



This work is licensed under a Creative Commons Attribution License (CC BY 4.0).

## Research article

urn:lsid:zoobank.org:pub:21226C21-DFF4-4EFD-A715-48EFF16C5F55

# The genus *Ophelina* Örsted, 1843 (Annelida: Opheliidae) in the coast of Kuwait (northern Indian Ocean), with the description of a new species

Julio PARAPAR <sup>1\*</sup>, Manal AL-KANDARI <sup>2</sup>, María BARROSO <sup>3</sup> & Juan MOREIRA <sup>4</sup>

<sup>1,3</sup>Departamento de Biología, Facultad de Ciencias, Universidade da Coruña, Spain.

<sup>2</sup>Kuwait Institute for Scientific Research, 22107 Salmiya, Kuwait.

<sup>4</sup>Departamento de Biología (Zoología) & Centro de Investigación en Biodiversidad y Cambio Global (CIBC-UAM), Facultad de Ciencias, Universidad Autónoma de Madrid, Spain.

\*Corresponding author: julio.parapar@udc.es

<sup>2</sup>Email: mkandari@kisir.edu.kw

<sup>3</sup>Email: maria.p.barroso@udc.es

<sup>4</sup>Email: juan.moreira@uam.es

<sup>1</sup>urn:lsid:zoobank.org:author:CE188F30-C9B0-44B1-8098-402D2A2F9BA5

<sup>2</sup>urn:lsid:zoobank.org:author:632F0DFC-4397-41C3-96B2-E4ECA9053E01

<sup>3</sup>urn:lsid:zoobank.org:author:47786960-D7BD-4273-AB22-7DDF2691C5FD

<sup>4</sup>urn:lsid:zoobank.org:author:B1E38B9B-7751-46E0-BEFD-7C77F7BBBEF0

**Abstract.** Two species of the genus *Ophelina* Örsted, 1843 (Annelida, Opheliidae) are reported from the coast of Kuwait (Arabian Gulf) after specimens collected in the intertidal and shallow subtidal, namely *Ophelina arabica* sp. nov. and *Ophelina grandis* (Pillai, 1961). The new species is mainly characterised by features of the anal tube, which is provided with about 25 annulations at each side; the ventral margins are fully fused while dorsal margins are fused at most of their length but are free at the distal end in the shape of a conspicuous incision; the posterior end is opened with free margins; the anal tube also lacks marginal papillae but bears a pair of basal papillae and an unpaired anal cirrus attached to ventral margin at mid-length. *Ophelina grandis* is reported for the first time in the Arabian Gulf; specimens are fully described and compared with similar species. A key for species of *Ophelina* in the Indo-Pacific, Southern Asia, Indo-Malay Archipelago and Australia, is also provided.

**Keywords.** Taxonomy, Polychaeta, species diversity, Kuwait, SEM.

Parapar J., Al-Kandari M., Barroso M. & Moreira J. 2023. The genus *Ophelina* Örsted, 1843 (Annelida: Opheliidae) in the coast of Kuwait (northern Indian Ocean), with the description of a new species. *European Journal of Taxonomy* 870: 1–29. <https://doi.org/10.5852/ejt.2023.870.2113>

## Introduction

The family Opheliidae Malmgren, 1867 currently comprises 5–8 genera and ca 160 to 171 species (Parapar *et al.* 2021b; Read & Fauchald 2022). Nevertheless, a comprehensive revision of this family is

needed given its confusing taxonomic history (Parapar *et al.* 2021b), and the evidence of paraphyly in *Ophelina* Örsted, 1843 that is the most speciose genus (Paul *et al.* 2010; Wiklund *et al.* 2019; Blake & Maciolek 2020; Gunton *et al.* 2021). Furthermore, taxonomic knowledge on opheliids from several geographic regions is still scarce or fragmentary, mostly across the Indian Ocean and large areas of the Indo-Pacific. This is also hindered because of short or incomplete descriptions of new taxa described in the 19<sup>th</sup> century (often based on broken or damaged specimens), and worldwide reports of specimens attributed to European species that might correspond to undescribed species (Parapar *et al.* 2021b).

Regarding the Arabian Gulf, several species of Opheliidae have been reported beginning in the early years of the 20<sup>th</sup> century, namely *Armandia leptocirris* (Grube, 1878), *A. intermedia* Fauvel, 1902, *A. lanceolata* Willey, 1905, *Polyophthalmus pictus* Dujardin, 1839, *Ophelina acuminata* Örsted, 1843, *O. longicaudata* (Caullery, 1944) and *O. af. cylindricaudata* (Hansen, 1879) (e.g., Fauvel 1911, 1919; Wesenberg-Lund 1949; Mohammad 1971, 1980; Fiege 1992). Recently, *Polyophthalmus zhadanae* Parapar, Al-Kandari, Candás & Moreira, 2021 has been described from intertidal and shallow depths from Kuwait and Saudi Arabia (Parapar *et al.* 2021a). Regarding the genus *Ophelina*, *O. acuminata* was reported from Kuwait by Wesenberg-Lund (1949), Al-Rifaie *et al.* (2012) and Al-Yamani *et al.* (2012), *O. longicaudata* from Saudi Arabia by Fiege (1992) and Nazeer *et al.* (2021), and *O. af. cylindricaudata*, *O. acuminata* and *Ophelina* sp. from Qatar by Al-Omari (2011). However, the type localities of *O. acuminata* and *O. cylindricaudata* correspond to northern Europe, and that of *O. longicaudata* is in Indonesia (Örsted 1843; Hansen 1879; Caullery 1944).

In this frame, specimens of the genus *Ophelina* collected by the Kuwait Institute for Scientific Research (KISR) from several intertidal localities across Kuwait (see Al-Kandari *et al.* 2019) were examined. Two species were found in samples: *Ophelina grandis* (Pillai, 1961) is reported for the first time for the Arabian Gulf and specimens are fully described and compared with similar species; and one species new to science that is described here as *Ophelina arabica* sp. nov. A key for species of *Ophelina* in the Indo-Pacific, Southern Asia, Indo-Malay Archipelago, and Australia is also provided.

## Material and methods

Specimens examined in this study were collected from intertidal habitats along 19 transects in several locations across Kuwait during the late autumn and winter of 2014–2020. Sampling localities included mainland areas and seven islands, extending from Khor Al-Subiya in the north to the border with Saudi Arabia in the south. Samples were washed in the field with a 300 µm mesh sieve; specimens of *Ophelina* retained in the mesh were removed. Al-Kandari *et al.* (2017, 2019) provide additional details on the sampling methodology.

Line drawings and measurements of specimens were made using an Olympus BX51 compound microscope provided with a camera lucida. Specimens selected for Scanning Electron Microscopy (SEM) examination were dehydrated in a graded ethanol series, critical-point dried using CO<sub>2</sub>, mounted on aluminium stubs, covered with gold in a BAL-TEC SCD 004 evaporator, and examined and photographed under a JEOL JSM-6400 scanning electron microscope at the Servicios de Apoyo á Investigación, Universidade da Coruña (SAI-UDC), Spain.

The type specimens of *O. grandis* deposited in the Natural History Museum (NHM), London, could not be examined because of post-mail issues; photos of holotype and paratypes were provided instead by the NHM staff (cf. Fig. 11). The type series of the new species and non-type material of *O. grandis* from Kuwait were deposited in the Museo Nacional de Ciencias Naturales, Madrid, Spain (MNCN). The description of the new species is based on the holotype and complemented by the examination and microphotographs of paratypes.

**Anatomical abbreviations used in text and figures**

aclc	=	anterior chaetigers long chaetae
AT/at	=	anal tube
ata	=	anal tube annulations
atdi	=	anal tube dorsal incision
atvdf	=	anal tube ventro-distal fusion line
atvpf	=	anal tube ventro-proximal fusion line
br	=	branchiae
br_a	=	branchiae - anterior
br_p	=	branchiae - posterior
brb	=	branchial basis
bt	=	buccal tentacles
CH/ch	=	chaetiger
lclc	=	last chaetigers long chaetae
lg	=	lateral groove
mo	=	mouth
neu	=	neurochaetae
not	=	notochaetae
nuo	=	nuchal organ
pa	=	palpode
pbp	=	pair of basal papillae (“ventral lateral cirri”, “paired anal cirri” in previous work)
pcl	=	parapodial prechaetal lobe (“anterior lobe” in Parapar <i>et al.</i> 2011)
pcd	=	parapodial dorsal cirrus
pmp_p	=	paired marginal papillae - posterior
pmp_v	=	paired marginal papillae - ventral
pvl	=	parapodial ventral lobe
uac	=	unpaired anal cirrus
vg	=	ventral groove

**Repositories and services**

KISR	=	Kuwait Institute for Scientific Research, Kuwait City, Kuwait
MNCN	=	Museo Nacional de Ciencias Naturales, Madrid, Spain
NHM	=	Natural History Museum (formerly BM(NH)), London, UK
SAI-UDC	=	Servizos de Apoio á Investigación, Universidade da Coruña, Spain

**Results*****Taxonomy***

Phylum Annelida Lamarck, 1809  
Family Opheliidae Malmgren, 1867

Genus *Ophelina* Örsted, 1843

*Ophelina* Örsted, 1843: 45.  
*Ammotrypane* Rathke, 1843: 188.  
*Ladice* Kinberg, 1866: 257.  
*Terpsichore* Kinberg, 1866: 257  
*Omaria* Grube, 1869: 66.  
*Urosiphon* Chamberlin, 1919: 384.

### Type species

*Ophelina acuminata* Örsted, 1843.

### Diagnosis

[Following Wiklund *et al.* (2019) and Blake & Maciolek (2020).]

Body elongate, with deep ventral groove and two lateral grooves along entire body length. Prostomium conical, sometimes with terminal palpode; eyes present or absent. Branchiae present or absent; if present, beginning on chaetiger 2, continuing to posterior end, sometimes missed from middle or last posterior chaetigers; branchiae single, cirriform. Segmental lateral eyes absent. Noto- and neuropodia with small fascicles of capillary chaetae; short ventral lobe present; small button-like dorsal cirrus sometimes present. Pygidium with anal tube sometimes bearing long unpaired anal cirrus, a pair of basal papillae, and several pairs of marginal papillae.

### Remarks

In *Ophelina*, the terminology used to refer to the anal tube and its features is quite heterogeneous. Here, we retain the terms “anal tube”, “unpaired anal cirrus”, “pair of basal papillae” and “paired marginal cirri” following recent work (Parapar & Moreira 2015; Moreira & Parapar 2017; Magalhães *et al.* 2019; Wiklund *et al.* 2019). The “anal tube” has been previously referred to as “anal syphon” (Willey 1905), “anal funnel” (e.g., Fauvel 1932; Takahashi 1938; Tampi 1958; Pillai 1961; Eibye-Jacobsen 2002), “pavillon/tube postanal” (e.g., Caullery 1944), “pygidial organ/anal funnel” (e.g., Gallardo 1968) or “pygidial funnel” (e.g., Neave & Glasby 2013). The “unpaired anal cirrus” has also been described as “unpaired cirrus” (e.g., Horst 1919; Hartmann-Schröder & Parker 1995), “papille/cirre impaire” (e.g., Fauvel 1902, 1927), “branchie anale” (e.g., Caullery 1944), “ventral cirrus” (e.g., Kongsrud *et al.* 2011; Wiklund *et al.* 2019), “anal cirrus” (e.g., Tampi 1958; Pillai 1961; Parapar *et al.* 2011; Gopal *et al.* 2016), “anal branchiae” (e.g., Gallardo 1968) and “midventral cirrus/filament” (Barroso & Paiva 2013). Regarding the “pair of basal papillae”, these have been reported as “papilles ventrales” (Fauvel 1902, 1927), “couple of cirri at base” (Horst 1919), “ventral papillae” (Fauvel 1932), “branchie anale” (Caullery 1944), “ventral cirri” (Pillai 1961), “anal cirri” (Gallardo 1968), “anal papillae” (Hartmann-Schröder & Parker 1995) and “paired anal cirri” (Neave & Glasby 2013). Finally, the “paired marginal papillae” have been named as “papilles latérales” (Fauvel 1902, 1927), “border cirri” (Horst 1919), “papilles des bords latéraux” (Caullery 1944), “border papillae” (Tampi 1958; Pillai 1961; Gallardo 1968), “marginal cirri/margin with cirri/cirri on margin” (Gallardo 1968; Kongsrud *et al.* 2011; Wiklund *et al.* 2019), “papillae of margin” (Eibye-Jacobsen 2002; Barroso & Paiva 2013), “margin anal cirri” (Neave & Glasby 2013) and “pygidium marginal papillae” (Parapar *et al.* 2021a).

We added to the diagnosis of the genus the potential presence of “parapodial dorsal cirrus” that has been observed at least in several species, including the new species described below.

### *Ophelina arabica* sp. nov.

urn:lsid:zoobank.org:act:9BAE4E13-A48B-47E7-BA20-E6BE453CB446

Figs 1–6, 13

### Diagnosis

Parapodial prechaetal lobe rounded throughout; short button-like dorsal cirrus; ventral lobe low and lingulate. Anal tube provided with about 25 annulations on each side; ventral margin fully fused; dorsal margin fused at most of their length but free at distal end as conspicuous incision; posterior opening well-defined, margins free. Anal tube lacking marginal papillae; one pair of basal papillae and unpaired anal cirrus attached to ventral margin at mid-length.

**Etymology**

The name of the new species refers to the Arabian Gulf, where the type specimens were found.

**Type material****Holotype**

KUWAIT • Arabian Gulf, Ras Al-Zour; 28.74170° N, 48.38250° E; 8 Jan. 2015; sample P10443 code RZO; low intertidal; sand; MNCN 16.01/17001.

**Paratypes**

KUWAIT • 3 specs; same collection data as for holotype; MNCN 16.01/17002 • 2 specs; same collection data as for holotype; MNCN 16.01/17008 • 1 spec. (mounted for SEM); same collection data as for holotype; sample P10423; MNCN 16.01/17003 • 1 spec. (mounted for SEM); Mina Abdullah; 29.00011° N, 48.16422° E; 16 Feb. 2014; sample P13183 code MAB; mid intertidal; MNCN 16.01/17004.

**Description**

**MEASUREMENTS.** Holotype, complete specimen, 14.0 mm long and 1.0 mm wide for 35 chaetigers. Complete paratypes ranging from 6–12 mm in length and 0.5–1.0 mm in width for 32–35 chaetigers. Smallest specimen 6.0 mm long and 0.5 mm wide (MNCN 16.01/17002) with 32 chaetigers. One specimen (MNCN 16.01/17008) with unpaired anal cirrus 3 three times as long as anal tube.

**BODY.** Slender, tubular, progressively tapering in last 4–5 chaetigers (Fig. 2A); lateral and ventral grooves extending from anterior to posterior body end (Figs 1H, 2C, 3A, C, 4D).

