

Taxonomic and morphometric analyses of the *Haplosyllis spongicola* complex (Polychaeta: Syllidae: Syllinae) from Spanish seas, with re-description of the type species and descriptions of two new species

PATRICIA LATTIG¹, GUILLERMO SAN MARTÍN¹ and DANIEL MARTÍN²

¹Departamento de Biología (Zoología), Laboratorio de Biología Marina e invertebrados, Facultad de Ciencias, Universidad Autónoma de Madrid, calle Darwin 2, 28049 Canto Blanco, Madrid, Spain.

E-mail: guillermo.sanmartin@uam.es; patricia.lattig@uam.es

²Centre d'Estudis Avançats de Blanes (CSIC), Carrer d'accés a la Cala Sant Francesc 14, 17300 Blanes (Girona), Catalunya, Spain.

SUMMARY: This is the first contribution to a worldwide taxonomic revision of the closely related genera *Haplosyllis* (the main goal is to describe species within the *Haplosyllis spongicola* complex) and *Geminosyllis*. The type species, *Haplosyllis spongicola*, is re-described based on the syntypes and other material collected from Spanish seas. A combined taxonomic and morphometric (i.e. PCA and discriminant analysis) approach was used to study species of the *Haplosyllis spongicola* complex from Spanish seas. Two of them are described here as new: *Haplosyllis carmenbritoa* n. sp. from the Canary Islands, and *Geminosyllis granulosa* n. sp. from Iberian and western Mediterranean waters, and which is attributed to *Geminosyllis* due to the presence of a pharyngeal trepan. The third species, which also belongs to *Geminosyllis*, is morphologically very close to, and morphometrically indistinguishable from, *H. spongicola*, except for the presence of the trepan. This casts serious doubts on the relevance of this structure for separating the two genera and thus prevents us from describing this last species as new.

Keywords: species complex, *Haplosyllis spongicola*, *Geminosyllis*, Iberian and western Mediterranean, morphometric analyses.

RESUMEN: ANÁLISIS TAXONÓMICO Y MORFOMÉTRICO DEL COMPLEJO *HAPLOSYLLIS SPONGICOLA* (POLYCHAETA: SYLLIDAE: SYLLINAE) DE LOS MARES DE ESPAÑA, CON LA RE-DESCRIPCIÓN DE LA ESPECIE TIPO Y LA DESCRIPCIÓN DE DOS NUEVAS ESPECIES. – Esta es la primera contribución de la revisión taxonómica a nivel mundial de las especies relacionadas del género *Haplosyllis* (cuyo objetivo principal es describir especies del complejo *Haplosyllis spongicola*) y *Geminosyllis*. La especie tipo, *Haplosyllis spongicola*, es redescrita, con base a los sintipos y material adicional colectado en los mares de España. Se utilizó, un estudio taxonómico en conjunto con un análisis morfométrico (i.e. PCA y análisis discriminante) para estudiar las especies del complejo *Haplosyllis spongicola* de los mares de España. Dos de ellas se describen como nuevas especies: *Haplosyllis carmenbritoa* n. sp. de las Islas Canarias y *Geminosyllis granulosa* n. sp. de aguas Ibéricas y el Mediterráneo Occidental, atribuida a *Geminosyllis* por la presencia de un trépano en la faringe. La tercera especie, también se atribuye a *Geminosyllis*, es morfológicamente muy cercana y morfométricamente indistinguible de *H. spongicola*, excepto por la presencia de trépano. Esto genera serias dudas sobre la relevancia de esta estructura utilizada para separar los dos géneros y, por ello, nos previene describir a esta última especie como nueva.

Palabras clave: complejo de especies, *Haplosyllis spongicola*, *Geminosyllis*, Mediterráneo Ibérico y Occidental, análisis morfométrico.

INTRODUCTION

Haplosyllis spongicola (Polychaeta: Syllidae: Syllinae) was described from specimens collected in

the Adriatic Sea by Grube (1855). Since then, the species has been widely reported in temperate, tropical and subtropical seas (Martin *et al.*, 2003). It is commonly known as a sponge symbiont (Martin and

Britayev, 1998; López *et al.*, 2001), although it has also been reported on many different hard substrates. Despite being a frequent component of faunistic lists and papers on descriptive benthic ecology, very little is known about its ecology and behaviour (but see Martin and Britayev, 1998 and López *et al.*, 2001). Moreover, a recent study on inter-population variability (Martin *et al.*, 2003) casts serious doubts on the accuracy of identifications of *H. spongicola* for populations associated with more than 40 currently known host sponges all around the world (López *et al.*, 2001).

