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Onuphid polychaetes associated with the *Cymodocea nodosa* meadows of La Gomera (Canary Islands, NW Africa) – new species and new records from the eastern North Atlantic

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This study recognizes six species of onuphid polychaetes associated with the Cymodocea nodosa *meadows of the Canary Islands. Of these, three species of the genus* Aponuphis, A. bilineata, A. brementi *and* A. ornata *have been previously reported from the eastern North Atlantic, whilst* A. willsiei *was only known from the western Mediterranean Sea. We describe two new species:* Onuphis erici *sp. nov. and* Kinbergonuphis sanmartini *sp. nov., of which the latter represents the first discovery of the genus* Kinbergonuphis *in the eastern North Atlantic Ocean. Furthermore, we present brief notes on their ontogeny and ecology and remarks on the presence and microstructure of lateral organs observed in one of the new species.*

Keywords: polychaetes, Eunicida, *Kinbergonuphis*, *Onuphis*, biodiversity, ontogenetic changes, seagrass, lateral organ

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INTRODUCTION

Cymodocea nodosa (Ucria) Ascherson is a species of seagrass of the family Cymodoceaceae growing in meadows on the seabed, sometimes associated with other seagrasses. *Cymodocea nodosa* meadows are widely distributed in the Mediterranean Sea and the adjoining subtropical eastern North Atlantic, bounded on the north by southern Iberia and on the south by the Tropic of Cancer, being especially abundant in the Macaronesian archipelagos of Madeira and the Canary Islands (Brito, 1999). *Cymodocea nodosa*, commonly known as little Neptune grass, is a pioneer species that is capable of forming grasslands in the absence of other seagrasses, beginning a chain of ecological succession that finally leads to a more biodiverse steady-state ecosystem. In the Mediterranean Sea, the little Neptune grass occurs on sandy and sandy-muddy bottoms to 20 m deep; however, in the Canary Islands the species can reach greater depths of 35–40 m (Brito, 1999; Brito *et al.*, 2005). *Cymodocea nodosa* shows a preference for protected bays, springs, lagoons and the vicinities of the river mouths (Den Hartog, 1977).

The polychaete fauna associated with *C. nodosa* meadows is very diverse and abundant (Giangrande & Gambi, 1986). Early studies on the polychaetes of the *C. nodosa* meadows from the Canary Islands demonstrated that the seagrass meadow breaks the hydrodynamism, allowing the settlement of fine sediment particles that retain high quantities of organic matter. This fact accounts for the high species diversity and richness of nematodes and polychaetes (Brito, 1999). Similar results were also obtained in the Mediterranean Sea (Giangrande & Gambi, 1986).

Polychaetes are considered as excellent descriptors of the faunal communities associated with seagrasses (Hutchings, 1982). Previous studies on polychaetes associated with *C. nodosa* meadows from the Canary Islands have shown that the best represented families, in terms of abundance, are Spionidae, Syllidae and Onuphidae (Herrando-Pérez *et al.*, 2001).

Members of the family Onuphidae are mostly tube-building polychaetes considered as ecosystem engineers, since they stabilize the sediment with their tubes and thus increase the structural complexity and biodiversity of their habitat (Bailey-Brock, 1984). Furthermore, several species of the genera *Onuphis* Audouin & Milne-Edwards, 1833 and *Aponuphis* Kucheruk, 1978 were reported among the most dominant polychaete species in infralittoral sandy bottoms in the Mediterranean Sea and subtropical eastern Atlantic (Giangrande & Gambi, 1986; Herrando-Pérez *et al.*, 2001). This outlines the ecological importance of these species as relevant contributors of macrofaunal species assemblages in infralittoral soft bottom communities.

Despite the wide distribution and great ecological importance of onuphid polychaetes, our knowledge of their diversity in many habitats, such as the seagrass beds, is still incomplete.

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Therefore, in order to get a better understanding of the actual diversity of the onuphid polychaetes in the eastern Atlantic seagrass meadows, we present a comprehensive study of the onuphid fauna associated with *Cymodocea nodosa* meadows of La Gomera island (Canary Islands, NW Africa). We also describe and illustrate two new species of *Onuphis* and *Kinbergonuphis* Fauchald, 1982a respectively, newly report *Aponuphis willsiei* Cantone & Bellan, 1996 from the eastern North Atlantic waters and remark on the presence and microstructure of lateral organs in one of the new species.

MATERIALS AND METHODS

The onuphid material was collected from off La Gomera island (28°06′00″N 17°08′00″W) in August 1995 by the environmental audit Tecnología Ambiental S.A. (INTECSA, 1997), which aimed to assess the possible environmental impact caused by future extractions of sediments for beach amelioration. The samples were collected at subtidal depths, from 22 to 39 m, using a 0.1 m^2 (bite size) Van Veen grab sampler (INTECSA, 1997). The specimens were anaesthetized in 7% $MgCl_2$, fixed in 10% neutral buffered formalin and later transferred to 70% ethanol.

Specimens were examined under both dissecting stereomicroscope and compound light microscope. Temporary glycerol slides of small specimens and parapodia were used for detailed examination of the chaetal distribution and the morphology of parapodia. Line drawings were made with the aid of a camera lucida and digital photography. Photomicrographs were taken with a Leica DFC310FX camera mounted on a Leica M205FA stereomicroscope.

Selected specimens were prepared for examination with scanning electron microscopy (SEM). All samples were dehydrated in an ascending series of graded ethanol. Thereafter, they were submersed in acetone, critical point dried using acetone as intermediate liquid, mounted on aluminium stubs, sputter coated with gold and imaged with a JEOL 6610 LV scanning electron microscope. Measurements and counts in the descriptions are of the holotype; the range for the paratypes is given in parentheses. Body width (without parapodia) is measured at the 10th chaetiger; general and prostomial appendages terminology follows Paxton (1986, 1998 respectively).

The specimens examined in this study are deposited in the Museo Nacional de Ciencias Naturales, Madrid (MNCN) and the Australian Museum, Sydney (AM).

RESULTS

SYSTEMATICS

Order EUNICIDA
Family ONUPHIDAE Kinberg, 1865
Subfamily ONUPHINAE Kinberg, 1865

Genus *Aponuphis* Kucheruk, 1978

Aponuphis bilineata (Baird, 1870)

Hyalinoecia bilineata Baird, 1870, p. 358
Aponuphis bilineata: Kucheruk, 1978, p. 91; Arias & Paxton, 2015, p. 358, figure 7A, B

MATERIAL EXAMINED

MNCN 16.01/17725 (1 specimen), off Punta Iguala, 28°02.877′N 17°18.674′W, SW La Gomera Island, Canary Islands, 25 m depth, Aug 1995; MNCN 16.01/17726 (1 specimen), off Punta Iguala, 28°03.410′N 17°19.030′W, SW La Gomera Island, Canary Islands, 15 m depth, Aug 1995; MNCN 16.01/17727 (1 specimen), off Baja del Callao, 28°12.687′N 17 19.154′W, SW La Gomera Island, Canary Islands, 39 m depth, Aug 1995; MNCN 16.01/17728 (2 specimens), off Valle Gran Rey, 28°05.146′N 17°20.740′W, SW La Gomera Island, Canary Islands, 40 m depth, Aug 1995.

DIAGNOSIS

Antennae usually to chaetiger 10–15, maximally to chaetiger 22; four to six ceratophoral rings on median antenna, seven to 11 on lateral antennae. Anterior five to six chaetigers with several bi- to tridentate pseudocompound hooks, chaetigers 6–7 with one hook only; slender long-appendaged hooks present. Ventral cirri subulate on first five chaetigers. Subacicular hooks from chaetiger 10. Branchiae from chaetiger 4–5. Species occurring as two colour morphs: Morph (1), peristomium completely pigmented or four separate spots, two longitudinal pigment stripes and two segmental lateral spots from chaetiger 1 to posterior region, stripes becoming discontinuous between chaetigers, forming two segmental spots as pigmentation decreases posteriorly, previously referred as typical. Morph (2), peristomium and first three to four chaetigers with two large brownish spots almost filling dorsal surface of segment, sometimes coalescing medially; from chaetiger 4–5 to median region with two longitudinal dorsal pigment stripes discoursing laterally close to parapodia. Maximum width without parapodia 1.5 mm.