**PROSTOMIUM AND PERISTOMIUM.** Prostomium pointed; terminal palpode on distal end (Figs 1A, 2A, 3A). Prostomial eyes not seen. Nuchal organs large, as deep oval lateral depressions (Figs 1A, 3A–B).

**PARAPODIA AND CHAETAE.** Parapodia biramous; each parapodium provided with a prechaetal lobe, ventral lobe, and a short button-like dorsal cirrus (Figs 1B–G, 3C–F, 4A–C). Prechaetal lobe rounded throughout; ventral lobe low, lingulate. Chaetae all smooth, simple, long capillaries (Figs 1A, H, 2); those of anterior parapodia oriented laterally or postero-laterally (Fig. 1A). Chaetae arranged in two bundles with 6–8 chaetae each (Figs 3D–F, 4A–C); notochaetae generally 1.5 times as long as neurochaetae. Notochaetae about as long as branchiae all along body length; notochaetae of posterior five chaetigers about 2.0 times as long as preceding chaetigers (Fig. 1H), oriented latero-posteriorly but not surpassing anal tube distal end (Figs 1H, 4D–E).

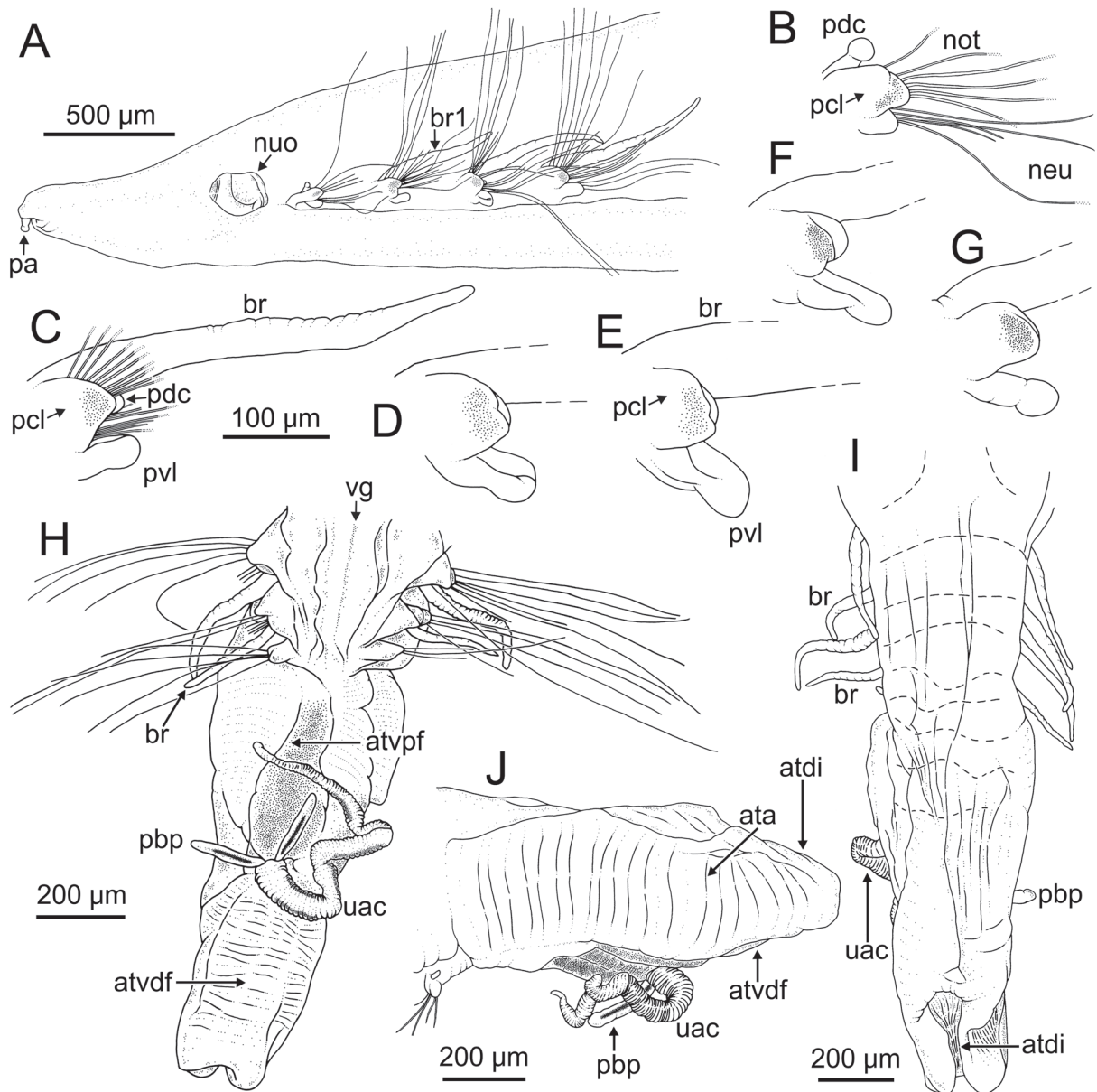
**BRANCHIAE.** Present from CH2 (Figs 1A, 3C–D) to last chaetiger (Fig. 1H). Branchiae 0.8 times as long as body width, progressively shorter in last chaetigers but about as long as body width (Fig. 1H–I).

**ANAL TUBE.** Not laterally compressed; 2.5 times as long as wide, as long as last 5–6 posterior-most chaetigers (Figs 1H–J, 2B–C, 4D–E, 5A–B); with about 25 annulations in each side (Figs 1H, J, 4E). Dorsal margin fused at most of its length but free at distal end, showing conspicuous disto-dorsal incision (Figs 1I, 5B). Ventral margin fully fused; ventral fusion line more defined in proximal half (anterior to anal cirrus and basal cirri) than in distal half (posterior to anal cirrus and basal cirri) (Figs 1H, 4E). Anal tube posterior opening well-defined, margins free, and not fused (Figs 1I, 5A–B). No marginal papillae; unpaired anal cirrus not crenulated attached to ventral margin at mid-length and flanked by a pair of basal papillae (Figs 1H, J, 4E–F, 5B). Paired basal papillae about 0.1 times as long as anal tube, about as wide and 0.5 times as long as last chaetigers branchiae (Fig. 1H, 5C–D); unpaired anal cirrus about 0.66 times as long as anal tube (Figs 1H, J, 4E–F, 5B–C).

**PIGMENTATION.** Not present in preserved specimens (Fig. 2). A reddish spot present in distal end of anterior lobe of all parapodia (Fig. 1B–G). Same pigmentation in ventral proximal half of anal tube (Fig. 1H, J).

**Type locality and distribution**

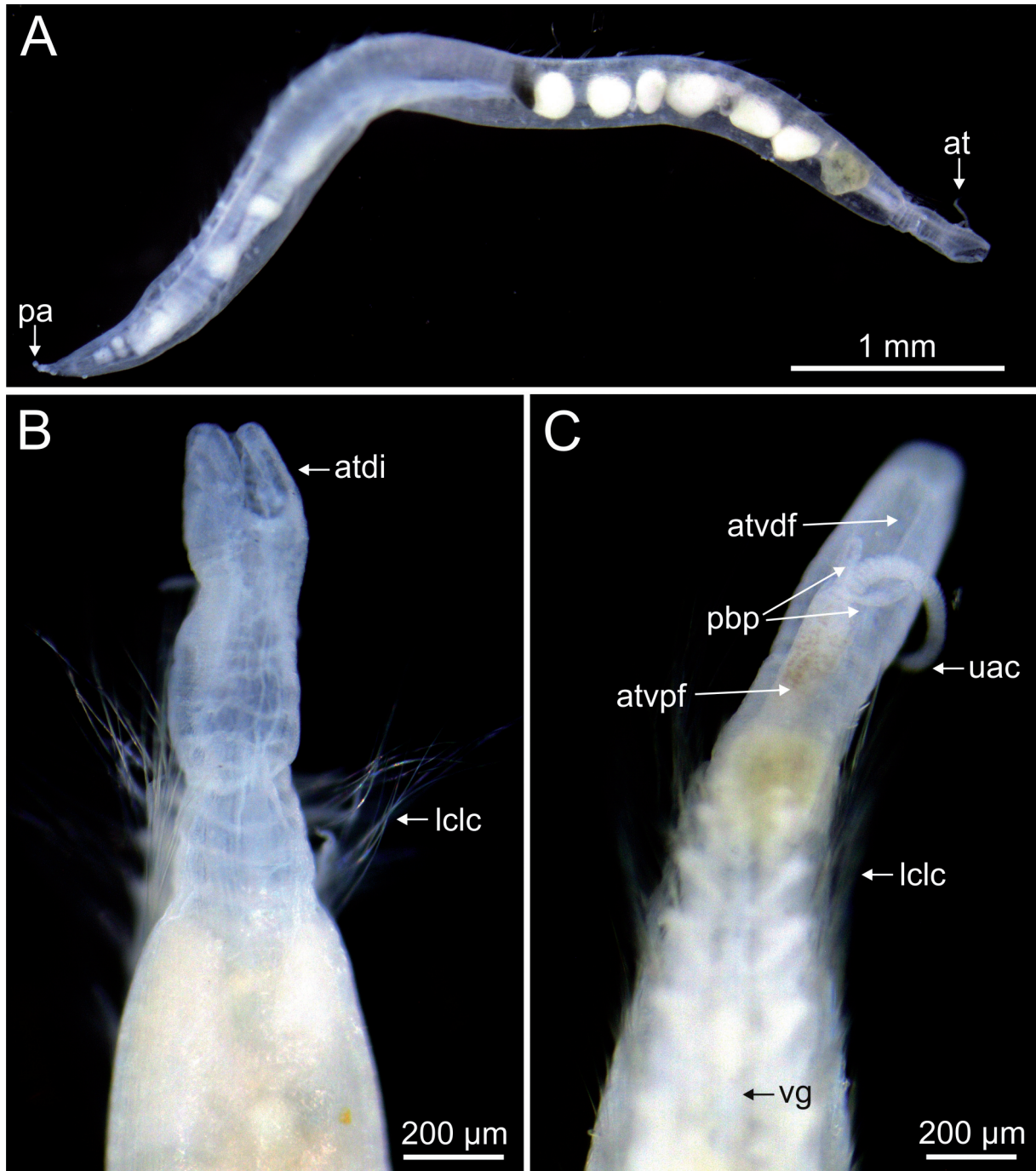
Low intertidal, Ras Al-Zour, South Kuwait; locality RZO, 28.74170° N, 48.38250° E. Paratypes also collected in this locality, and in Mina Abdullah (locality MAB, 29.00011° N, 48.16422° E; Fig. 6) also associated with sandy substrate.



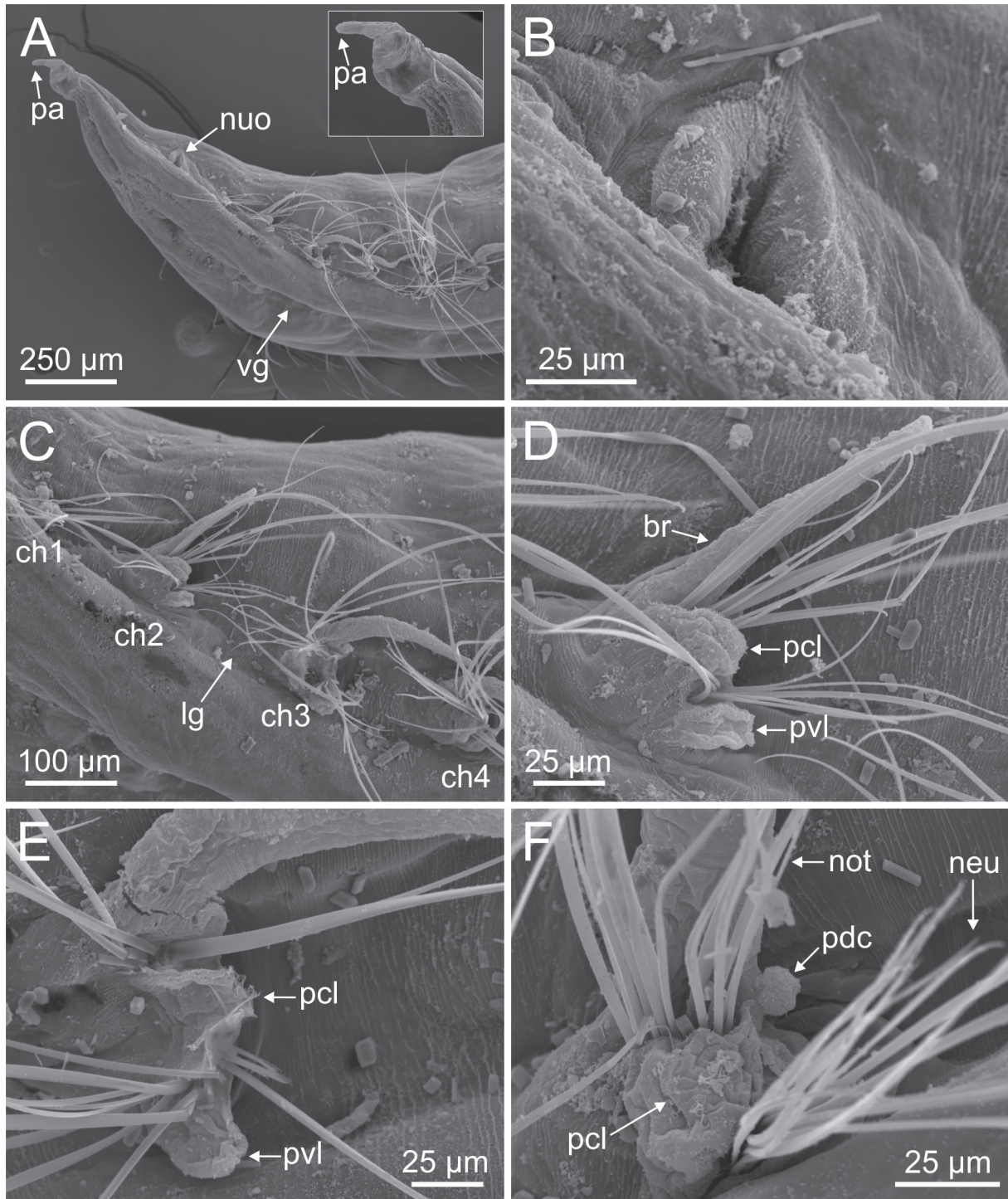
**Fig. 1.** *Ophelina arabica* sp. nov., holotype (MNCN 16.01/17001), line drawings. **A.** Anterior end, lateral view. **B–G.** Parapodia: 1 (B), 2 (C), 3 (D), 6 (E), 17 (F) and 29 (G), left side. **H–J.** Anal tube: ventral (H), dorsal (I) and lateral (J) views. Abbreviations: ata = anal tube annulations; atdi = anal tube dorsal incision; atvdf = anal tube ventro-distal fusion line; atvpf = anal tube ventro-proximal fusion line; br = branchia; neu = neurochaetae; not = notochaetae; nuo = nuchal organ; pa = palpus; pbp = pair of basal papillae; pcl = parapodial prechaetal lobe; pdc = parapodial dorsal cirrus; pvl = parapodial ventral lobe; uac = unpaired anal cirrus; vg = ventral groove. B–G = same scale; D–G, I: chaetae not illustrated.