According to the literature, the specimens of *Haplosyllis spongicola* seem to have a high morphological variability, and several authors described varieties, subspecies, or even similar species, mainly based on differences in cirrus length and chaetal shape. For instance, *H. spongicola* var. *tentaculata* was characterized by the presence of long (20-30 articles) cirri (Marion, 1879), like the *H. spongicola* of Fauvel (1923), whose drawings (Fig. 95 a-d) corresponded to *H. hamata* (Claparede, 1868) from Naples, a species with short cirri which Fauvel (1923) synonymized to *H. spongicola*. These kinds of mistakes have generated confusion in identifying the species, which have often been repeated throughout the literature. As a consequence, *H. spongicola* is commonly reported as a short-cirri species. In turn, Rioja (1941) described another species with short cirri from Acapulco, México, *H. spongicola brevicirra*, and Cognetti (1955, 1957, 1961) described two subspecies, *Syllis (Haplosyllis) spongicola spongicola*, with short cirri, and *S. (H.) spongicola tentaculata*, with long cirri, both from the Mediterranean. The same subspecies were later reported by Imajima (1966) from Japanese waters.

Nowadays, there is strong evidence that marine species with worldwide distributions represent species complexes (Hilbish, 1996), which are sometimes very difficult to distinguish on the basis of morphological characters. However, recent studies have demonstrated that, once distinguished, appropriate morphological characters allow some of these cosmopolitan species to be subdivided into many valid species. In turn, their geographical ranges of distribution usually became narrow and, in the case of symbionts, their associations tend to demonstrate a high degree of specificity. The *Harmothoe lunulata* complex, for instance, was separated into 21 species belonging to three genera in addition to *Harmothoe* (i.e., *Malmgreniella*, *Paragattiana* and *Wilsoniella*) by Pettibone (1993).

More recently, the *Owenia fusiformis* complex has generated many papers describing new species all around the world including California (Blake, 2000), the Yellow Sea (Koh and Bhaud, 2001), the North Atlantic (Koh and Bhaud, 2003; Koh *et al.*, 2003), Australia (Ford and Hutchings, 2005), and the Persian Gulf (Martin *et al.*, 2006).

Haplosyllis spongicola was also regarded as a cosmopolitan species (San Martín, 2003). Nevertheless, the different populations reported around the world under the species name *H. spongicola* actually consist of a complex of cryptic species, which show enough taxonomically robust differences to be formally described as different species (Martin *et al.*, 2003). Recently, some papers have already described new species of *Haplosyllis*, which are closer to the “*spongicola*” complex but different enough to prevent confusions caused by the imprecise description of the type species and the posterior intricate network of synonymies. For instance, *Haplosyllis lobo* Paola, San Martín and Martin, 2006 from Argentina (Paola *et al.*, 2006) and *Haplosyllis crassicirrata* Aguado, San Martín and Nishi, 2006 from Japan (Aguado *et al.*, 2006). However, the present paper can be considered as the first contribution to a worldwide taxonomic revision of the genus *Haplosyllis*. The type species of *H. spongicola* is re-described here based on type material and newly collected Iberian specimens. This creates a solid formal basis that will allow further work on the species complex. As a consequence, two new species, one *Haplosyllis* and one *Geminosyllis*, are also described from Spanish seas (Atlantic, Cantabric Sea, western Mediterranean and Canary Islands). A second species of *Geminosyllis* is recognized but not described as new because its distinction from *H. spongicola* remains doubtful. Combined with classical, taxonomically robust morphological observations, a morphometric approach is used to identify the characters to distinguish species within the *H. spongicola* complex.

MATERIAL AND METHODS

The syntypes of *Haplosyllis spongicola* were examined from a loan of the Museum Przyrodnicze Uniwersitetu Wroclawskiego. The samples of the populations of the Spanish Atlantic and Cantabric Seas and from the Balearic Columbretes and Alborán Islands were collected during the “Fauna Ibérica” I, II,

III and IV cruises, and examined as a loan from the Museo Nacional de Ciencias Naturales of Madrid (MNCN). Samples from Nerja were collected by the staff of the Zoology Department at Malaga University (San Martín and Aguirre, 1991). Samples from Almería and Cape of Palos (Murcia) belong to the personal collections of G. San Martín and were collected from rhizomes of *Posidonia oceanica* (San Martín and Viéitez, 1984; San Martín *et al.*, 1990). Specimens from the Cape of Creus were collected by C. Alós from calcareous concretions (Alós, 1988; 1989) and those from the Canary Islands were collected by J. Núñez from coralline substrates associated with *Dendrophyllia ramea* (Núñez, 1990). The specimens from Blanes and Cadaqués belong to the personal collection of D. Martín.

Scanning electron microscope images were taken at the “Servicio Interdepartamental de Investigación” (SIDI) of the “Universidad Autónoma de Madrid” (UAM) and at the “Servei de Microscopia Electrònica” of the “Institut de Ciències del Mar” of Barcelona (ICM, CSIC).

Morphometric analyses were based on 40 different measures of the body, appendages and proventricle, together with six chaetal measurements based on Martín *et al.*, (2003) (Table 4). Measurements were standardized by dividing by the individual's body length. Measurements of 16, 34 and 13 specimens respectively of *Haplosyllis spongicola*, *Geminosyllis granulosa* sp. nov and *Geminosyllis* sp. 1 (depending on the available material) were included in the analyses. *Haplosyllis carmenbritoa* n. sp. was not considered because of the low number of specimens.