REMARKS

Examined specimens were small juveniles with fading pigmentation of the typical colour pattern and ranged in width from 0.35 to 0.45 mm. Complete specimens were about 13 mm in length with 90 chaetigers. The studied material differed from larger specimens of the same species in having only five chaetigers with hooks (adults usually also with one hook present on chaetiger 6 and 7), a higher proportion of bidentate than tridentate pseudocompound hooks, and slender long-appendaged hooks restricted to chaetiger 1 (in adults they are present until chaetiger 3 or 4); subulate ventral cirri on first three to four chaetigers (instead of five as in adults) and branchiae started on chaetiger 5–6 (usually on 4–5 in adults).

DISTRIBUTION

Eastern North Atlantic, from Cornwall (UK) to West Africa, and the Mediterranean Sea.

Aponuphis brementi (Fauvel, 1916)

Hyalinoecia brementi Fauvel, 1916, p. 5, figures 2 & 3
Aponuphis brementi: Paxton, 1986 p. 4; Arias & Paxton, 2015, p. 360, figure 7C

MATERIAL EXAMINED

MNCN 16.01/17729 (1 specimen), off Valle del Gran Rey, 28°05.034′N 17°20.628′W, SW La Gomera Island, Canary Islands, 30 m depth, Aug 1995; MNCN 16.01/17730 (4 specimens), off Valle del Gran Rey, 28°05.467′N 17°20.637′W, SW La Gomera Island, Canary Islands, 14 m depth, Aug 1995;

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MNCN 16.01/17731 (1 specimen), off Valle del Gran Rey, 28°05.356′N 17°20.815′W, SW La Gomera Island, Canary Islands, 35 m depth, Aug 1995; MNCN 16.01/17732 (3 specimens), off Punta Iguala, 28°02.877′N 17°18.674′W, SW La Gomera Island, Canary Islands, 25 m depth, Aug 1995; MNCN 16.01/17733 (3 specimens), off Punta Iguala, 28°02.789′N 17°18.593′W, SW La Gomera Island, Canary Islands, 30 m depth, Aug 1995; MNCN 16.01/17734 (2 specimens), off Punta Iguala, 28°03.251′N 17°19.017′W, SW La Gomera Island, Canary Islands, 30 m depth, Aug 1995; MNCN 16.01/17735 (4 specimens), off Valle del Gran Rey, 28°05.466′N 17°20.713′W, SW La Gomera Island, Canary Islands, 15 m depth, Aug 1995.

DIAGNOSIS

Antennae usually to chaetiger 15–20; four to seven ceratophoral rings on median antenna, usually six to nine, maximally 11 on lateral antennae. Anterior four to six chaetigers with several tridentate pseudocompound hooks, chaetigers 5–8 with one hook only, rarely bidentate; slender long-appendaged hooks present. Ventral cirri subulate on first five to seven chaetigers. Subacicular hooks from chaetiger 12–15. Branchiae from chaetiger 1–2. Colour pattern consisting of two large dorsal spots on peristomium and chaetigers 1–4, and two segmental lateral spots from chaetiger 1. From chaetiger 5 central spots becoming progressively smaller and thinner, by chaetiger 10 represented only by thin band. Maximum width without parapodia 1.6 mm.

REMARKS

Examined specimens ranged in width from 0.30 to 0.60 mm. Complete specimens measured over 20 mm in length with 90 chaetigers. All specimens fit faithfully with the diagnosis of the species. Most of them still presented a well preserved colour pattern, varying from bright red to dark reddish. Some specimens were collected within their tubes that were parchment-like and externally covered with some gravel and coarse sand grains.

DISTRIBUTION

Eastern North Atlantic, from the Bay of Biscay to West Africa, and the Mediterranean Sea.

Aponuphis ornata (Fauvel, 1928) (Figure 1F)

Hyalinoecia bilineata ornata Fauvel, 1928, p. 12

Aponuphis ornata: Paxton, 1986, p. 54; Arias & Paxton, 2015, figures 7D–H, 8 & 9

Onuphis eremita: Herrando-Pérez *et al.*, 2001, p. 280 (only in list) in part. Not Audouin & Milne-Edwards, 1833

MATERIAL EXAMINED

AM W.49128 (1 specimen), off Valle del Gran Rey, 28°05.359′N 17°20.600′W, SW La Gomera Island, Canary Islands, 25 m depth, Aug 1995; MNCN 16.01/17736 (1 specimen), off Valle del Gran Rey, 28°05.359′N 17°20.600′W, SW La Gomera Island, Canary Islands, 25 m depth, Aug 1995; MNCN 16.01/17737 (4 specimens), off Valle del Gran Rey, 28°05.359′N 17°20.600′W, SW La Gomera Island, Canary Islands, 25 m depth, Aug 1995; MNCN 16.01/17738 (1 specimen), off Punta Iguala, 28°03.251′N 17°19.017′W, SW La Gomera Island, Canary Islands, 30 m depth, Aug 1995; MNCN 16.01/17739 (2 specimens), off Punta Iguala, 28°02.877′N 17°18.674′W, SW La Gomera Island, Canary Islands, 25 m depth, Aug 1995; MNCN 16.01/17740 (1 specimen), off Valle del Gran Rey, 28°05.466′N 17°20.713′W, SW La Gomera Island, Canary Islands, 15 m depth, Aug 1995; MNCN 16.01/17741 (2 specimens), off Punta Iguala, 28°02.789′N 17°18.593′W, SW La Gomera Island, Canary Islands, 30 m depth, Aug 1995.

DIAGNOSIS

Antennae usually to chaetiger 10, maximally to 16; four to six ceratophoral rings on median antenna, usually seven to 11 on lateral antennae. Anterior three to five chaetigers with several tridentate pseudocompound hooks (rarely tri- and quadridentate), chaetigers 4–6 with one hook only; slender long-appendaged hooks present. Ventral cirri subulate on first five chaetigers. Subacicular hooks from chaetiger 10. Branchiae from chaetiger 3–4. Colour pattern consisting of orange to brown transverse bands and spots varying along body region. Peristomium with two large dorsal spots, sometimes coalescing medially; first chaetigers with two wide bands separated medially (one close to anterior end of segment and other close to posterior edge), presenting four bars; following chaetigers with one solid band anteriorly and two bars posteriorly, bars and bands ranging from relatively narrow to wide; two segmental lateral spots from chaetiger 1 to posterior region; sometimes posterior bands displayed medially on segment, appearing as more or less quadrangular spots. Other specimens with more complicated pattern as consequence of fusion of anterior and posterior segmental bars (Figure 1F). More posteriorly, anterior and posterior bars (or posterior quadrangular spots) getting closer and merging into single wide transversal band per segment. Maximum width without parapodia 1.4 mm.

REMARKS

Some of the examined specimens have a striking colour pattern, appearing as solidly brown coloured as a consequence of the fusion of the anterior and posterior segmental bars together with the lateral spots (Figure 1F). These solidly coloured specimens occurred in the same stations as specimens with the typical colour pattern and others with an intermediate pattern between the two, evidencing a high colour polymorphism within the population. Several specimens were collected brooding vermiform juveniles inside their tubes. This fact was also observed by previous examiners of the samples (i.e. Herrando-Pérez *et al.*, 2001). However these authors misidentified the brooding specimens as *Onuphis eremita*, and consequently stated that *O. eremita* was a brooder species with direct development (Herrando-Pérez *et al.*, 2001). Nevertheless, at present we know that *O. eremita* is a broadcast spawner that undergoes indirect development (Arias & Paxton, 2014) and the brooding onuphid reported by Herrando-Pérez *et al.* (2001) is actually *A. ornata*, a confirmed brooding species with direct development (Arias & Paxton, 2015).