**Remarks**

Among the three species of *Ophelina* previously reported from the Arabian Gulf (see Introduction) (Fig. 13), *O. longicaudata* is the only one described from the Indian Ocean (Indonesia); the shape of the

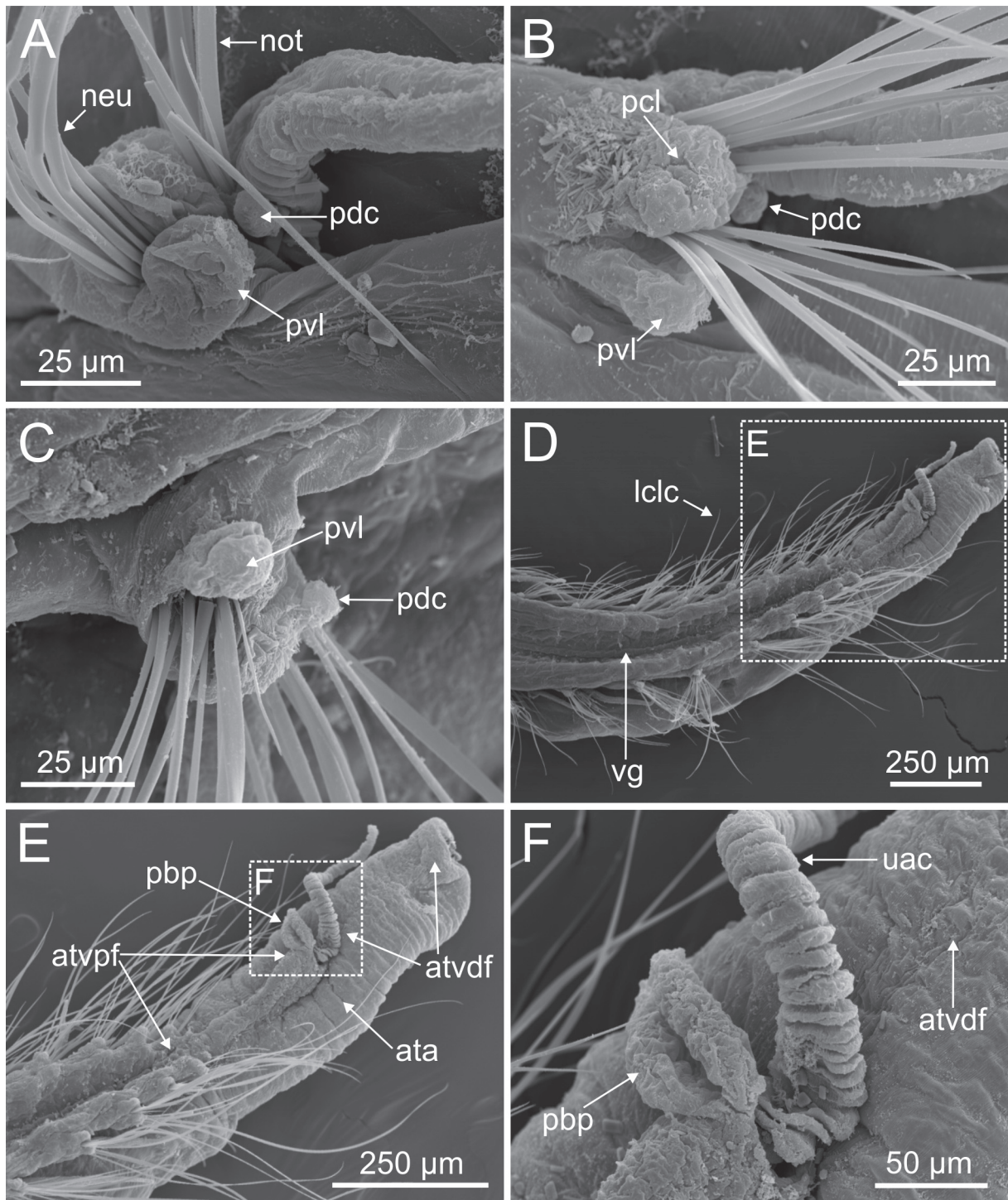


**Fig. 2.** *Ophelina arabica* sp. nov. Stereomicrographs. **A.** Paratype (MNCN 16.01/17002). **B–C.** Holotype (MNCN 16.01/17001). **A.** Complete specimen. **B.** Posterior end, dorsal view. **C.** Posterior end, ventral view. Abbreviations: at = anal tube; atdi = anal tube dorsal incision; atvdf = anal tube ventro-distal fusion line; atvpf = anal tube ventro-proximal fusion line; lclc = last chaetigers long chaetae; pa = palpode; pbp = pair of basal papillae; uac = unpaired anal cirrus; vg = ventral groove.



**Fig. 3.** *Ophelina arabica* sp. nov., paratype (MNCN 16.01/17003), SEM micrographs. **A.** Anterior end, latero-ventral view (framed: palpode, detail). **B.** Nuchal organ, left side. **C.** CH1–4, lateral view. **D.** CH2. **E.** CH6. **F.** CH9. Abbreviations: br = branchia; CH/ch = chaetiger; lg = lateral groove; neu = neurochaetae; not = notochaetae; nuo = nuchal organ; pa = palpode; pcl = parapodial prechaetal lobe; pdc = parapodial dorsal cirrus; pvl = parapodial ventral lobe; vg = ventral groove.

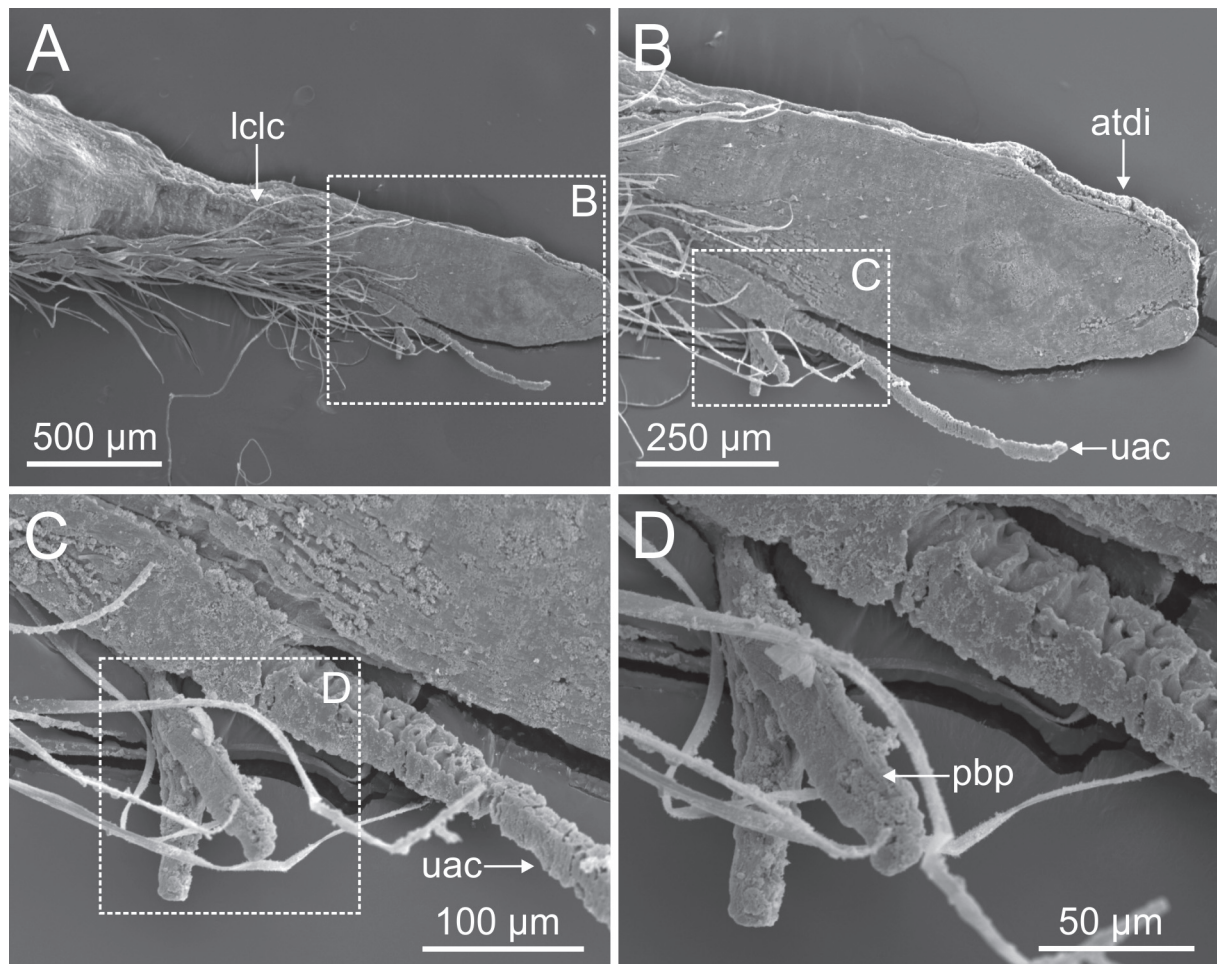




**Fig. 4.** *Ophelina arabica* sp. nov., paratype (MNCN 16.01/17003), SEM micrographs. **A.** CH14. **B.** CH21. **C.** CH28. **D.** Posterior end, ventral view. **E.** Last chaetigers, detail (framed in D). **F.** Pair of basal papillae and unpaired anal cirrus, detail (framed in E). Abbreviations: ata = anal tube annulations; atvdf = anal tube ventro-distal fusion line; atvpf = anal tube ventro-proximal fusion line; lclc = last chaetigers long chaetae; neu = neurochaetae; not = notochaetae; pbp = pair of basal papillae; pcl = parapodial prechaetal lobe; pdc = parapodial dorsal cirrus; pvl = parapodial ventral lobe; uac = unpaired anal cirrus; vg = ventral groove.

anal tube (Caullery 1944: fig. 35b–c) is similar to that of *O. arabica* sp. nov., but they differ from each other in the following: 1) *O. longicaudata* lacks the disto-dorsal incision as present in *O. arabica*; 2) the posterior margins of tube opening are provided with papillae in *O. longicaudata*; 3) the unpaired anal cirrus is much longer in *O. longicaudata* (about two times as long as the anal tube) and protrudes from the interior of the tube, while in *O. arabica* the cirrus is attached to the external surface and about 0.5 times as long as the anal tube. On the other hand, Day (1967) illustrates the anal tube of specimens from South Africa attributed to *O. longicaudata* (Day 1967: fig. 25.2.c); the marginal papillae are, however, larger than in the type specimens, and therefore these specimens may well correspond to another species.

The other two species of *Ophelina* reported from the studied area, namely *O. acuminata* and *O. cylindricaudata*, have the type locality in northern Europe. Only Al-Omari (2011) provides illustrations of specimens from the Arabian Gulf, but these do not show the most relevant taxonomic characters. Following descriptions of European specimens (e.g., Støp-Bowitz 1945; Ushakov 1955; Parapar & Moreira 2008; Kongsrud *et al.* 2011; Parapar 2012), *O. acuminata* differs from *O. arabica* sp. nov. in having an anal tube spoon-shaped provided with a well-defined ventral opening, one long unpaired anal cirrus and a pair of basal papillae twice as thick as posterior branchiae and about half the length of the



**Fig. 5.** *Ophelina arabica* sp. nov., paratype (MNCN 16.01/17004), SEM micrographs. **A.** Posterior end, lateral view. **B.** Anal tube and unpaired anal cirrus (framed in A). **C.** Anal tube, antero-ventral region, detail (framed in B). **D.** Pair of basal papillae, detail (framed in C). Abbreviations: atdi = anal tube dorsal incision; lclc = last chaetigers long chaetae; pbp = pair of basal papillae; uac = unpaired anal cirrus.

anal tube (see Støp-Bowitz 1945: fig. 3; Ushakov 1955: fig. 118a, c; Parapar & Moreira 2008: fig. 2c; Parapar 2012: fig. 147a, c). Regarding *O. cylindricaudata*, this species differs from *O. arabica* sp. nov. in the following: 1) the length of branchiae varies across the body, being shorter at mid-body; 2) the anal tube lacks both the paired basal papillae and the dorsal incision as present in *O. arabica* (see Støp-Bowitz 1945: fig. 5; Ushakov 1955: fig. 118e, as *Ammotrypane cylindricaudatus*; Parapar & Moreira 2008: fig. 4c; Parapar 2012: fig. 151a, c); 3) the posterior opening of the anal tube bears a dorsal mucro in *O. cylindricaudata* from which a short anal cirrus protrudes to the exterior (Kongsrud *et al.* 2011: fig. 3c).

Following original descriptions (usually incomplete) of other species of *Ophelina* from the Indian Ocean and the comparative table provided by Neave & Glasby (2013), *O. arabica* sp. nov. is close to *O. sibogae*



**Fig. 6.** Sampling localities in Inner Arabian Gulf where *Ophelina arabica* sp. nov. and *O. grandis* (Pillai, 1961) were collected.

(Caullery, 1944) (Fig. 12F), *O. grandis* (Pillai, 1961) (Fig. 12E), *O. kampeni* (Horst, 1919) (Fig. 12G), *O. cyprophilia* Neave & Glasby, 2013 (Neave & Glasby 2013: figs 6a–b, 7) and *O. tessellata* Neave & Glasby, 2013 (Neave & Glasby 2013: figs 6e–f, 9). However, the aforementioned species bear a “spoon-shaped” anal tube, fused completely along the dorsal midline, also provided with posterior marginal papillae. The slightly truncated profile of the disto-dorsal posterior margin of the anal tube of *O. arabica* resembles that as illustrated for specimens identified as *O. fauveli* (Caullery, 1944) by Neave & Glasby (2013: fig. 6d); this illustration does not, however, agree with that provided in the original description by Caullery (1944) regarding the tube shape and sizes of posterior marginal papillae.

*Ophelina arabica* sp. nov. differs from *O. grandis* (see below) in a number of features of the anal tube: 1) the dorsal margin is completely fused in *O. grandis* while showing a distal incision in *O. arabica*; 2) the ventral margin is opened in *O. grandis* and fused along its entire length in *O. arabica*; 3) *O. grandis* is provided with paired marginal papillae; 4) the pair of basal papillae and the unpaired anal cirrus are attached proximally to the ventral margin of the anal tube in *O. grandis* and at mid-length in *O. arabica*. In addition, *O. grandis* branchiae are of different lengths across the body, while notochaetae are all similar in length.

