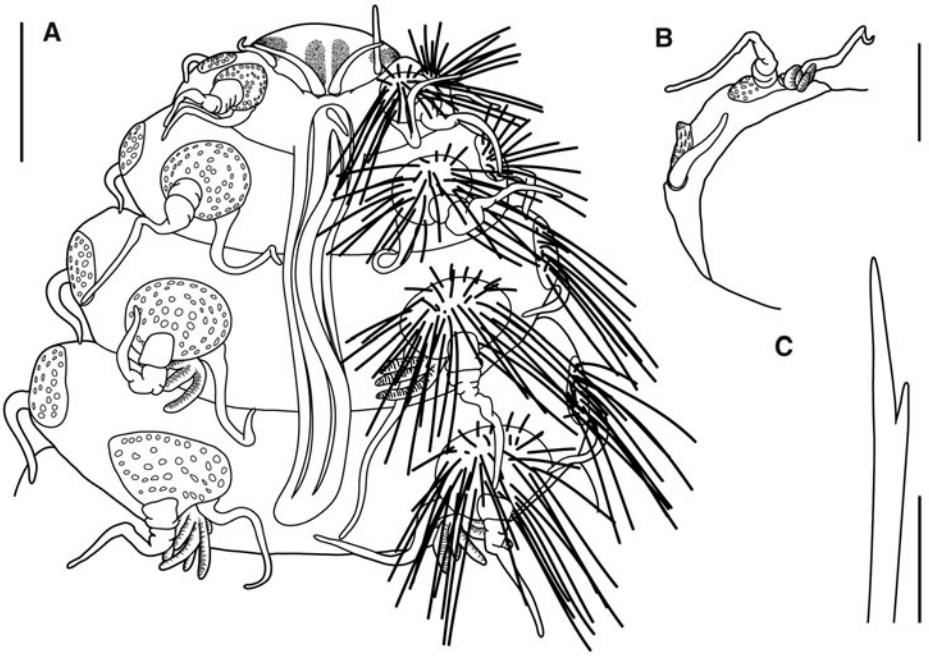

Fig. 3. *Archinome storchi* sp. nov. Paratype (SMF 17877). (A) Anterior region, dorsal view; (B) left parapodium of chaetiger 4, posterior view; (C) notochaeta. Scale bars: A & B, 1 mm; C, 250 µm.

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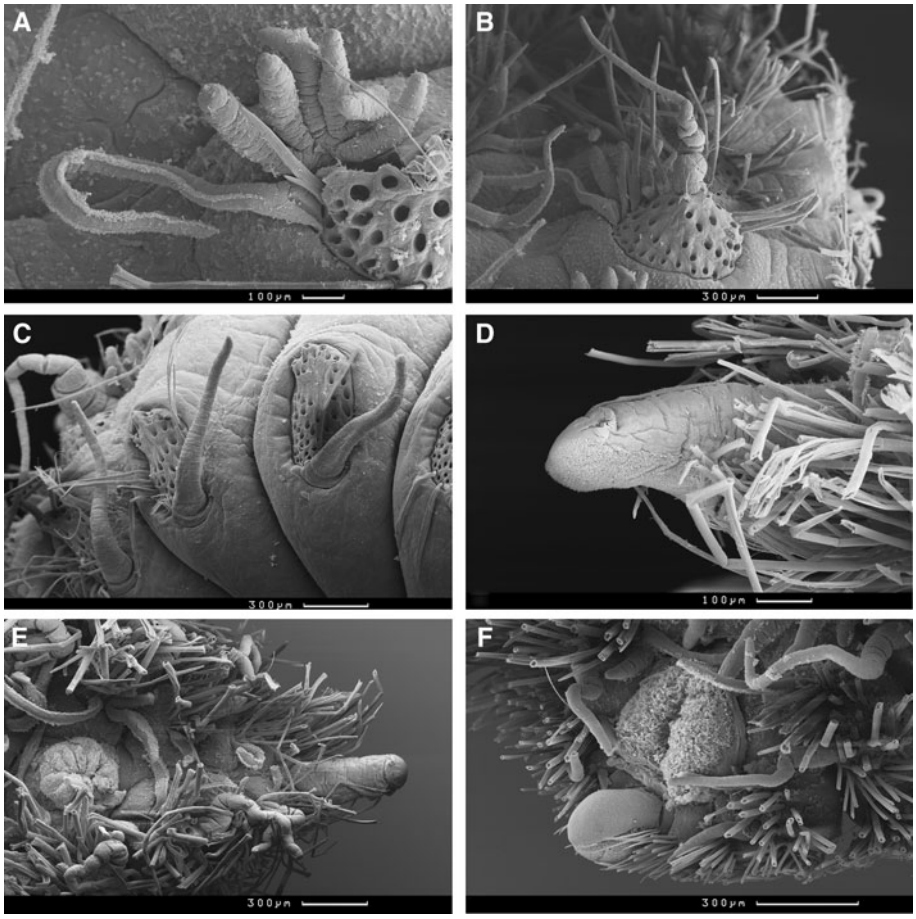

Fig. 4. *Archinome storchi* sp. nov. (A–C: SMF 17877; D & E: SMF 17878): (A) Dorsal cirrus and branchiae on chaetiger 8, dorsal view; (B) notopodium on chaetiger 10 with coiled lateral cirrus, anterior view; chaetae removed; (C) neuropodia with ventral cirri, chaetigers 4–6 from left to right, lateral view; chaetae removed; (D) anal cirrus, lateral view; (E) posterior end, dorsal view. *Archinome rosacea* from Logatchev (MAR) (SMF 17892); (F) posterior end, dorso-lateral view.

DISTRIBUTION

Archinome storchi sp. nov. is only known from the type locality on the PAR at 37°S.

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