DISTRIBUTION

Eastern North Atlantic, from the Bay of Biscay to West Africa, and the Mediterranean Sea.

Aponuphis willsiei Cantone & Bellan, 1996

Aponuphis willsiei Cantone & Bellan, 1996, p. 27; Arias & Paxton, 2015, p. 363, figure 10

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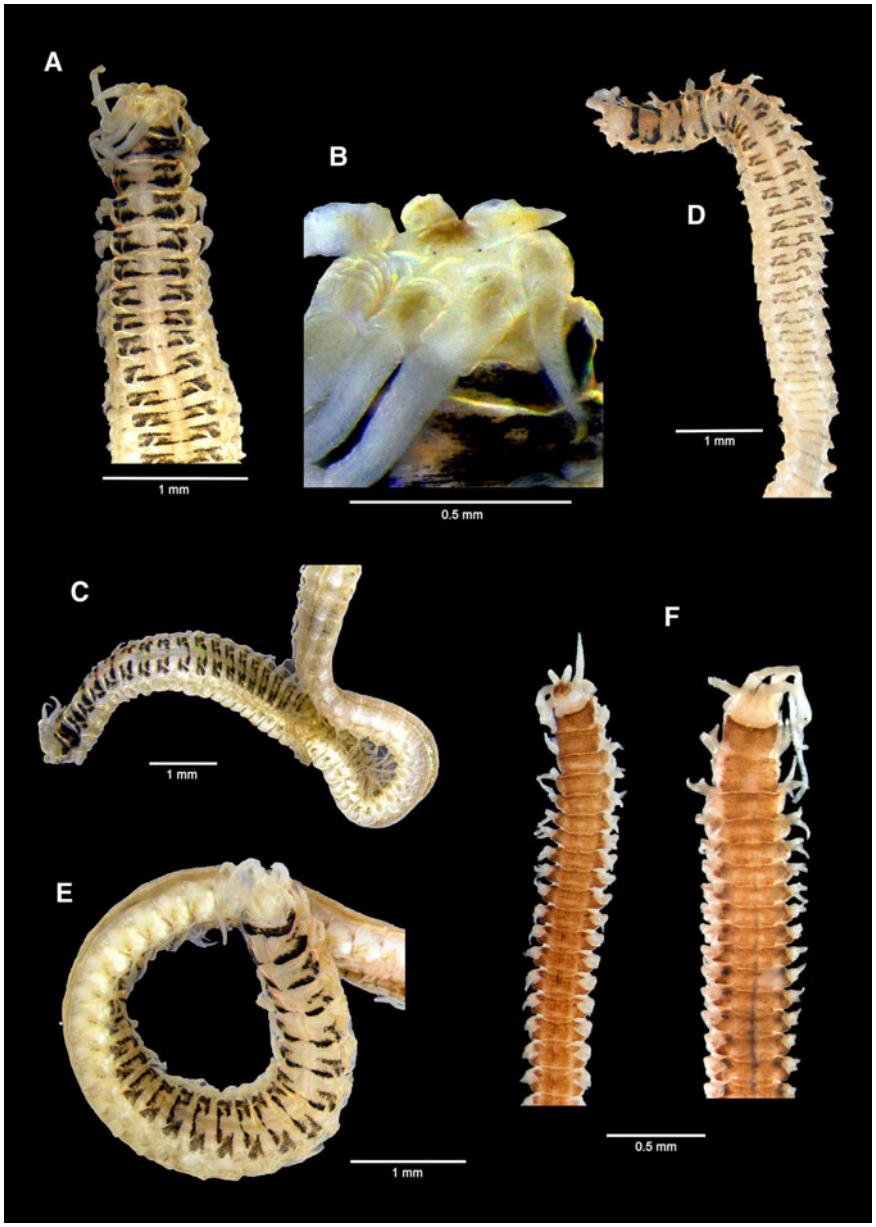

Fig. 1. *Kinbergonuphis sanmartini* sp. nov. A–C holotype (MNCN 16.01/17744), D, E paratypes (AM W.49129; MNCN 16.01/17745); *Aponuphis ornata* (F). Photomicrographs. (A) anterior end, dorsal view; (B) detailed view of prostomium; (C) anterior end, lateral view; (D, E) dorso-lateral view of the two paratypes; (F) anterior dorsal view of two fully coloured specimens.

MATERIAL EXAMINED

MNCN 16.01/17742 (2 specimens), off Punta Iguala, 28°03.397′N 17°18.865′W, SW La Gomera Island, Canary Islands, 11 m depth, Aug 1995; MNCN 16.01/17743 (2 specimens), off Punta Iguala, 28°02.907′N 17°18.827′W, SW La Gomera Island, Canary Islands, 30 m depth, Aug 1995.

DIAGNOSIS

Antennae up to chaetiger 10; three to six ceratophoral rings on antennae. Anterior four chaetigers with four to five usually bidentate pseudocompound to compound hooks, chaetiger 5 with two to three hooks; all hooks of almost equal thickness, slender long-appendaged hooks absent. Ventral cirri subulate on first four chaetigers. Subacicular hooks from chaetiger 9–10. Branchiae absent. No colour pattern. Maximum width without parapodia 1.0 mm.

REMARKS

This is the first record of this species from the eastern North Atlantic Ocean, representing its southernmost known distribution to date. Examined specimens were incomplete, ranging in width from 0.30 to 0.45 mm and appeared whitish and highly iridescent. In general, the examined specimens agree very well with the original description and the specimens reported from the western Mediterranean by Arias & Paxton (2015), except for a chaetal detail. The pseudocompound hooks of the anterior modified parapodia were reported as bidentate, while in the Canarian specimens

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some tridentate pseudocompound hooks were present together with the bidentate hooks on the anterior five chaetigers.

DISTRIBUTION

This species is only known from the Gulf of Marseille (the type locality), SW Iberian Peninsula (Murcia, Spain), the Alborán Sea and the Canary Islands (subtropical NE Atlantic).

Genus *Kinbergonuphis* Fauchald, 1982a

Kinbergonuphis sanmartini sp. nov.

(Figures 1A–E; 2; 3)

Onuphis eremita: Herrando-Pérez *et al.*, 2001, p. 280 (only in list) in part. Not Audouin & Milne-Edwards, 1833

TYPE MATERIAL

Holotype: MNCN 16.01/17744, off Valle Gran Rey, 28°05.31′N 17°20.46′W, SW La Gomera Island, Canary Islands, 26.1 m depth, Aug 1995.

Paratypes: MNCN 16.01/17745 (1 specimen), same data as holotype; AM W.49129 (1 specimen), same data as holotype.

TYPE LOCALITY

Off Valle Gran Rey, 28°05.31′N 17°20.46′W, 26.1 m depth, SW La Gomera Island, Canary Islands, NW Africa, eastern North Atlantic.

DIAGNOSIS

Conspicuous dark brown to black dorsal transverse pigment patches on anterior segments, fading gradually in median region. Two pairs of small eyespots on prostomium; antennae and palps with 3–5 ceratophoral rings. First five chaetigers with tridentate pseudocompound hooks; slender and thin long-appendaged hooks present; large median hook from chaetiger 3–7. Ventral cirri subulate in first six chaetigers; distinct subulate postchaetal lobes in first 11–13 chaetigers. Subacicular hooks from chaetiger 14–15. Single pectinate chaetae with 9–11 teeth from chaetiger 1. Single branchiae from chaetiger 6, reaching maximal number of four filaments in median chaetigers.

DESCRIPTION

Holotype incomplete, consisting of 88 chaetigers, 21.5 mm long and 0.7 mm wide (at chaetiger 10, excluding parapodia). Paratypes incomplete with 39 chaetigers, 9.0 mm in length, 0.7 mm in width and 41 chaetigers, 10 mm in length, 0.6 mm in width, respectively.