***Ophelina grandis* (Pillai, 1961)**

Figs 6–11, 12 A–B, D–E, 13

*Ammotrypane grandis* Pillai, 1961: 25–27, fig. 9a–c.

*Ammotrypane grandis* Pillai – Hartman 1959: 428. — Gallardo 1968: pl. 52 fig. 5: 112. — Hartman 1974: 627. — Phasuk 1992: 85.

*Ophelina grandis* (Pillai) – Eibye-Jacobsen 2002: 69. — Neave & Glasby 2013: 336, tab. 4.

**Diagnosis**

Parapodial prechaetal lobe elongated and triangular throughout; ventral lobe low and lingulate. Anal tube long, delicate, spoon-shaped, annulated; posterior and ventral margins free, tube opening well-defined, provided with about 15 pairs of marginal papillae; a pair of basal papillae and unpaired anal cirrus attached basally on ventral margin and projecting inside tube.

**Material examined**

**Holotype**

SRI LANKA • Tambalagam Lake; NHM 1960.3.13.17.

**Paratypes**

SRI LANKA • 1 spec.; same collection data as for holotype; NHM 1960.3.13.18 • 1 spec.; same collection data as for holotype; NHM 1960.3.13.19 • 1 spec.; same collection data as for holotype; NHM 1960.3.13.20 • 1 spec.; same collection data as for holotype; NHM 1960.3.13.21.

**Additional material**

KUWAIT • 1 spec.; Failaka Island; 29.39383° N, 48.39930° E; 24 Dec. 2014; sample P12610 code FI3; mid intertidal; fine sand; MNCN 16.01/17005 • 1 spec. (mounted for SEM); same collection data as for preceding; MNCN 16.01/17006 • 1 spec.; Failaka Island; 29.65636° N, 48.66550° E; 24 Dec. 2014; sample P12611 code FI3; mid intertidal; fine sand; MNCN 16.01/17007 • 1 spec.; Sulaibikhat Bay; 29.352483° N, 47.887467° E; 13 Oct. 2019; sample M1828 code KB5; subtidal; mud; MNCN 16.01/17009 • 1 spec.; same collection data as for preceding; sample M1835 code KB5; MNCN 16.01/17010.

## Description

**MEASUREMENTS.** Complete specimens ranging from 15–31 mm in length and 1.0–2.0 mm in width for 61–64 chaetigers.

**BODY.** Body slender, tubular, progressively tapering in last 5–6 chaetigers (Figs 8A, C, 11A–B); lateral and ventral grooves extending from anterior to posterior body end (Fig. 11A, E–F).

**PROSTOMIUM AND PERISTOMIUM.** Prostomium pointed; terminal palpode on distal end (Figs 7A, 8A–B, 11E). Prostomial eyes not seen. Nuchal organs large, as deep oval lateral depressions (Figs 7A, 8B, 9A, C). Buccal tentacles of one type, ca 150 mm long, apparently arranged in two rows of three each (Fig. 9A–B).

**PARAPODIA AND CHAETAE.** Parapodia biramous; each parapodium provided with a prechaetal lobe and a ventral lobe; dorsal cirrus not present. Prechaetal lobe elongated, triangular throughout; ventral lobe low, lingulate (Figs 7B–D, 9D–F, 10A–D). CH3 prechaetal lobe 0.2 times as long as branchiae; from following chaetigers 0.1 times as long as branchiae. Chaetae all simple, long capillaries, arranged in two rows (Fig. 10B); those of anterior parapodia oriented laterally or posterolaterally. Notochaetae generally longer than neurochaetae; in anterior and posterior parapodia as long as branchiae and 0.5 times as long as branchiae in mid-body.

**BRANCHIAE.** Present from CH2 (Figs 7A, 9A) to last chaetiger (Fig. 7E–G). Anterior chaetigers branchiae as long as body width, about 0.8 times as long in mid-body and 1.2 times as long in posterior chaetigers.

**ANAL TUBE.** Anal tube spoon-shaped (Figs 7E, G, 11C–D, F) slightly compressed laterally at most, three times longer than wide, as long as 10 posterior-most chaetigers; with about 40 annulations (Figs 7E, 8C, 11C–D); posterior and ventral margins free, not fused, tube opening well defined, margins provided with about 15 pairs of deciduous marginal papillae, highly variable in length; the longest about 0.5 times as long as tube width (Figs 7E–G, 8C, 11C–D); a pair of basal papillae about 0.25 as long as anal tube and 0.5 times as long as last branchiae (Figs 7E–F, 8C); unpaired anal cirrus attached basally on ventral margin and projecting inside, about 0.66 times as long as tube (Figs 7E, G, 8C, 11B).

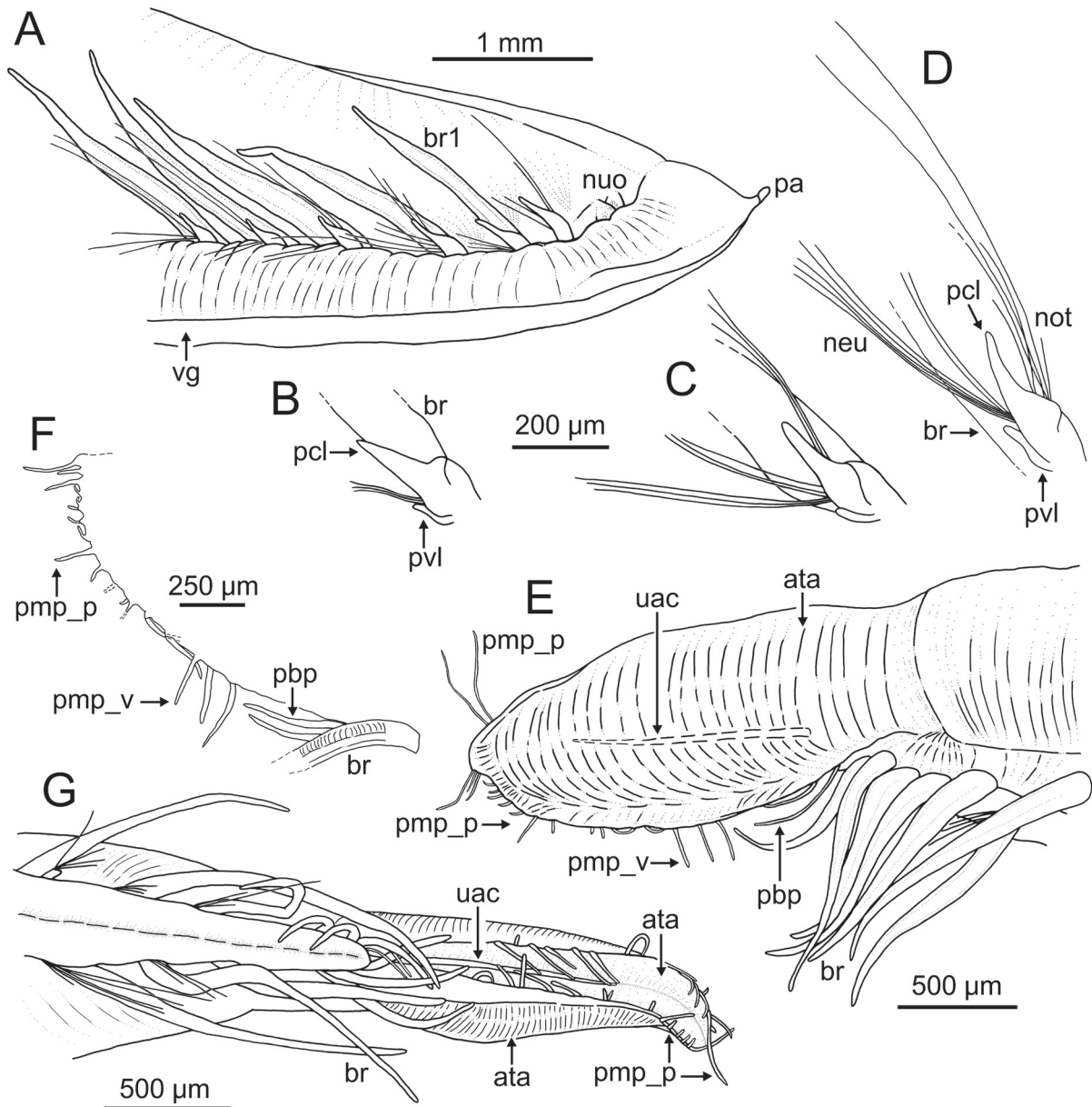
**PIGMENTATION.** Light brown in preserved specimens (Figs 8, 11).

## Remarks

*Ophelina grandis* (Pillai, 1961) was originally described from Tambalagam Bay (Sri Lanka) (Fig. 13). Pillai (1961) characterises this species by the following: (1) body length ranges from 18.0 to 34.5 mm for 62–66 pairs of parapodia; (2) proboscis funnel-shaped with 7 short oral cirri; (3) notochaetae of first 2–3 chaetigers much larger than those of following and directed forward (Fig. 12A); (4) long cirriform branchiae from CH2 to the last segment (Fig. 12B); (5) small reddish-brown pigment spot (“not eyes”, sensu Pillai 1961) present in each branchia (“not in all specimens”, sensu Pillai 1961); (6) anal tube spoon-shaped with rim provided with short and slender papillae, the posterior ones being shorter (Fig. 12B); (7) two quite short and slender paired basal papillae and unpaired anal cirrus (“missing in some specimens, very short in few and long in the others”, sensu Pillai 1961) (Fig. 12B). These diagnostic characters were present in the specimens we examined from the Arabian Gulf, apart from (3) (= long anterior notochaetae). In fact, this feature could not be confirmed in the photographs of the type of material provided by the NHM (Fig. 11).

Rullier (1965) describes *Ophelina gigantea* (Rullier, 1965; as *Ammotrypane*) from eastern Australia (Fig. 13), that resembles *O. grandis* in the number of chaetigers (65–68), parapodia shape (“sétigères suivants portent une longue branchie cirriforme et un court cirre ventral”; Rullier 1965: 190), branchiae

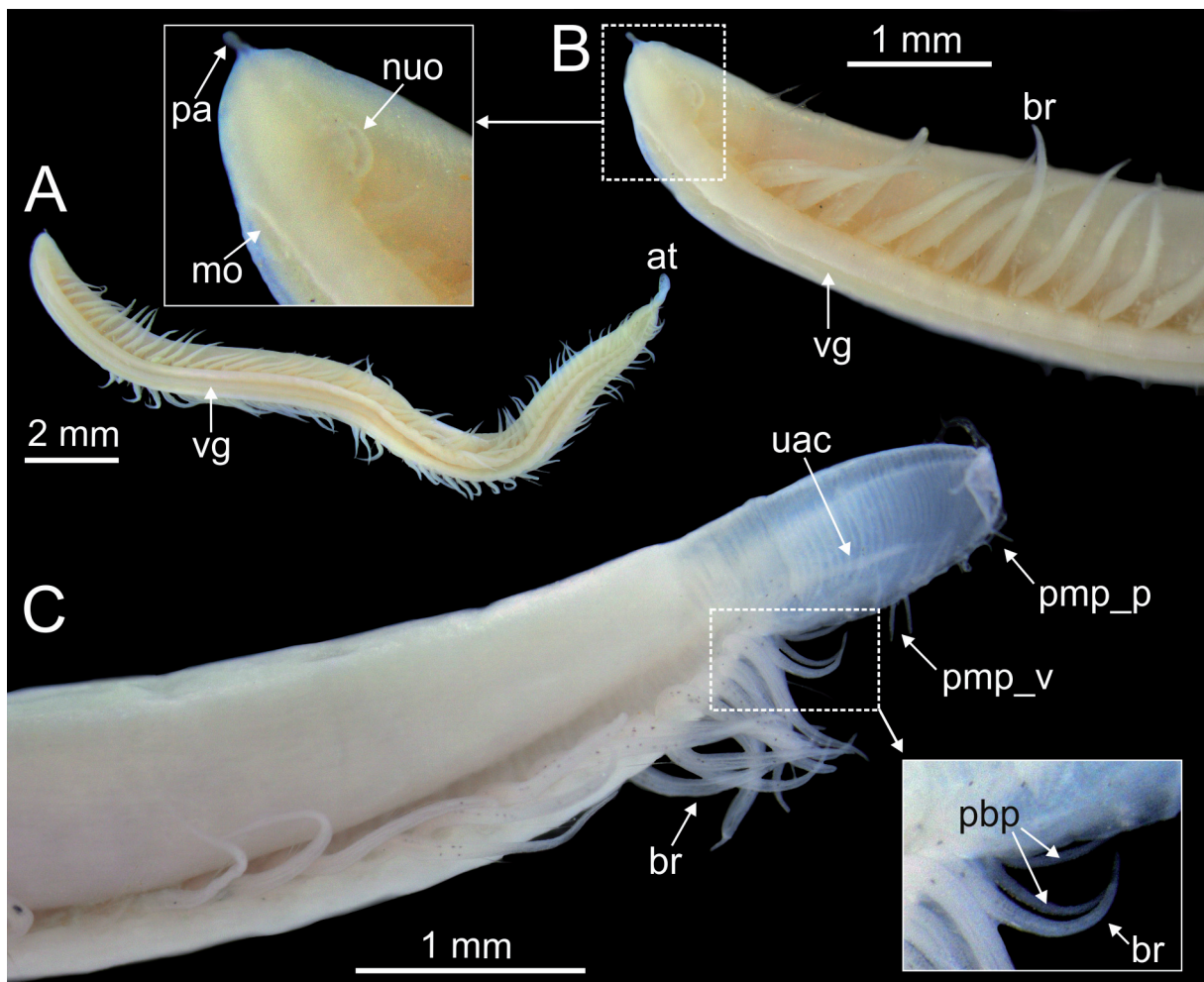
of same length present to the last chaetiger (“branchies se rencontrent jusqu’à pygidium et elles sont pratiquement la même taille”; Rullier 1965: 190) and anal tube shape (“...en cuiller, ouvert ventralement, formé d’une membrane translucide veinée d’une quarantaine de côtes transversales et bordée d’une centaine de très petites papilles cylindriques. Il existe deux petites papilles anales continuant les bords du tube anal et un cirre impair beaucoup plus long, logé dans la cavité du tube anal”; Rullier 1965: 191)



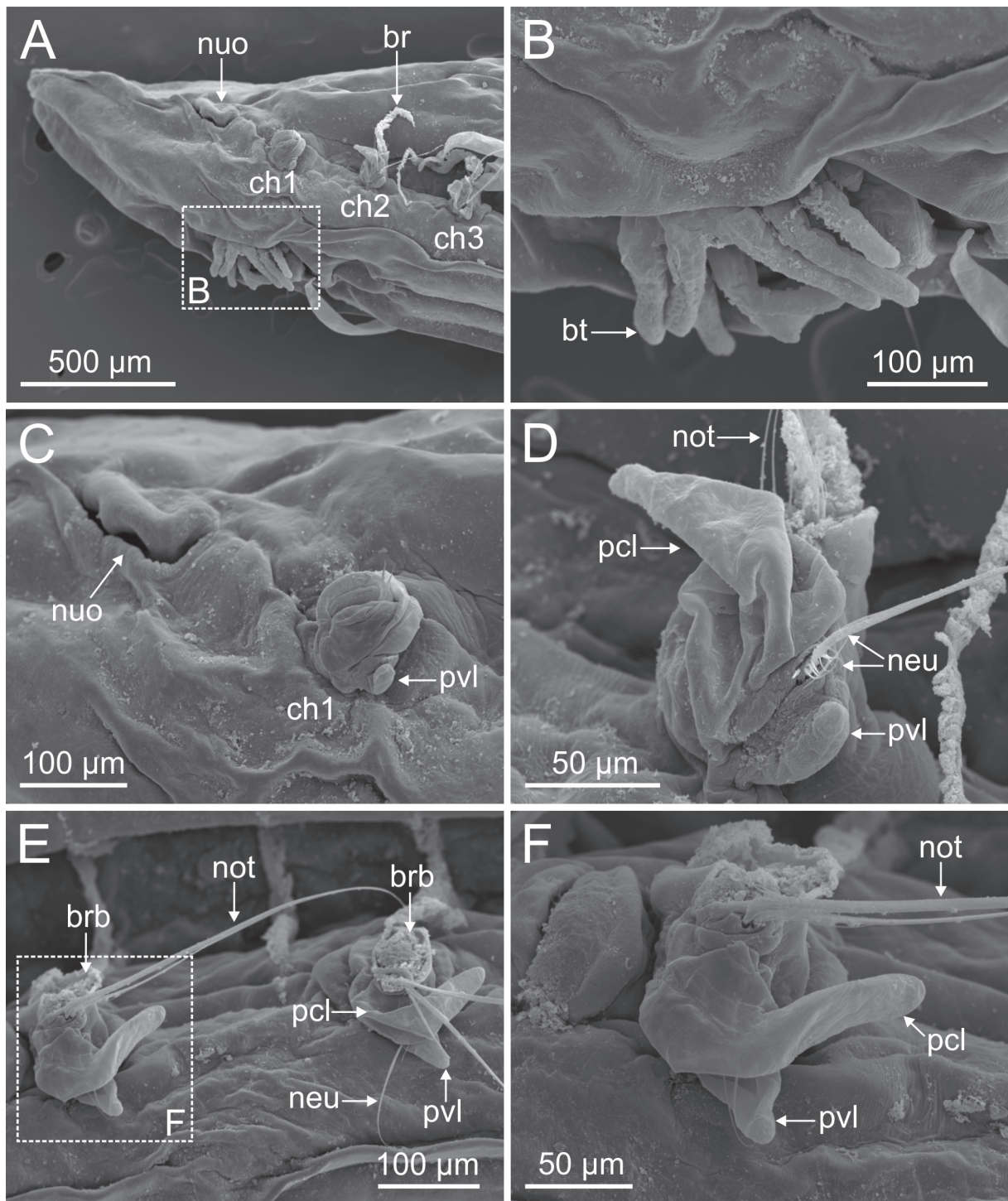
**Fig. 7.** *Ophelina grandis* (Pillai, 1961). Line drawings, specimen from Kuwait (MNCN 16.01/17005). **A.** Anterior end, lateral view. **B–D.** Parapodia: 2 (B), 3 (C) and 5 (D), right side. **E.** Anal tube, lateral view. **F.** Anal tube, lateral view, detail of posterior and ventral margins and papillae. **G.** Anal tube, ventral view. Abbreviations: ata = anal tube annulations; br = branchia; neu = neurochaetae; not = notochaetae; nuo = nuchal organ; pa = palpode; pbp = pair of basal papillae; pcl = parapodial prechaetal lobe; pmp\_p = paired marginal papillae - posterior; pmp\_v = paired marginal papillae - ventral; pvl = parapodial ventral lobe; uac = unpaired anal cirrus; vg = ventral groove. B–D = same scale.

(Fig. 12C). However, *O. gigantea* is much longer (62–64 mm vs 15–31 mm in *O. grandis*) and marginal papillae are proportionally smaller when compared to anal tube width. Rullier (1965) does not provide a comparison with type specimens of *O. grandis* and compares *O. gigantea* instead with *O. sibogae* (Indonesia), *O. kampeni* (Malaysia), *O. buitendyki* (Horst, 1919) (Java) and *O. norvegica* Støp-Bowitz, 1945 (Norway). These four species are shorter in length, bear fewer chaetigers and anal tube shape is different (“De plus, la forme de la tête et surtout du tube anal distinguent ces espèces de celles que nous décrivons”; Rullier 1965: 191).

Gallardo (1968) later reported *O. grandis* from Nha Trang Bay (Vietnam) (Fig. 13), highlighting the similarities with *O. gigantea*, but proposing two distinctive characters: in *O. gigantea* the anal tube is longer (“pygidial organ” sensu Gallardo 1968), and marginal papillae are shorter (cf. Fig. 12B vs Fig. 12C). We agree with Gallardo (1968) but also noticed that the pair of basal papillae and posterior marginal ventral papillae are of different sizes in *O. grandis* while in *O. gigantea* they are mostly similar to each other and smaller, in turn, than those of *O. grandis*. Furthermore, the anal tube looks truncated



**Fig. 8.** *Ophelina grandis* (Pillai, 1961). Stereomicrographs, specimen from Kuwait (MNCN 16.01/17005). **A.** Complete specimen, ventral view. **B.** Anterior end, lateral view. **C.** Posterior end, lateral view. Abbreviations: at = anal tube; br = branchia; mo = mouth; nuo = nuchal organ; pa = palpode; pbp = pair of basal papillae; pmp\_p = paired marginal papillae - posterior; pmp\_v = paired marginal papillae - ventral; uac = unpaired anal cirrus; vg = ventral groove.

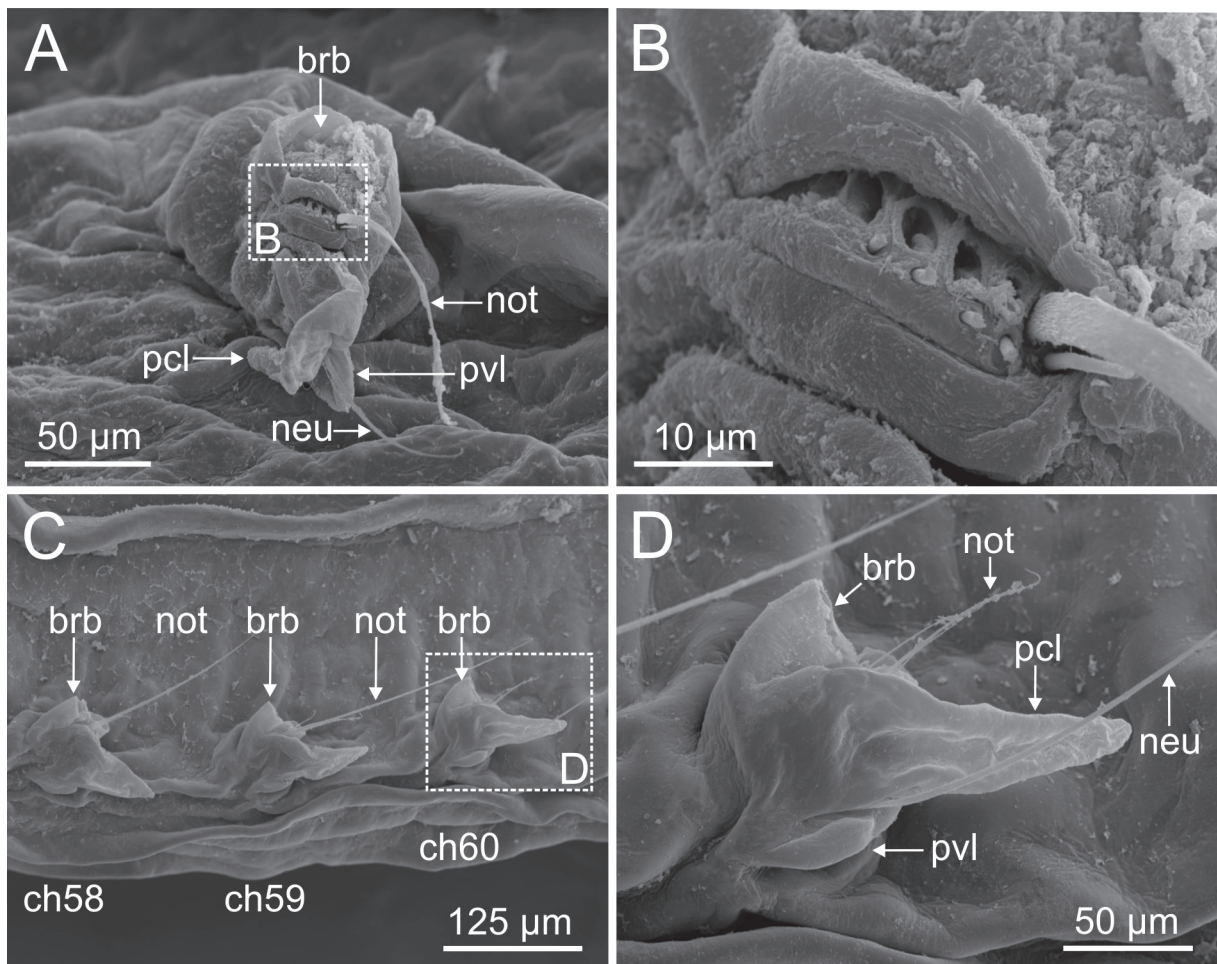


**Fig. 9.** *Ophelina grandis* (Pillai, 1961). SEM micrographs, specimen from Kuwait (MNCN 16.01/17006). **A.** Anterior end, latero-ventral view. **B.** Buccal tentacles (framed in A). **C.** Nuchal organ and CH1, lateral view. **D.** CH2. **E.** CH11–12. **F.** CH11, detail (framed in E). Abbreviations: br = branchia; brb = branchial basis; bt = buccal tentacles; CH/ch = chaetiger; neu = neurochaetae; not = notochaetae; nuo = nuchal organ; pcl = prechaetal lobe; pvl = parapodial ventral lobe.

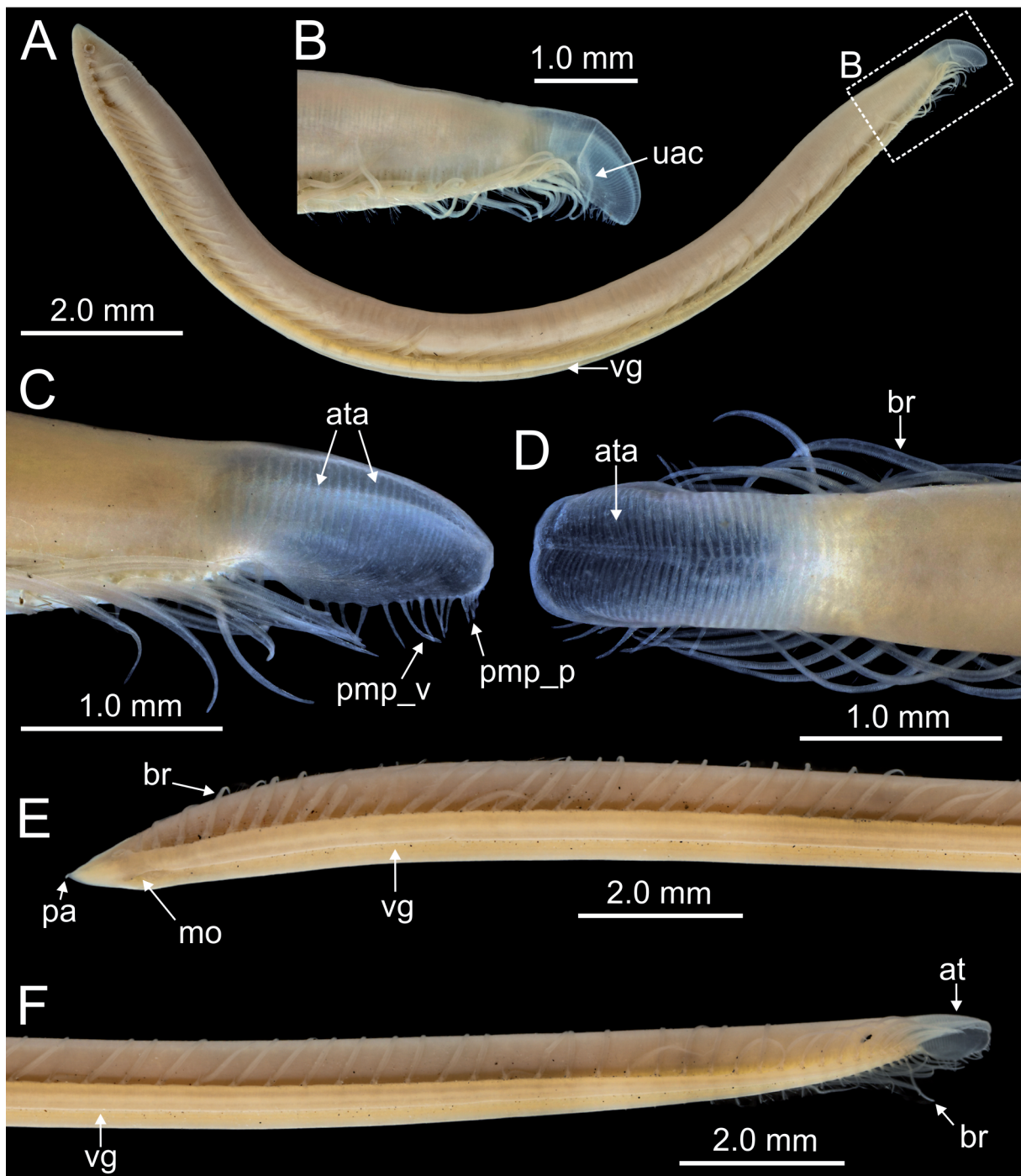


posteriorly in *O. grandis* but more pointed distally instead in *O. gigantea*. Gallardo (1968) also proposed a novel taxonomic character not previously considered for the genus (and not considered afterwards so far): number, shape, and arrangement of buccal tentacles (cf. Gallardo 1968: pl. lii–liii). Examination of tentacles with SEM in a specimen from Kuwait (Fig. 9A–B) confirms previous observations by Pillai (1961) and Gallardo (1968) (Fig. 12D). These tentacles are similar to those of *O. dubia* (Caullery, 1944) (cf. Gallardo 1968: pl. lii fig. 2) and quite different from those of *O. longicaudata* and *O. leptocirris* (Gallardo 1968: pl. lii figs 3–4); therefore, examination and description of tentacles in future work might serve indeed to differentiate species (Gallardo 1968).