Anterior end of body nearly cylindrical, becoming broader and slightly depressed between chaetigers 8–10. Ethanol stored specimens preserving conspicuous colour pattern (Figure 1A–E): light brown pigment forming large, circular spots on ceratophores, anterior end of prostomium and bases of frontal lips (Figure 1B); dark brown to black band on peristomium; anterior chaetigers with two pairs of dorso-lateral dark rectangular patches (Figure 1A, B), second pair of patches coalescing medially into a parallel band after about chaetiger 10 (Figure 1C–E). Colour pattern fading gradually in median region (Figure 1D). Prostomium anteriorly rounded and weakly incised with frontal and upper lips stout and oval, latter without median section. Palps reaching chaetiger 1, lateral antennae reaching chaetiger 4–5, median antenna reaching chaetiger 4–5; antennae and palps with gradually tapering styles and ringed ceratophores with 3–4 (2–4) basal rings plus a long distal ring. Two pairs of small eyespots: one pair between bases of palp and lateral antenna and another pair at anterior end of prostomium (Figure 1B). Nuchal grooves straight with small middorsal separation laterally curving towards eyespots. Peristomium half as long as first chaetiger. Peristomial cirri slender, slightly longer than peristomium, inserted distally on peristomium slightly lateral to lateral antennae.

Anterior chaetigers (1–5) subequal in length, longer than those following (Figure 1A). First five pairs of parapodia modified, not enlarged, directed slightly anterolaterally, with prechaetal fold, subtriangular prechaetal lobe and long subulate postchaetal lobe (Figures 2A & 3C). Prechaetal lobe becoming low by chaetiger 10, postchaetal lobe becoming successively shorter by chaetiger 11–13, reduced to small knob by chaetiger 15. Ventral cirri subulate on anterior six chaetigers (Figure 2B), followed by transitory form on chaetiger 7 and replaced by round glandular pads from chaetiger 8. Ventral glandular pads with irregular cuticular pore pattern. Dorsal cirri of modified parapodia longer than postchaetal lobes (Figure 2A). Branchiae first present from chaetiger 6 as single filament (Figure 2B), branching from chaetiger 10 and reaching maximal number of four filaments in median chaetigers.

Aciculae yellowish with tapering distal ends, generally three per parapodium. Tridentate pseudocompound hooks with falcate hoods and pointed tips present in first five chaetigers (Figure 3A, B, F). First two chaetigers with following chaetal complement going from superior to inferior part of chaetal fan: one or two slender limbate chaetae, one distally oblique pectinate chaeta with 9–11 teeth; one to two slender long-appendaged hooks, one median robust short-appendaged hook, two to three more slender hooks (Figure 3A, B). From chaetiger 3 appendage of median robust hook transformed to typical large median hook although still pseudocompound (Figure 2C). From chaetiger 5 two to three ventral limbate chaetae. Slender pseudocompound hooks replaced by ventral limbates by chaetiger 6 (Figure 3D). Median large hook simple from chaetiger 6 and persisting until chaetiger 7 (Figures 2D & 3E). Bidentate subacicular hooded hooks from chaetiger 14–15 (Figure 3H). Single pectinate chaeta from first chaetiger to end of fragments (Figure 3G).

Mandibles small in relation to maxillae (Figure 2E, F), with white calcified cutting plates (Figure 2F) and slender shafts. Maxillae (Figure 2E) weakly sclerotized; maxillary formula (based on paratype): Mx I = 1 + 1; Mx II = 8 + 8; Mx III = 6 + 0; Mx IV = 7 + 9; Mx V = 1 + 1. Mx VI absent. Tube cylindrical in shape, parchment-like and externally covered with sand-grains.

ETYMOLOGY

It is a great pleasure to dedicate this new species to Dr Guillermo San Martín, polychaete authority and a long-time colleague.

REMARKS

Kinbergonuphis sanmartini sp. nov. belongs to a group of seven species (Table 1) previously treated by Fauchald (1982b), where they were regarded as members of the genus *Onuphis*.These species are characterized by having tridentate pseudocompound hooks on the anterior five to eight chaetigers, presenting large median hooks, multifilamentous branchiae from chaetigers 5 to 10 and subulate ventral cirri

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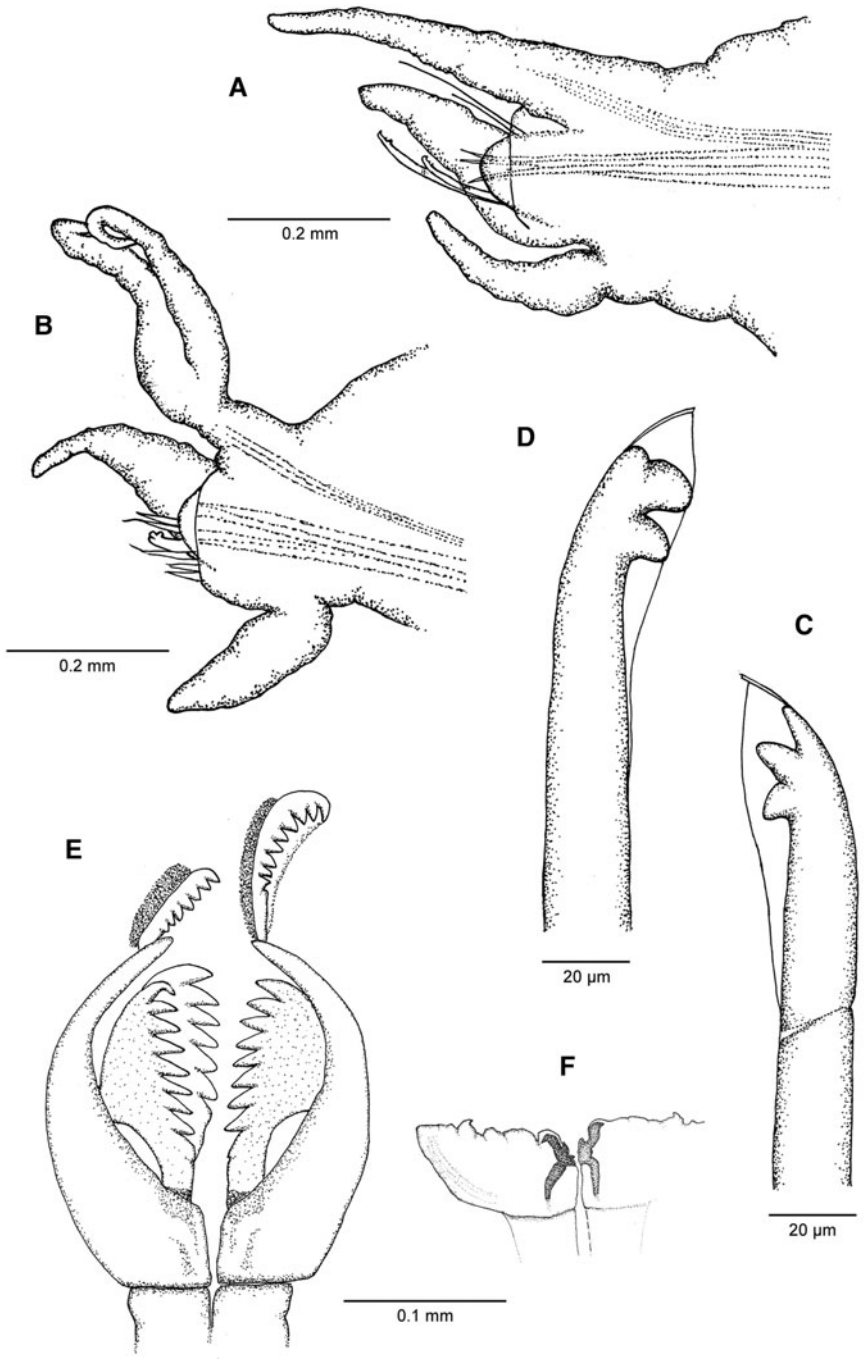

Fig. 2. *Kinbergonuphis sanmartini* sp. nov. (Paratype MNCN 16.01/17745). Line drawings. (A) parapodium 1, anterior view; (B) parapodium 6, anterior view; (C) pseudocompound large median hook from parapodium 4; (D) simple large median hook from parapodium 6; (E) maxillae; (F) mandibles.

on at least the first five chaetigers (Fauchald, 1982a). *Kinbergonuphis sanmartini* sp. nov. resembles *K. pulchra* and *K. virgata* by the early origin of the pectinate chaetae (starting from chaetiger 1–3), while in the remaining species of this group they do not appear until the median chaetigers. However, the new species can be distinguished from the latter two species by presenting simple large hooks only until chaetiger 7 while in the other two species they occur until chaetiger 15–21. Other interspecific differences among the members of this group of seven species are detailed in Table 1.