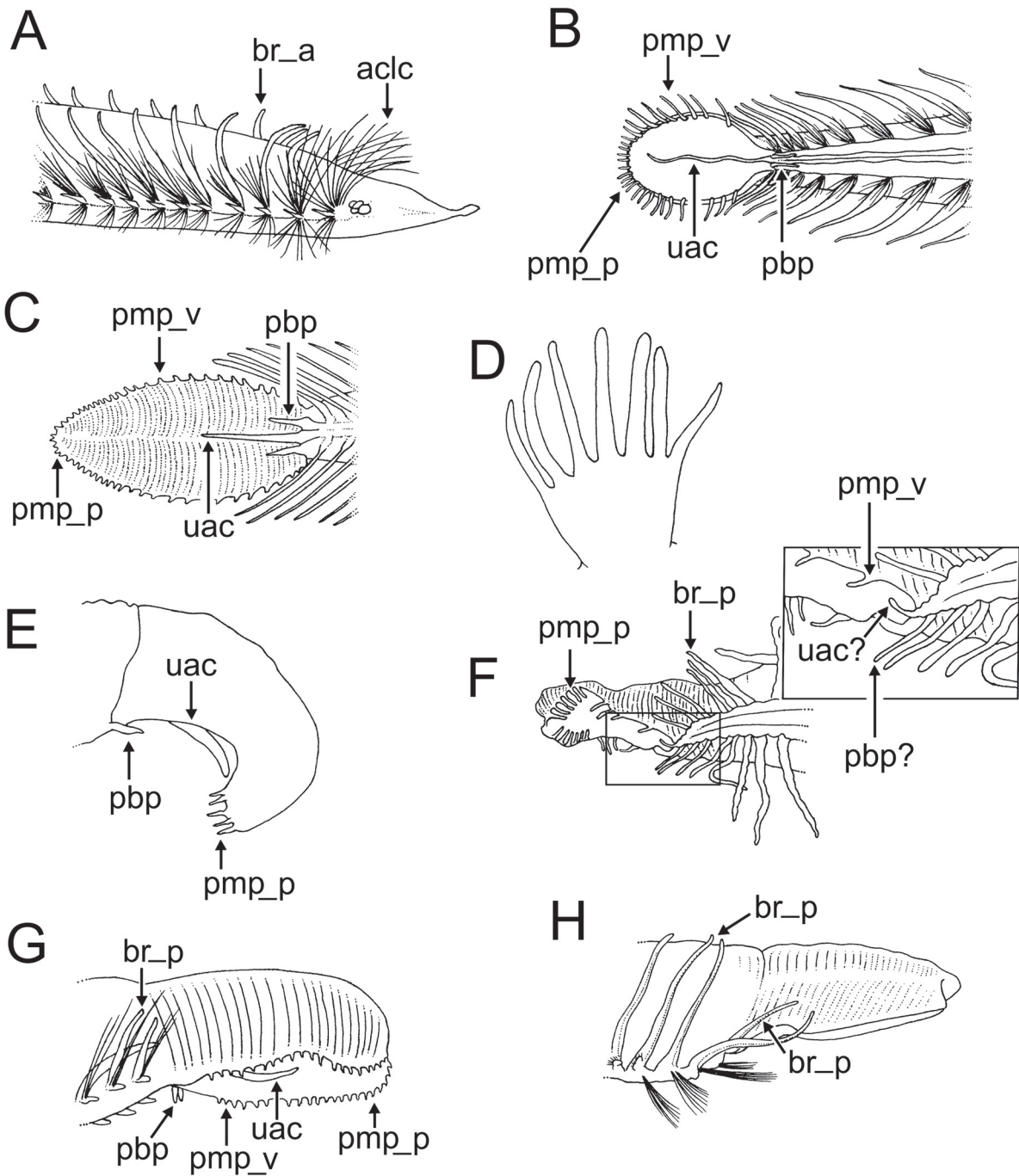
More recently, Eibye-Jacobsen (2002) also reported *O. grandis* from the Andaman Sea, including specimens previously studied by Phasuk (1992). This material differs from the original description regarding the size and arrangement of chaetae of CH1–2 and by having fewer marginal papillae in the anal tube (Fig. 12E); the latter might be due, however, to manipulation of specimens (Eibye-Jacobsen 2002).



**Fig. 10.** *Ophelina grandis* (Pillai, 1961). SEM micrographs, specimen from Kuwait (MNCN 16.01/17006). **A.** CH41. **B.** CH41, notopodium, detail. **C.** CH58–60. **D.** CH60 (framed in C). Abbreviations: brb = branchial basis; CH/ch = chaetiger; neu = neurochaetae; not = notochaetae; pcl = prechaetal lobe; pvl = parapodial ventral lobe.



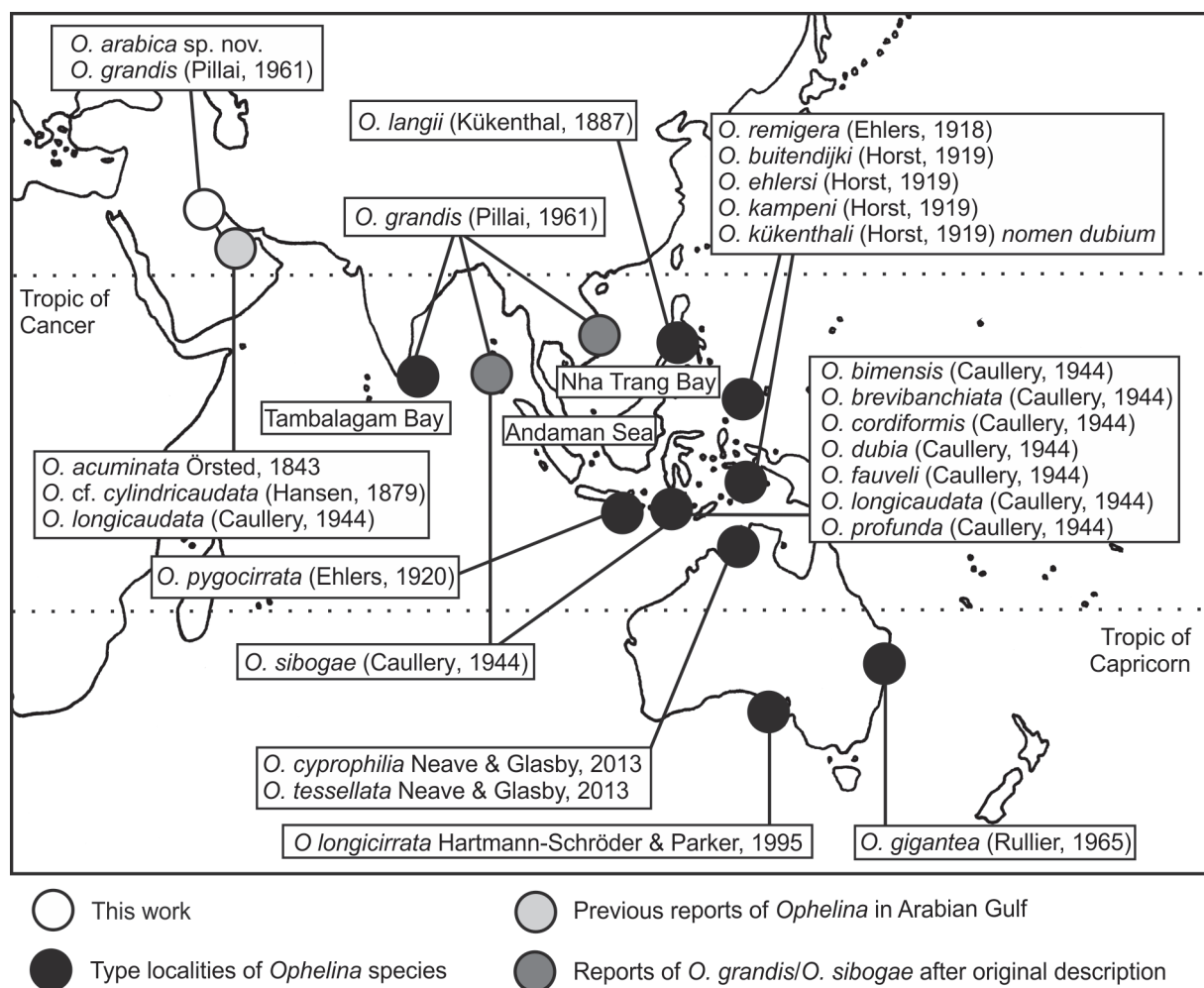
**Fig. 11.** *Ophelina grandis* (Pillai, 1961). Stereomicrographs. **A–B.** Holotype (NHM 1960.3.13.17). **C–F.** Paratype (NHM 1960.3.13.18). **A.** Complete specimen, left lateral view. **B.** Posterior end and anal tube, detail (framed in A). **C.** Posterior end and anal tube, dorso-lateral view. **D.** Posterior end and anal tube, dorsal view. **E.** Anterior body half, left latero-ventral view. **F.** Posterior body half, left latero-ventral view. Abbreviations: at = anal tube; ata = anal tube annulations; br = branchia; mo = mouth; pa = palpod; pmp\_p = paired marginal papillae - posterior; pmp\_v = paired marginal papillae - ventral; uac = unpaired anal cirrus; vg = ventral groove.



**Fig. 12.** Line drawings of several Indo-Pacific species of *Ophelina* (all redrawn from original sources). **A–B, D–E.** *Ophelina grandis* (Pillai, 1961). **C.** *Ophelina gigantea* (Rullier, 1965). **F.** *Ophelina sibogae* (Caullery, 1944). **G.** *Ophelina kampeni* (Horst, 1919). **H.** *Ophelina langii* (Kükenthal, 1887). **A.** Anterior body, lateral view. **B.** Posterior body end, ventral view. **C.** Last body chaetigers and anal tube, ventral view. **D.** Buccal tentacles. **E.** Anal tube, lateral view. **F.** Last body chaetigers and anal tube, ventral view. **G–H.** Last body chaetigers and anal tube, lateral view. Sources for drawings: A–B = Pillai (1961); C = Rullier (1965); D = Gallardo (1968); E = Eibye-Jacobsen (2002); F = Caullery (1944); G = Horst (1919); H = Kükenthal (1887). Abbreviations: aclc = anterior chaetigers long chaetae; br\_a = branchiae - anterior; br\_p = branchiae - posterior; pbp = pair of basal papillae; pmp\_p = paired marginal papillae - posterior; pmp\_v = paired marginal papillae - ventral; uac = unpaired anal cirrus.

*Ophelina sibogae* was originally described from depths of 9 m, which agrees with our findings in Kuwait. This species is similar to *O. grandis* in body length (15–30 mm), number of chaetigers (55–65) and anal tube shape (“forme de cuiller à concavité ventrale, pourvue d’une fine annulation transversale ... Sur les bords latéraux libres, sont insérées un certain nombre de papilles cirriformes ... A son intérieur, sur la ligne médiane, on trouve un cierge impar”; Caullery 1944: 41). However, both species differ in the following (Fig. 12F): (1) marginal papillae are of the same length in *O. sibogae*; (2) the unpaired anal cirrus is small and about 0.8 times as long as the tube (cf. Neave & Glasby 2013); (3) branchiae are shorter on last chaetigers. In addition, the pair of basal papillae are apparently not present, but Neave & Glasby (2013) mentioned such a feature probably after the illustration provided by Caullery (1944: fig. 31). However, a revision of the type specimens of *O. sibogae* is needed to assess whether *O. grandis* is a different species.

Other two species described from the Indian Ocean are similar to *O. grandis*: *O. kampeni* and *O. langii* (Kükenthal, 1887) (Fig. 12G–H). *Ophelina kampeni* also has an anal tube that is spoon-shaped and bears short marginal papillae along its free margins; the tube is also provided with a pair of basal papillae and unpaired anal cirrus within (Horst 1919: fig. 1; Fig. 12G); this species lacks instead parapodial ventral cirri (“prechaetal lobe” in Horst 1919) and bears shorter branchiae not reaching median dorsal



**Fig. 13.** Type localities of species of *Ophelina* described in the Indo-Pacific and Australia and records of *Ophelina* in the Arabian Gulf.

body line. On the contrary, *O. grandis* bears a well-developed prechaetal lobe in parapodia (Figs 9D–F, 10A, C–D), and anterior and posterior branchiae are much longer, surpassing dorsal body margin (Fig. 8A–C). Besides, the anal tube of *O. kampeni* is provided with a pair of basal papillae and marginal papillae that are of different lengths to those of *O. grandis* (Figs 7E–G, 8C, 11B–D vs Fig. 12G), i.e., the pair of basal papillae are about 0.2 times as long as last branchiae in *O. kampeni* (Fig. 12G) and 0.5 times in *O. grandis* (Fig. 12B); marginal papillae of *O. kampeni* are of the same length and 0.5 times as long as the pair of basal papillae and about 0.05 times as long as anal tube height. In contrast, *O. grandis* posterior and ventral marginal papillae differ in length; the latter is also as long as the pair of basal papillae and about 0.2 times as long as the anal tube height. Regarding *O. langii*, several features are shared with *O. grandis* following Kükenthal (1887): (1) length (23.0 mm), width (1.3 mm), and a number of chaetigers (50) are similar; (2) branchiae are long and conspicuously pointed and quite crowded in last chaetigers; (3) anal tube is tubular in shape, translucent, opened ventrally and provided with >20 annulations (Kükenthal 1887: pl. xxi fig. 5; Fig. 12H). However, the anal tube of *O. langii* has free ventral and posterior margins that lack marginal papillae, a pair of basal papillae and the unpaired anal cirrus (Horst 1919).

*Ophelina longicaudata* (Andaman Sea) and *O. longicirrata* Hartmann-Schröder & Parker, 1995 (South Australia) (Fig. 13) also bear an anal tube similar to that of *O. grandis*. However, *O. longicaudata* has the ventral margins totally fused, and the unpaired anal cirrus is much longer as explained above (Caullery 1944: fig. 35). Regarding *O. longicirrata*, the anal tube is provided only with marginal papillae on the posterior margin (Hartmann-Schröder & Parker 1995: fig. 11), that is, in turn, larger than in *O. grandis*, also lacking the pair of basal papillae and unpaired anal cirrus; Hartmann-Schröder & Parker (1995) refer, however, to a “ventral cushion that may be base of a lost unpaired cirrus” and also state that *O. fauveli* (Caullery 1944: fig. 35) is close to *O. longicirrata* but bears a shorter anal tube (see also Remarks for *O. arabica* sp. nov.).

*Ophelina cyprophilia* Neave & Glasby, 2013 (North Australia) (Fig. 13) is distinguished from *O. grandis* because of the shorter branchiae, the shape of the anal tube, and having fewer and smaller paired marginal papillae (Neave & Glasby 2013). We also point to two further differences: (1) the anal tube profile is not truncated in *O. cyprophilia*; (2) the pair of basal papillae (as “paired anal cirri” in Neave & Glasby 2013) are shorter in *O. cyprophilia* (0.3 times as long as anal tube) than in *O. grandis* (up to 0.5 times as long as tube) (Neave & Glasby 2013: fig. 6a–b).

Two European species were reported in the Arabian Gulf (namely *O. cylindricaudata* and *O. acuminata*), and their anal tube resembles that of *O. grandis*. In *O. cylindricaudata*, the anal tube is tubular in shape and about as long as the last six chaetigers. However, the ventral margin is fused and lacks marginal papillae, as in *O. grandis* (Kongsrud *et al.* 2011: fig. 3c). *Ophelina acuminata* bears such papillae instead but the anal tube is spoon-shaped, and the pair of basal papillae are thicker than in *O. grandis* (Stop-Bowitz 1945: fig. 3). Therefore, it is likely that the previous records of these two species in the Arabian Gulf may correspond to *O. grandis* or other still not described species.

### **Key to species of *Ophelina* described/reported in the Indian Ocean**

The key comprises species of *Ophelina* originally described from the Indo-Pacific, Southern Asia, Indo-Malay Archipelago, and Australia, plus those two European species reported from the Arabian Gulf. The main characters used to discriminate among species are the anal tube features, including the unpaired anal cirrus, paired marginal papillae and the pair of basal papillae.

We follow Rullier (1965), Kongsrud *et al.* (2011), Parapar & Moreira (2015), Moreira & Parapar (2017), Magalhães *et al.* (2019), and Parapar *et al.* (2021a, 2021b) when using the term “anal tube” instead of many others used before (see Remarks to the diagnosis of genus). Anyhow, we must state that this

structure is a pygidial construction instead of being only restricted to the anal part itself and that the shape of the anal tube is not indeed “tubular” in all species. Besides, the anal tube shape is also a relevant diagnostic character, but various terms in the literature refer to its very shape. Therefore, the two main appearances are used in the key: 1) tube longer than wide (“groove-shaped”) and 2) tube as long as wide (“spoon/hood-shaped”).

Other body characters of high taxonomic relevance in the genus *Ophelina* were not used in this key, such as the parapodial shape. Because many available descriptions (especially those from the early 20<sup>th</sup> century) still need to be completed; this would require a revision of the available type material of a number of species. Such revision might eventually result, in turn, in the erection of new species. Redescriptions and taxonomic comments are available across the literature for several species, but we intended to follow original descriptions and illustrations as much as possible unless indicated otherwise.

The key also includes the European *O. acuminata* Örsted, 1843 and *O. longicaudata* (Caullery, 1944) because they have been previously reported in the Indian Ocean. However, these records might actually correspond to other described and/or new species. On the other hand, three species were not included in the key:

- 1) *Ophelina dubia* (Caullery, 1944): the original description does not describe the anal tube, apparently lost (“Le tube anal manque sur l’échantillon”, Caullery 1944: 45).
- 2) *Ophelina ehlersi* (Horst, 1919): the original description confirms the presence of paired basal papillae but states that “The anal tube is short (?broken off)” (Horst 1919: 23), and therefore the presence of paired marginal papillae and unpaired anal cirrus is not mentioned/confirmed.
- 3) *Ophelina kükenthali* (Horst, 1919): the original description reports the anal tube as “gutter shaped”, and the presence of the unpaired anal cirrus and 8–9 “cirri” on the posterior margin (supposedly the paired marginal papillae), but no illustration is provided and sizes/proportions among each other are not mentioned. Later, Neave & Glasby (2013) wrongly state that this species lacks the unpaired anal cirrus, and bears instead the pair of basal papillae.

The type locality of each species is indicated between brackets.

- |                                                                                                                                                                                              |                                                                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| 1. Anal tube (AT) with all three types of anal cirri/papillae .....                                                                                                                          | 12                                                                  |
| – AT lacking at least one type of anal cirri/papillae .....                                                                                                                                  | 2                                                                   |
| 2. AT without paired marginal papillae .....                                                                                                                                                 | 3                                                                   |
| – AT with paired marginal papillae .....                                                                                                                                                     | 7                                                                   |
| 3. AT as long as wide (bell, spoon or hood-shaped) .....                                                                                                                                     | 4                                                                   |
| – AT longer than wide (tube or groove-shaped) .....                                                                                                                                          | 5                                                                   |
| 4. Prechaetal lobes well developed; anterior-most lobes almost as long as branchiae; branchiae longer than chaetae; anal tube opened ventrally, heart-shaped and pointed at dorsal end ..... |                                                                     |
| ..... <i>O. cordiformis</i> (Caullery, 1944) <sup>1</sup> [Indonesia]                                                                                                                        |                                                                     |
| – Prechaetal lobes poorly developed; branchiae small, shorter than chaetae; anal tube very short with ventral prolongation .....                                                             | <i>O. brevibranchiata</i> (Caullery, 1944) <sup>2</sup> [Indonesia] |
| 5. Unpaired ventral cirrus present .....                                                                                                                                                     | 6                                                                   |
| – Unpaired ventral cirrus absent .....                                                                                                                                                       | <i>O. langii</i> (Kükenthal, 1887) [Philippines; Fig. 12H]          |

6. AT opened dorsally at distal end .....	<i>O. arabica</i> sp. nov. [Arabian Gulf]	
– AT fused dorsally .....	<i>O. cylindricaudata</i> (Hansen, 1879) [NE Atlantic]	
7. AT unpaired anal cirrus absent .....		8
– AT unpaired anal cirrus present .....		10
8. AT pair of basal papillae present .....	<i>O. buitendijki</i> (Horst, 1919) <sup>3</sup> [Indonesia]	
– AT pair of basal papillae absent .....		9
9. Midbody branchiae length about 0.5 body width .....	<i>O. pygocirrata</i> (Ehlers, 1920) <sup>4</sup> [Indonesia]	
– Midbody branchiae length about 2.0 body width .....	<i>O. longicirrata</i> Hartmann-Schröder & Parker, 1995 <sup>5</sup> [S Australia]	
10. AT ventral margin fused. Paired marginal papillae about 0.05 times AT length; .....	<i>O. longicaudata</i> (Caullery, 1944) [Indonesia]	
– AT ventral margin not fused. Paired marginal papillae >0.05 times AT length .....		11
11. Paired marginal papillae as long as AT .....	<i>O. bimensis</i> (Caullery, 1944) [Indonesia]	
– Paired marginal papillae about 0.2 times AT length .....	<i>O. profunda</i> (Caullery, 1944) <sup>6</sup> [Indonesia]	
12. AT as long as wide .....		13
– AT longer than wide .....		15
13. Unpaired ventral cirrus provided with paired papillae along both sides .....	<i>O. remigera</i> (Ehlers, 1918) <sup>7</sup> [Indonesia]	
– Unpaired ventral cirrus not provided with papillae .....		14
14. Paired marginal papillae similar in shape and length (about 0.05 times maximal AT length) .....	<i>O. tessellata</i> Neave & Glasby, 2013 [N Australia]	
– Paired marginal papillae of different shape and length (about 0.2 times maximal AT length) .....	<i>O. fauveli</i> (Caullery, 1944) <sup>8</sup> [Indonesia]	
15. Paired marginal papillae of different length <sup>9</sup> .....		16
– Paired marginal papillae of same length <sup>9,10</sup> .....		17
16. Posterior paired marginal papillae longer than anterior ones .....	<i>O. cyprophilia</i> Neave & Glasby, 2013 [N Australia]	
– Anterior paired marginal papillae longer than posterior ones .....	<i>O. grandis</i> (Pillai, 1961) <sup>10,11</sup> [Sri Lanka; Fig. 12A–B]	
17. Paired marginal papillae length <0.1 times maximal AT width .....		18
– Paired marginal papillae length >0.1 times maximal AT width .....		19
18. Pair of basal papillae <0.1 times unpaired ventral cirrus length .....	<i>O. kampeni</i> (Horst, 1919) [Indonesia; Fig. 12G]	
– Pair of basal papillae about 0.5 times unpaired ventral cirrus length .....	<i>O. gigantea</i> (Rullier, 1965) [E Australia; Fig. 12C]	
19. Unpaired ventral cirrus longer than maximal AT length ...	<i>O. acuminata</i> Örsted, 1843 [NE Atlantic]	
– Unpaired ventral cirrus not longer than maximal AT length .....	<i>O. sibogae</i> (Caullery, 1944) <sup>11</sup> [Indonesia; Fig. 12F]	

- (1) Eibye-Jacobsen (2002) describes specimens identified as *Ophelina* cf. *cordiformis* from the Andaman Sea and discusses similarities/differences with the only type specimen of *O. cordiformis*, which is damaged according to the original description by Caullery (1944).
- (2) “Je n’y ai pas aperçu de papilles marginales, ni de branchie anale” (Caullery 1944: 46). The original description and drawings by Caullery (1944) for *O. brevibranchiata* are much simpler than those provided for other species in the same work; therefore, this species is not well characterised morphologically yet.
- (3) Following the original description by Horst (1919) and that by Neave & Glasby (2013), no illustration is available.
- (4) Following the original description by Ehlers (1920) and that by Neave & Glasby (2013), no illustration is available.
- (5) Following the original description by Hartmann-Schröder & Parker (1995) and that by Neave & Glasby (2013).
- (6) Caullery (1944) states in the original description that the unpaired anal cirrus is not present (“Je n’ai pas vu de branchie anale”; Caullery 1944: 47); however, Caullery (1944: fig. 38c) illustrates a long cirrus coming out from the interior of the anal tube that might likely correspond to a true unpaired anal cirrus.
- (7) Ehlers (1918) mentions in the anal tube a “a brownish, short ovate body” (in German in original source: “ein bräunlicher, kurz eiförmiger Körper”; Ehlers 1918: figs 2–3 in table xvii). This structure might correspond to the only papilla remaining of the pair of basal papillae as present in other species. Furthermore, Neave & Glasby (2013) describe a “second protrusion” that we recognise as the unpaired anal cirrus.
- (8) The concept provided by Neave & Glasby (2013) for this species is different to that of the original description (see remarks above).
- (9) This feature might have been overlooked in the original descriptions of some species.
- (10) This feature is also present in European specimens of *O. acuminata* but not in specimens from South Africa illustrated by Day (1967); the latter may, therefore, represent a different species (see Remarks for *O. arabica* sp. nov.).
- (11) The descriptions by Eibye-Jacobsen (2002) for specimens identified as belonging to *O. grandis* and *O. sibogae* differ from the original descriptions regarding features of the anal tube; therefore, these specimens might represent undescribed species (see also Remarks for *O. arabica* sp. nov.).

## Discussion

Taxonomy of genus *Ophelina* is still hindered by a number of issues:

- (1) Lack of consistent descriptions of species regarding relevant characters and their nomenclature, particularly for studies done before the 21<sup>st</sup> century; for instance, terminology for the anal tube papillae is quite variable across the literature.
- (2) Discrimination among species often relies only on features of the anal tube.



- (3) Differences in knowledge among geographic areas, with some regions still poorly studied.
- (4) Species originally described from NE Atlantic are often reported from other latitudes, and these records might actually represent other species.

This overall situation applied to opheliid knowledge in the Arabian Gulf. As stated previously, several species that were reported there, i.e., *P. pictus*, *O. acuminata* and *O. af. cylindricaudata*, were described from European waters by the 19<sup>th</sup> century. However, recent work based on examining a large number of intertidal samples from Kuwait revealed the presence of a new species of *Polyophthalmus* Quatrefages, 1850 (Parapar *et al.* 2021a). The present study is a follow-up to that work and allowed us to describe a new species of *Ophelina* and provide the first record of *O. grandis* for the Arabian Gulf. Therefore, the identity of opheliids previously reported in the Arabian Gulf should be reconsidered and revised. Finally, a full review of the genus *Ophelina* would be desirable but based on consistent terminology for taxonomic characters and a full redescription of species that need an adequate description.

### **Acknowledgements**

The authors thank Ada Castro and Catalina Sueiro (Servizos de Apoio á Investigación, Universidade da Coruña) for SEM assistance. Many thanks also to Emma Sherlock (Natural History Museum, London, England) for providing photographs of type specimens of *Ophelina grandis*. Our gratitude also to the Kuwait Institute for Scientific Research (KISR) for providing financial support and facilitating this research, with fieldwork supported by two captains, Abdulrahman Yousef and Ali Al-Hamad, who drive the boats to Kuwaiti Islands. Authors would also like to thank the topical and desk editors of EJT Tony Robillard and Pepe Fernández, for their constructive comments on the manuscript. Special thanks to the KISR staff who collected the intertidal samples and sorted the specimens used in this work. Finally, comments by Aiswarya Gopal and one anonymous referee on an earlier manuscript version are greatly appreciated.

### **Funding information**

This work is supported by KISR.

### **Conflict of interest**

The authors declare that they have no conflict of interest.

### **Ethical approval**

No animal testing was performed during this study.

### **Sampling and field studies**

All necessary permits for field studies and sampling have been obtained by the authors from the competent authorities and are mentioned in the acknowledgements.

### **Data availability statement**

All data generated or analysed during this study are included in this published article.

### **References**

Al-Kandari M., Bishop J., Skryabin V., Polikarpov I., Sattari Z., Taqi A. & Hussain S. 2017. *Biodiversity, Distribution, and Abundance of Intertidal Macrofauna in Kuwait*. Kuwait Institute for Scientific Research Report, KISR No. 14461. Final Report FM075C, Vols I–III.