DISTRIBUTION AND ECOLOGY

Kinbergonuphis sanmartini sp. nov. is known from the shallow (22–40 m depth) soft bottoms of La Gomera Island (Canary Islands) associated with meadows of *C. nodosa*.

Genus *Onuphis* Audouin & Milne-Edwards, 1833

Onuphis erici sp. nov.

(Figures 4–6)

Onuphis eremita: Herrando-Pérez *et al.*, 2001, p. 280 (only in list) in part. Not Audouin & Milne-Edwards, 1833

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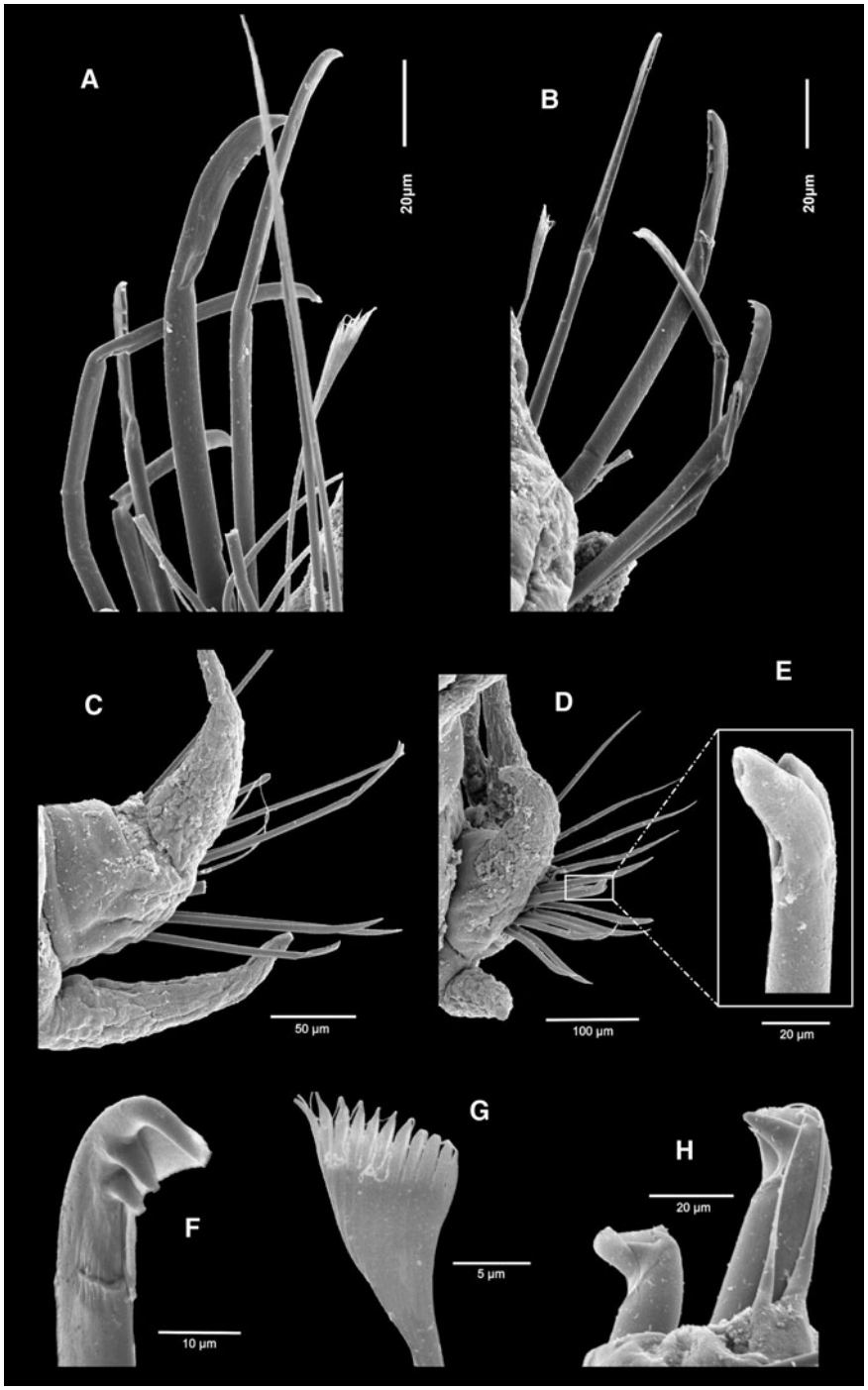

Fig. 3. *Kinbergonuphis sanmartini* sp. nov. (Paratype MNCN 16.01/17745). Scanning electron micrographs. (A) chaetal complement from parapodium 1; (B) same from parapodium 2; (C) parapodium 1, posterior view; (D) parapodium 6, posterior view; (E) simple large median hook from parapodium 6 (dentition obscured by hoods); (F) tridentate pseudocompound hook from chaetiger 1; (G) pectinate chaeta from chaetiger 1; (H) subacicular hooks from chaetiger 15.

TYPE MATERIAL

Holotype: MNCN 16.01/17746, off Punta Iguala, 28°03.251′N 17°19.017′W, SW La Gomera Island, Canary Islands, 30 m depth, Aug 1995.

Paratypes: AM W.49130 (1 specimen), off Punta Iguala, 28°03.251′N 17°19.017′W, SW La Gomera Island, Canary Islands, 30 m depth, Aug 1995; MNCN 16.01/17747 (1 specimen), off Valle del Gran Rey, 28 05.356 N 17 20.815 W, SW La Gomera Island, Canary Islands, 35 m depth, Aug 1995.

NON TYPE MATERIAL

MNCN 16.01/17748 (1 juvenile specimen), off Punta Iguala, 28°03.251′N 17°19.017′W, SW La Gomera Island, Canary Islands, 30 m depth, Aug 1995; MNCN 16.01/17749 (3 large juvenile specimens coated with gold for SEM studies), off Valle del Gran Rey, 28 05.356 N 17 20.815 W, SW La Gomera Island, Canary Islands, 35 m depth, Aug 1995; MNCN 16.01/17750 (2 juvenile specimens), off Valle del Gran Rey, 28°05.466′N 17°20.713′W, SW La Gomera Island,

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Table 1. Comparison of key features and habitats of selected species of *Kinbergonuphis*. PCHs pseudocompound hooks, SAHs subacicular hooks, VC ventral cirri.