- Al-Kandari M., Sattari Z., Hussain S., Radashevsky V.I. & Zhadan A. 2019. Checklist of intertidal polychaetes (Annelida) of Kuwait, Northern part of the Arabian Gulf. *Regional Studies in Marine Science* 32: 100872. <https://doi.org/10.1016/j.rsma.2019.100872>
- Al-Omari N.H.A. 2011. *A Guide to Polychaetes (Annelida) in Qatar Marine Sediments*. Environmental Studies Center, Qatar University.
- Al-Rifaie K., Al-Yamani F., Lennox A., Boltachova N., Revkov N., Grintsov V. & Murina V. 2012. Macrozoobenthos community structure during four seasons in Kuwait Bay. *International Journal of Oceans and Oceanography* 6: 45–67.
- Al-Yamani F.Y., Skryabin V., Boltachova N., Revkov N., Makarov M., Grintsov V. & Kolesnikova E. 2012. *Illustrated Atlas of the Benthos of Kuwait*. Kuwait Institute for Scientific Research, Safat.
- Barroso P. & Paiva P.C. 2013. Deep sea *Ophelina* (Polychaeta: Opheliidae) from southern Brazil. *Marine Biodiversity Records* 6: e51. <https://doi.org/10.1017/S1755267213000201>
- Blake J.A. & Macirolek N.J. 2020. 7.6. Opheliida/Capitellida. In: Schmidt-Rhaesa A. (ed.) *Handbook of Zoology. Annelida: Pleistoannelida, Sedentaria II*: 285–302. De Gruyter, Berlin. <https://doi.org/10.1515/9783110291681-008>
- Caullery M. 1944. Polychètes sédentaires de l'expédition du Siboga: Ariciidae, Spionidae, Chaetopteridae, Chlorhaemidae, Opheliidae, Oweniidae, Sabellariidae, Sternaspidae, Amphictenidae, Ampharetidae, Terebellidae. *Siboga Expeditie* 24 (2 bis): 1–204.
- Chamberlin R.V. 1919. The Annelida Polychaeta [Albatross Expeditions]. *Memoirs of the Museum of Comparative Zoology at Harvard College* 48: 1–514. <https://doi.org/10.5962/bhl.title.49195>
- Day J.H. 1967. *A Monograph on the Polychaeta of Southern Africa. Part 2: Sedentaria*. The British Museum of Natural History, London. <https://doi.org/10.5962/bhl.title.8596>
- Ehlers E. 1918. Polychaete Anneliden von den Aru- und Kei-Inseln. *Abhandlungen der Senckenbergischen naturforschenden Gesellschaft* 35 (2): 229–259.
- Ehlers E. 1920. Polychaeten von Java und Amboina. Ein Beitrag zur Kenntnis der malaiischen Strandfauna. *Abhandlungen der Königlichen Gesellschaft der Wissenschaften zu Göttingen, Neue Folge* 10 (7): 1–73.
- Eibye-Jacobsen D. 2002. Scalibregmatidae and Opheliidae (Annelida: Polychaeta) collected in the Andaman Sea, Thailand, during the BIOSHELF project. *Phuket Marine Biological Center Special Publication* 24: 57–74.
- Fauvel P. 1902. Annélides Polychètes de la Casamance rapportées par M. Aug. Chevalier. *Bulletin de la Société Linnéenne de Normandie, Série 5* 5: 59–105. Available from <https://biodiversitylibrary.org/page/1638569> [accessed 24 Mar. 2023].
- Fauvel P. 1911. Annélides Polychètes du Golfe Persique recueillies par M.N. Bogoyawlensky. *Archives de Zoologie expérimentale et générale Série 5* 6: 353–439. Available from <https://www.biodiversitylibrary.org/page/6200721> [accessed 24 Mar. 2023].
- Fauvel P. 1919. Annélides polychètes de Madagascar, de Djibouti et du Golfe Persique. *Archives de Zoologie expérimentale et générale* 58: 315–473. <https://doi.org/10.5962/bhl.part.8154>
- Fauvel P. 1927. Polychètes sédentaires. Addenda aux errantes, Archiannelides, Myzostomaires. *Faune de France* 16: 1–494.
- Fauvel P. 1932. Annelida Polychaeta of the Indian Museum, Calcutta. *Zoological Survey of India* 12 (1): 1–262.

- Fiege D. 1992. *Polychaeta of the Intertidal Zone in the Ras Az-Zawr Marduma Bay Region, Saudi Arabia*. Unpublished Progress Report of the Senckenbergische Forschungsinstitut, Frankfurt am Main.
- Gallardo V.A. 1968. Polychaeta from the Bay of Nha Trang, South Viet Nam. Scientific Results of Marine Investigations of the South China Sea and the Gulf of Thailand 1959–1961. *Naga Report* 4 (3): 35–279.
- Gopal A., Jaleel A., Parameswaran U.V & Vijayan A.K. 2016. *Armandia sampadae*, a new species of polychaete (Opheliidae) from Andaman Sea, Northern Indian Ocean. *Journal of the Marine Biological Association of the United Kingdom* 96 (8): 1625–1632. <https://doi.org/10.1017/S002531541500199X>
- Grube A.E. 1869. Familie der Opheliaceen. *Schlesische gesellschaft für vaterlandische kultur Breslau Jahresbericht* 46: 59–68. Available from <https://www.biodiversitylibrary.org/page/46562371> [accessed 24 Mar. 2023].
- Gunton L.M., Kupriyanova E.K., Alvestad T., Avery L., Blake J.A., Biriukova O., Böggemann M., Borisova P., Budaeva N., Burghardt I., Capa M., Georgieva M.N., Glasby C.J., Hsueh P.-W., Hutchings P., Jimi N., Kongsrud J.A., Langeneck J., Meissner K., Murray A., Nikolic M., Paxton A., Ramos D., Schulze A., Sobczyk R., Watson C., Wiklund H., Wilson R.S., Zhadan A. & Zhang J. 2021. Annelids of the eastern Australian abyss collected by 2017 RV ‘Investigator’ voyage. *ZooKeys* 1020: 1–198. <https://doi.org/10.3897/zookeys.1020.57921>
- Hansen G.A. 1879. Annelider fra den norske Nordhavsexpedition i 1876. *Nyt Magazin for Naturvidenskaberne, Christiania* 24 (1): 1–17. Available from <https://www.biodiversitylibrary.org/page/9491620> [accessed 24 Mar. 2023].
- Hartman O. 1959. Catalogue of the polychaetous annelids of the world. *Allan Hancock Foundation, Occasional Papers* 23: 1–628.
- Hartman O. 1974. Polychaetous annelids of the Indian Ocean including an account of species collected by members of the International Indian Ocean Expeditions, 1963–1964 and a catalogue and bibliography of the species from India. Part II. *Journal of Marine Biological Association of India* 16 (2): 609–644.
- Hartmann-Schröder G. & Parker S.A. 1995. Four new species of the family Opheliidae (Polychaeta) from Southern Australia. *Records of the South Australian Museum* 28: 1–12.
- Horst R. 1919. New species of the genus *Ammotrypane* Rathke. *Zoologische Mededelingen* 5: 22–24.
- Kinberg J.G.H. 1866. Annulata Nova. Continuatio. [various errantia & sedentaria]. *Öfversigt af Konglich Vetenskaps-akademiens Förhandlingar* 22 (4): 239–258. Available from <https://biodiversitylibrary.org/page/32339515> [accessed 24 Mar. 2023].
- Kongsrud J.A., Bakken T. & Oug E. 2011. Deep-water species of the genus *Ophelina* (Annelida, Opheliidae) in the Nordic Seas, with the description of *Ophelina brattegardii* sp. nov. *Italian Journal of Zoology* 78 (Suppl. 1): 95–111. <https://doi.org/10.1080/11250003.2011.606658>
- Kükenthal W. 1887. Die Opheliaceen der Expedition de “Vettore Pisani”. *Jenaische Zeitschrift für Naturwissenschaft* 1887 (21): 361–373.
- Magalhães W.F., Rizzo A.E. & Bailey-Brock J.H. 2019. Opheliidae (Annelida: Polychaeta) from the western Pacific islands, including five new species. *Zootaxa* 4555 (2): 209–235. <https://doi.org/10.11646/zootaxa.4555.2.3>
- Mohammad M.-B.M. 1971. Intertidal polychaetes from Kuwait, Arabian Gulf, with descriptions of three new species. *Journal of Zoology* 163: 285–303. <https://doi.org/10.1111/j.1469-7998.1971.tb04536.x>
- Mohammad M.-B.M. 1980. Polychaete annelids from Kuwaitian islands, Arabian Gulf, with descriptions of four new species. *Zoological Journal of the Linnean Society* 69 (1): 31–42. <https://doi.org/10.1111/j.1096-3642.1980.tb01931.x>

- Moreira J. & Parapar J. 2017. New data on the Opheliidae (Annelida) from Lizard Island (Great Barrier Reef, Australia): five new species of the genus *Armandia* Filippi, 1861. *Zootaxa* 4290 (3): 483–502. <https://doi.org/10.11646/zootaxa.4290.3.4>
- Nazeer Z., Khan S.A., Manikandan K., Manokaran S., Hsu H.H., Joydas T. & Lyly P.S. 2021. Macrofaunal assemblage in the intertidal area of Saudi Arabian Gulf Coast. *Regional Studies in Marine Science* 47: 101954. <https://doi.org/10.1016/j.rsma.2021.101954>
- Neave M.J. & Glasby C.J. 2013. New species of *Ophelina* (Annelida: Opheliidae: Ophelininae) from northern Australia. *Organisms Diversity & Evolution* 13 (2): 331–347. <https://doi.org/10.1007/s13127-013-0130-x>
- Örsted A.S. 1843. *Annulatorum danicorum conspectus. Auctore A.S. Örsted. Fasc. I. Maricolæ. (Quæstio ab universitate Hafniensi ad solvendum proposita et proemio ornata)*. Sumtibus Librariæ Wahlianae, København [= Hafniæ].
- Parapar J. 2012. Familia Opheliidae. In: Parapar J., Alós C., Núñez J., Moreira J., López E., Aguirrezabalaga F., Besteiro C. & Martínez A. *Annelida Polychaeta III. In: Ramos M.A. et al. (eds) Fauna Ibérica Vol. 36: 284–332*. Museo Nacional de Ciencias Naturales (CSIC), Madrid.
- Parapar J. & Moreira J. 2008. Sobre la presencia del género *Ophelina* Örsted, 1843 (Polychaeta, Opheliidae) en el litoral de la península Ibérica. *Nova Acta Científica Compostelana (Biología)* 17: 117–134.
- Parapar J. & Moreira J. 2015. Six new species of the genus *Armandia* Filippi, 1861 (Polychaeta, Opheliidae) from Lizard Island (Great Barrier Reef, Australia). *Zootaxa* 4019 (1): 577–603. <https://doi.org/10.11646/zootaxa.4019.1.19>
- Parapar J., Moreira J. & Helgason G.V. 2011. Distribution and diversity of the Opheliidae (Annelida, Polychaeta) on the continental shelf and slope of Iceland, with a review of the genus *Ophelina* in northeast Atlantic waters and description of two new species. *Organisms Diversity & Evolution* 11 (2): 83–105. <https://doi.org/10.1007/s13127-011-0046-2>
- Parapar J., Al-Khandari M., Candás M. & Moreira J. 2021a. A new species of *Polyophthalmus* (Annelida, Opheliidae) from the Arabian Gulf, with an insight on internal anatomy and diversity of the genus. *Zootaxa* 5052 (4): 501–528. <https://doi.org/10.11646/zootaxa.5052.4.3>
- Parapar J., Martínez A. & Moreira J. 2021b. On the systematics and biodiversity of the Opheliidae and Scalibregmatidae. *Diversity* 13 (2): 87. <https://doi.org/10.3390/d13020087>
- Paul C., Halanych K.M., Tiedemann R. & Bleidorn C. 2010. Molecules reject an opheliid affinity for *Travisia* (Annelida). *Systematics and Biodiversity* 8 (4): 507–512. <https://doi.org/10.1080/14772000.2010.517810>
- Phasuk B. 1992. Preliminary report on the polychaetes from the Fifth Thai-Danish Expedition along the Andaman Sea coast of Thailand. *Phuket Marine Biological Center Research Bulletin* 57: 77–87.
- Pillai G. 1961. Annelida Polychaeta of Tambalagam Lake, Ceylon. *Ceylon Journal of Science (Biological Sciences)* 4 (1): 23–39.
- Rathke H. 1843. Beiträge zur fauna Norwegens. *Nova Acta Academiae Caesareae Leopoldino-Carolinae Naturae Curiosorum* 20: 1–264. <https://doi.org/10.5962/bhl.title.11613>
- Read G. & Fauchald K. (eds) 2022. World Polychaeta Database. *Ophelina acuminata* Örsted, 1843. Available from <https://www.marinespecies.org/aphia.php?p=taxdetails&id=130500> [10 Sep. 2022].
- Rullier F. 1965. Contribution à la faune des annélides polychètes de l’Australie. *University of Queensland Papers, Department of Zoology* 2 (9): 163–201.

- Støp-Bowitz C. 1945. Les Ophéliens Norvégiens. *Meddelelser fra Zoologiske Museum* 52: 21–61.
- Takahashi K. 1938. On a new species of polychaetous annelid, *Armandia simodaensis*, sp. nov. *Zoological Magazine* 50: 152–154.
- Tampi P.R.S. 1958. The anatomy of *Armandia leptocirris* Grube (Polychaeta). *Journal of the Zoological Society of India* 10 (1): 15–32.
- Ushakov P.V. 1955. *Polychaeta of the Far Eastern Seas of the U.S.S.R.* Zoological Institute, Academy of Sciences of the U.S.S.R.
- Wesenberg-Lund E. 1949. Polychaetes of the Iranian Gulf. *Danish Scientific Investigations in Iran* 4: 247–400.
- Wiklund H., Neal L., Glover A.G., Drennan R., Rabone M. & Dahlgren T.G. 2019. Abyssal fauna of polymetallic nodule exploration areas, eastern Clarion-Clipperton Zone, central Pacific Ocean: Annelida: Capitellidae, Opheliidae, Scalibregmatidae, and Traviidae. *ZooKeys* 883: 1–82.  
<https://doi.org/10.3897/zookeys.883.36193>
- Willey A. 1905. Report on the Polychaeta collected by Professor Herdman, at Ceylon, in 1902. *Report to the Government of Ceylon on the Pearl Oyster Fisheries of the Gulf of Manaar, with Supplementary Reports upon the Marine Biology of Ceylon, by other Naturalists. Part IV. Supplementary Reports* 30: 243–324. Available from <https://www.biodiversitylibrary.org/page/1936112> [accessed 24 Mar. 2023].

*Manuscript received: 7 January 2023*

*Manuscript accepted: 15 March 2023*

*Published on: 5 May 2023*

*Topic editor: Tony Robillard*

*Section editor: Magalie Castelin*

*Desk editor: Pepe Fernández*

Printed versions of all papers are also deposited in the libraries of the institutes that are members of the *EJT* consortium: Muséum national d’histoire naturelle, Paris, France; Meise Botanic Garden, Belgium; Royal Museum for Central Africa, Tervuren, Belgium; Royal Belgian Institute of Natural Sciences, Brussels, Belgium; Natural History Museum of Denmark, Copenhagen, Denmark; Naturalis Biodiversity Center, Leiden, the Netherlands; Museo Nacional de Ciencias Naturales-CSIC, Madrid, Spain; Leibniz Institute for the Analysis of Biodiversity Change, Bonn – Hamburg, Germany; National Museum of the Czech Republic, Prague, Czech Republic.