Feature	*K. difficilis*	*K. fragilis*	*K. orensanzi*	*K. pulchra*	*K. sanmartini* sp. nov.	*K. simoni*	*K. vermillionensis*	*K. virgata*
Colour pattern	Absent	?Absent	Absent	Present	Present	Present	Present	Present
No. of chaetigers with PCHs	5	7	4	6	5	5	8	7
Slender long-appendaged PCHs	?Absent	?	?Absent	Absent	Present	?	?	?
Presence of large median hook (chaetiger no.)	3–8	4–12	3–6	4–(15–19)	3–7	4–16	4–10	4–(21–22)
No. of chaetigers with subulate VC	8	7	5	9	6	6–8	9	11–13
Branchiae from chaetiger	6	6	6	6	6	6–9	7	5–7
Maximal number of branchial filaments	6	2	3	4	4	7–8	4	5
Origin of SAHs (chaetiger no.)	18	25	12–13	16–20	14–15	17	12	22–23
Origin of pectinate chaeta (chaetiger no.)	Median chaetigers	?	Median chaetigers	2	1	Median chaetigers	Median chaetigers	3
Number of pectinate chaetae per parapodium	Two	?	Two	?Two	Single	Single	?Two	?Two
Habitat	39 m	55–73 m	83–130 m	Intertidal	26 m	Intertidal	129 m	Intertidal
Geographic area	Uruguay, SW Atlantic	Río de la Plata, SW Atlantic	Uruguay, SW Atlantic	Gulf of Mexico, W Atlantic	Canary Islands, NE Atlantic	Gulf of Mexico, W Atlantic	Gulf of California, Pacific	Gulf of Mexico, W Atlantic
Reference	Fauchald (1982a)	Fauchald (1982a, b)	Fauchald (1982a)	Fauchald (1980, 1982a, b)	present study	Fauchald (1982a, b)	Fauchald (1968, 1982a, b)	Fauchald (1980, 1982a, b)

Canary Islands, 15 m depth, Aug 1995; MNCN 16.01/17751 (2 juvenile specimens), off Punta Iguala, 28°03.001′N 17°18.725′W, SW La Gomera Island, Canary Islands, 20 m depth, Aug 1995.

TYPE LOCALITY

Off Punta Iguala, 28°03.251′N 17°19.017′W, 30 m depth, SW La Gomera Island, Canary Islands, NW Africa, eastern North Atlantic.

DIAGNOSIS

Prostomium anteriorly extended with pair of subconical frontal lips inserted in frontolateral position. Two pairs of eyespots present. Lateral antennae reaching chaetiger 10–15 with 16–23 ceratophoral rings, markedly longer than median one. First five pairs of parapodia modified, directed slightly anterolaterally; tridentate pseudocompound hooks on chaetigers 1–3, bi- and tridentate on chaetigers 4–5; chaetiger 6 and 7 with only one or two bidentate PCHs. Slender and thin long-appendaged hooks absent. Hoods of pseudocompound hooks falcate with pointed tip. Subulate ventral cirri in first five chaetigers; distinct subulate postchaetal lobes in first 10–11 chaetigers. Subacicular hooks from chaetiger 10. Pectinate chaetae flat and slightly oblique with 7–8 teeth, single, present from chaetiger 10. Branchiae as single filament from first chaetiger.

DESCRIPTION

Small and slender species. All type specimens incomplete. Length of holotype 7 mm for 45 chaetigers, width 0.65 mm (at chaetiger 10, excluding parapodia); paratypes ranging from 5 to 12 mm in length (29–90 chaetigers) and from 0.50 to 0.60 mm in width. Anterior end of body nearly cylindrical, becoming broader and slightly depressed by chaetiger 5; thereafter flattened, with shorter segments. Body cream coloured in preserved condition, some specimens retaining colour pattern, consisting of light brown transverse dorsal bands on anterior segments and brownish spots on posterior base of parapodia through about chaetiger 20 (Figure 4B). Prostomium anteriorly extended with pair of subconical frontal lips inserted in frontolateral position (Figure 4A). Two pairs of eyespots present; one pair between bases of frontal lips and palps and another pair between palps and lateral antennae (Figure 4A). Palps reaching chaetiger 2–3 with 12–15 basal rings plus longer distal one on ceratophores. Lateral antennae reaching chaetiger 10–15 with 15–22 basal rings, median antenna reaching chaetiger 3–4 with 7–9 basal rings; all ceratophores with longer distal ring (Figure 5A). Styles of antennae and palps with irregularly scattered sensory buds (Figure 5B). Nuchal grooves straight with narrow middorsal separation (Figure 5C). Peristomial cirri inserted distally on peristomium below lateral antennae, longer than peristomium, reaching middle of prostomium (Figure 5A, C).

First five chaetigers slightly longer than those following (Figure 5A). First five pairs of parapodia modified, not enlarged, directed slightly anterolaterally, with low prechaetal fold, distally subulate prechaetal lobe and spindle-shaped postchaetal lobe, longer than parapodium; digitate dorsal cirrus longer than postchaetal lobe, latter longer than ventral cirrus (Figure 4C, D). Subulate ventral cirri in first five chaetigers, followed by transitional form on chaetiger 6 and pad-like thereafter (Figure 5A, D). Ventral glandular

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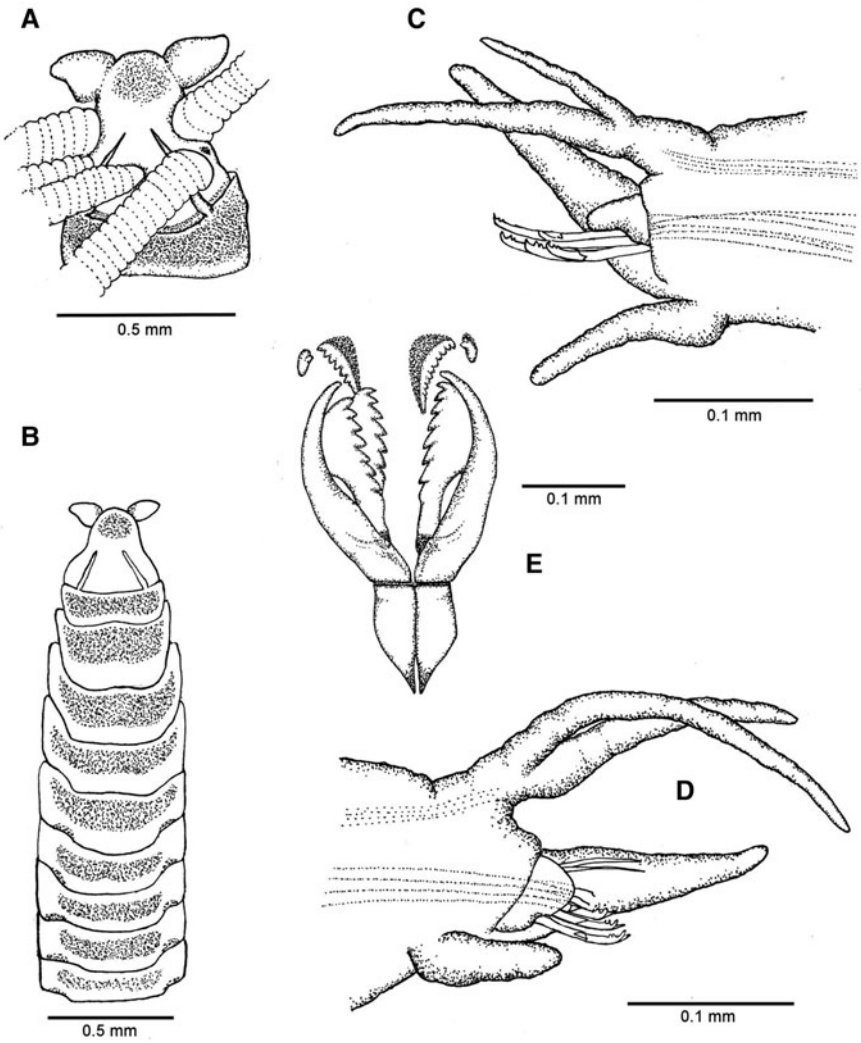

Fig. 4. *Onuphis erici* sp. nov. (Paratype MNCN 16.01/17747). Line drawings. (A) detailed view of prostomium, dorsal view; (B) anterior end, dorsal view showing colour pattern (palps and antennae, parapodia and chaetae omitted); (C) parapodium 1, anterior view; (D) parapodium 5, anterior view; (E) maxillae.

pads with irregular cuticular pore pattern. Distinct subulate postchaetal lobes in first 10–11 chaetigers, becoming smaller and conical in shape thereafter. Interramal papilla at base of dorsal cirrus absent. Ciliated sensory organ (lateral organ – see Discussion) emerging laterally at ventral base of dorsal cirrus from chaetiger 1 to end of body; round in shape with a diameter of about 15 μm (Figure 5E, F).

Branchiae as single filament, strap-like from first chaetiger (Figure 4C) to end of fragments. First four to five pairs of branchiae shorter and slenderer than dorsal cirrus (Figure 4C) becoming slightly longer and wider than dorsal cirrus thereafter (Figure 4D).

Aciculae yellowish with pointed tips, usually three per parapodium. Pseudocompound bi- and tridentate hooks with falcate hoods with pointed tips in first seven chaetigers. In first three chaetigers only tridentate hooks with large space between first and second tooth, third tooth much smaller and close to median tooth (Figure 6A); chaetal complement of parapodia 1–3 going from superior to inferior part of chaetal fan as follows: one to two simple chaetae (capillary), three protruding distal tips of aciculae and five to six pseudocompound hooks (Figure 6C), with median hook slightly more robust and with shorter appendage. From chaetigers 4 to 7 tridentate pseudocompound hooks occurring together with bidentate hooks (Figure 6B). Sixth and seventh parapodia with only one to two bidentate pseudocompound hooks and four to five limbate chaetae (Figure 6D). Slender and thin long-appendaged hooks absent. All pseudocompound hooks replaced by limbate chaetae from chaetiger 8. Hooded bidentate subacicular hooks from chaetiger 10 (Figure 6E, G), in first four to five pairs barely emerging to outside (Figure 6E). Pectinate chaetae flat and slightly oblique with 7–8 teeth, single, present from chaetiger 10 (Figure 6F, G). Mandibles translucent with weakly calcified cutting plates and slender shafts. Maxillae (Figure 4E) weakly sclerotized; maxillary formula: Mx I = 1 + 1, Mx II = 7 + 7, Mx III = 7 + 0, Mx IV = 7 + 10, Mx V = 1 + 1, Mx VI absent.

ONTOGENETIC VARIATION

Specimens less than 0.45 mm in width at the 10th chaetiger differed from larger specimens in having a late origin of the single branchiae; smaller number of subulate ventral cirri (from chaetigers 3 to 4) and hooks only present in the first

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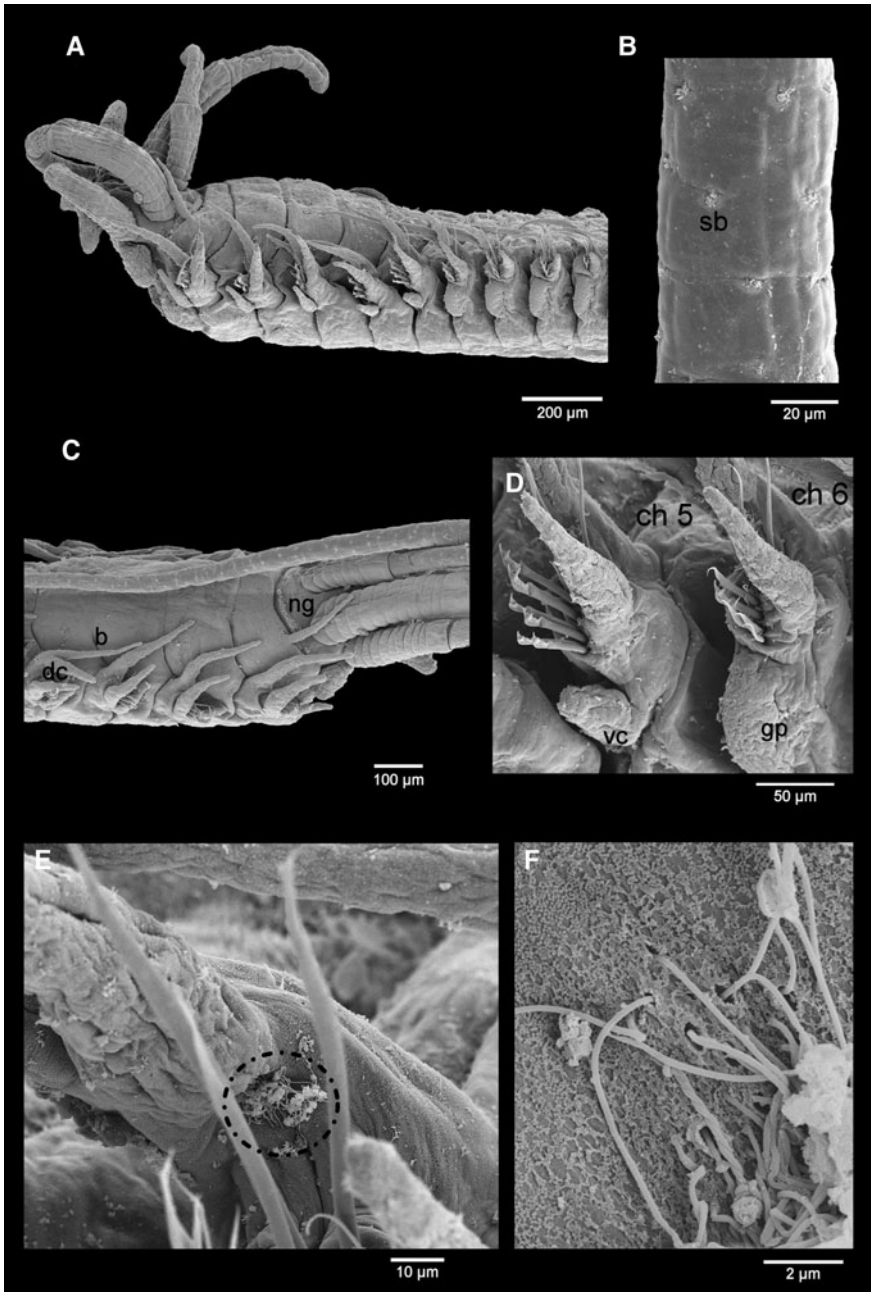

Fig. 5. *Onuphis erici* sp. nov. Scanning electron micrographs. (A) anterior end, lateral view; (B) detailed view of antenna, showing sensory buds; (C) anterior end, lateral view of a juvenile of 0.3 mm in width; (D) parapodia 5 and 6, posterior view; (E) overall view of sense organ (dotted circle) of anterior chaetiger; (F) detailed view of sense organ of anterior chaetiger. b, branchia; ch 5, chaetiger 5; ch 6, chaetiger 6; gp, glandular pad; ng, nuchal groove; sb, sensory bud; vc, ventral cirrus.

five chaetigers with a higher proportion of bidentate hooks than tridentate ones. As to the branchial development, in the smallest examined specimen (0.20 mm wide) the branchiae started on chaetiger 5; specimens of 0.25–0.35 mm in width had branchiae first present from chaetigers 3 to 4; in specimens of 0.40 mm wide the single branchial filaments started on chaetiger 2. In view of these features observed in juveniles, we have restricted the diagnosis of the new species to specimens with a width of more than 0.45 mm at chaetiger 10.

ETYMOLOGY

The new species is named after Eric Núñez, the son of the second author (JN).

REMARKS

The holotype presented a few chaetigers with two branchial filaments irregularly distributed in the middle region of the body. These abnormalities commonly occur in onuphids as a result of minor alterations in the regeneration process of damaged parapodia.

Onuphis erici sp. nov. is characterized by having single strap-like branchiae from chaetiger 1, shared with 10 other known *Onuphis* species (see Arias & Paxton, 2015: Table 1). Remarkably *O. erici* sp. nov. differs from nine of these species by having seven chaetigers with pseudocompound hooks. This peculiar feature is only shared with one species of the complex, i.e. the Japanese *O. shirikishinaiensis*

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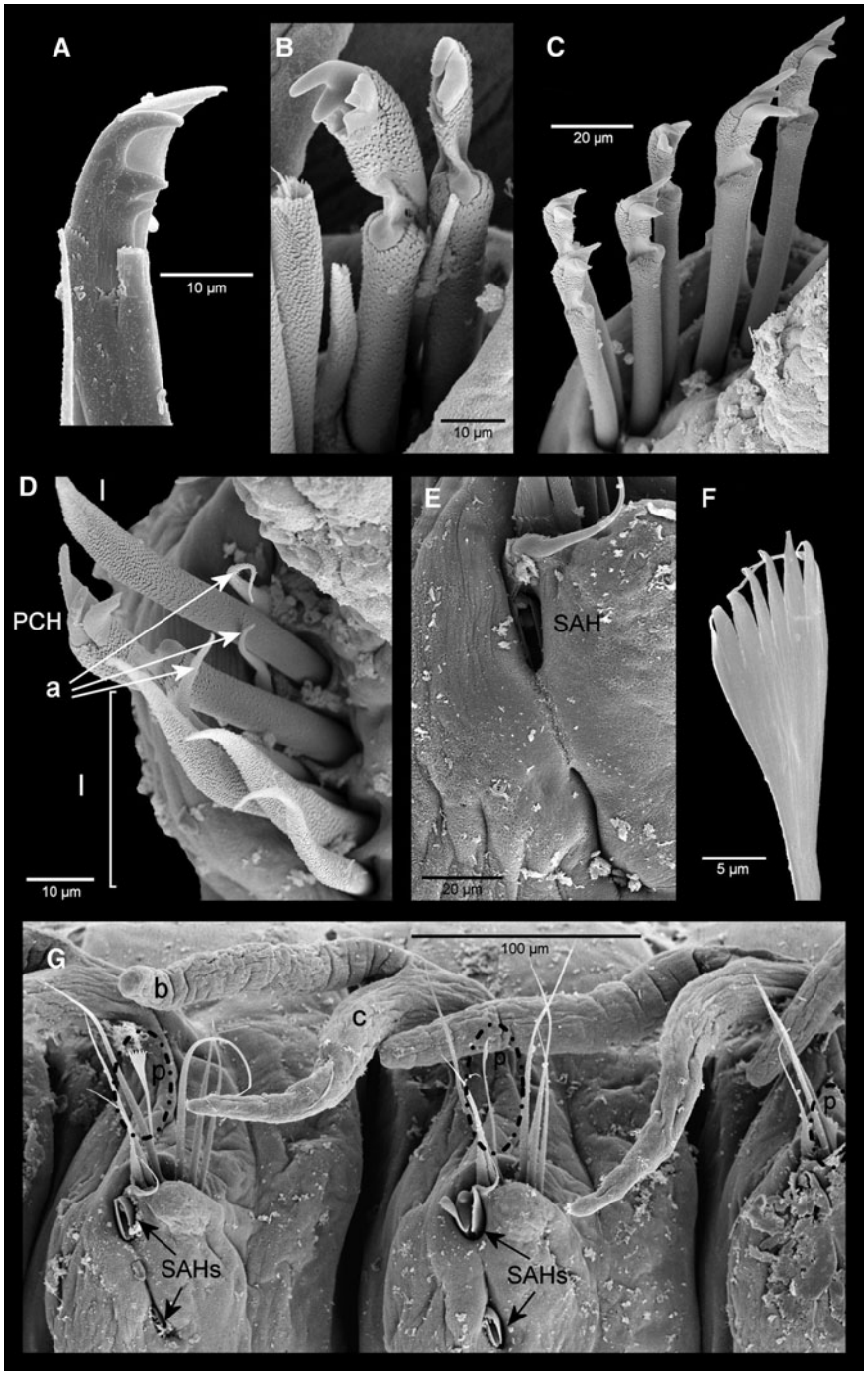

Fig. 6. *Onuphis erici* sp. nov. Scanning electron micrographs. (A) detailed view of a tridentate pseudocompound hook from parapodium 1; (B) pseudocompound hooks from parapodium 4; (C) overall view of pseudocompound hooks from parapodium 5; (D) chaetal complement from parapodium 6; (E) subacicular hook from parapodium 10; (F) pectinate chaeta from parapodium 10; (G) median chaetigers, lateral view. a, acicula; b, branchia; c, dorsal cirrus; l, limbate chaeta; p, pectinate chaeta (dotted circle); PCH, pseudocompound hook; SAH, subacicular hook.

(Imajima, 1960). However, both species can be easily distinguished by: (i) the origin of the subacicular hooks, from chaetiger 10 in *O. erici* sp. nov. and from chaetigers 11–13 in *O. shirikishinaiensis*; (ii) slender long-appendaged PCHs absent in *O. erici* sp. nov. and present in the latter; (iii) the number of subulate ventral cirri, 5 in *O. erici* sp. nov. and 6–8 in *O. shirikishinaiensis* and (iv) the number of chaetigers with subulate postchaetal lobe, 10–11 in *O. erici* sp. nov. and 16 in the Japanese species.

DISTRIBUTION AND ECOLOGY

Onuphis erici sp. nov. is known from the shallow (15–35 m depth) soft bottoms of La Gomera Island (Canary Islands) associated with meadows of *C. nodosa*.

DISCUSSION

The distribution and type of hooks of anterior modified chaetigers changes during the ontogeny of onuphids (Paxton,

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1986) and the progression of hooks is species specific (Paxton, 1996). In the genera *Onuphis* and *Aponuphis*, the presence and/or a greater proportion of bidentate than tridentate hooks on anterior chaetigers have been considered as a juvenile character (Arias & Paxton, 2014, 2015; Arias, 2016). A higher percentage of bidentate PCHs was observed in juveniles of *A. bilineata* and *O. erici* sp. nov., however both species retain some bidentate PCHs in their adult stage, mainly in the last three to four modified chaetigers.

In *O. erici* sp. nov. the chaetiger of the first appearance of the single branchiae is subject to growth-related variation. In adults the first branchiae appear on chaetiger 1, however in small juveniles the branchiae start on chaetiger 5 and from here they spread more posteriorly and also anteriorly, passing through intermediate forms with branchiae starting on chaetiger 4, 3 and 2.When the worm reaches at least 0.45 mm in width the branchiae start on chaetiger 1, which is here considered the adult condition of the species. A similar pattern of the progression of branchiae was observed in *O. elegans* and *O. hanneloreae* and several species of European *Aponuphis*, on which the first branchiae appear on chaetigers 6 to 9 in the smallest juveniles and from there they spread more posteriorly and anteriorly, reaching the adult stage of branchiae appearing on chaetiger 1 when the worm has attained at least two-thirds of its maximum length (Blake, 1975; Arias & Paxton, 2015; Arias, 2016 respectively).

Hayashi & Yamane (1994, 1997) described the presence of a sensorial organ with a presumed chemoreceptive function in polychaetes of the order Eunicida that they referred to as a 'dorsal cirrus organ'. The organ is located at the base of the ventral side of the dorsal cirrus and has been considered most likely as homologous to the 'lateral sense organ' by Purschke (2005). Further studies demonstrated that although there is a structural difference of the sensory cell types of so-called sedentary families, the Eunicida is the only known group of errant polychaetes possessing lateral organs (Purschke & Hausen, 2007). As far as onuphids are concerned, the organs have been previously reported only in *Kinbergonuphis fragilis* (Kinberg, 1865) and *Mooreonuphis stigmatis* (Tradwell, 1922) by Hayashi & Yamane (1994) and Budaeva & Fauchald (2010) respectively, making *Onuphis erici* sp. nov. the third onuphid species where their presence has been confirmed.

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