The morphometric analyses were carried out using STATISTICA 6.0 (Stat Soft, Inc) for Windows. The relationships between the three species under study were assessed based on 40 morphometric measurements using a Principal Component Analysis (PCA). The morphometric distinction between the three species was assessed by means of a discriminant analysis using a forward stepwise method; for the characters that most significantly contributed to this discrimination, a standard statistic Wilks' lambda (ranging from 1, no discriminatory power, to 0, perfect discriminatory power) was used. The partial Wilks' lambda index was used to assess the individual contribution to the between-group discrimination for each character respectively. The graphical representation for the distinction between the three species was performed by a *canonical analysis*.

RESULTS

Key to the Spanish genera and species of Haplosyllis and Geminosyllis

- 1a. Pharynx with a large tooth and a crown of 10-12 soft papillae *Haplosyllis* (2)
- 1b. Pharynx with a large tooth, a trepan of 9-10 small teeth and a crown of 10-12 soft papillae *Geminosyllis* (5)
- 2a. All chaetae bidentate (3)
- 2b. Anterior and mid-body chaetae unidentate, or with a very small, hair-like distal tooth, becoming more hooked and clearly bidentate when posterior-most; associated with the gorgonian *Paramuricea clavata* in the Mediterranean *H. chamaeleon*
- 3a. Both teeth of same size, or almost similar . (4)
- 3b. Chaetae with teeth of different sizes, the distal one smaller, sometimes difficult to see, and very similar in shape all along the body; 3 to 5 chaetae per parapodium, the anterior- most markedly less hooked than the mid-body and posterior-most ones; associated with the gorgonian *Villogorgia bebrycoides* in the Canary Islands *H. villogorgicola*
- 4a. Long, thin, whip-shaped cirri. Mid-body and posterior chaetae with small spines on its upper side; robust body, variable in size *H. spongicola*
- 4b. Cirri with same width from base to tip. Upper side of mail fang with 4-6 long spines followed by a few smaller ones (visible under SEM); body small (> 2 mm in length) *H. carmenbritoa*
- 5a. Body surface granulate. Mid-body and posterior chaetae with relatively short main fang *G. granulosa*
- 5b. Body surface non-granulate. Mid-body and posterior chaetae with a very long main fang *G. sp 1.*

Family SYLLIDAE Grube, 1850
Subfamily SYLLINAE Grube, 1850
Genus *Haplosyllis* Langerhans, 1879

Diagnosis. Body cylindrical, reaching large size (from 0.5 mm to 6 cm in length). Prostomium with four eyes, sometimes with anterior ocular spots. Three long antennae. Palps robust, fused at bases.

Two pairs of tentacular cirri. Dorsal and ventral cirrus on each parapodium. Antennae, dorsal cirri and tentacular cirri distinctly moniliform, some species with posterior cirri smooth, sometimes indistinctly articulated or almost smooth in juveniles. Pharynx with one tooth surrounded by papillae. Trepan absent. Chaetae all simple, wide, present in small numbers (1-3) per parapodium. Capillary chaetae absent. Reproduction by stolons.

***Haplosyllis spongicola* (Grube, 1855)**
(Figs 1-2)

Syllis spongicola Grube, 1855: 104-105.

?*Syllis setubalensis* McIntosh 1885: 195-196 (pl. 30, Fig. 5; pl. 33, Fig. 6; pl. 15a Fig. 16-17)

Syllis spongicola tentaculata (Marion 1879): Marion (1879): p. 19 (Fig. 4, 4 a-c); Cognetti (1955): 1-3 (Fig. 1b); Cognetti (1957): 10-14 (Fig. 2b); Cognetti (1961): 294.

Haplosyllis spongicola: San Martín (1984): 318-322 (pl. 77 d, f) (in part); San Martín (2003): 323-325 (Fig. 179 a, c, d y 180) (in part); Campoy (1982): 363-365 (in part).

Non: *Haplosyllis spongicola*: Fauvel (1923): 257-258, (Fig. 95 a-d), in part; Imajima (1966): 220-221, Fig. 38 (a-h). San Martín (1984): 321 pl. 77 (b, c), in part; San Martín (2003): 324, Fig. 179B (in part).

Non: *Syllis spongicola spongicola* Cognetti 1955: Cognetti 1955: 1-3, Fig. 1a, Cognetti 1957: 10-14, Fig. 2a, Cognetti 1961: 294.

Material examined:

Syntypes: MPW 399, Lesina, Adriatic Sea.

Fauna Ibérica II, III y IV: Cantabric Sea: MNCN 16.01/10550 (8) (114-116 m deep); MNCN 16.01/10551 (3) (116-120 m deep); MNCN 16.01/10552 (22) (136-137 m deep); MNCN 16.01/10553 (3) (146 m deep).

Atlantic Sea: MNCN 16.01/10548 (2) (18 m deep); MNCN 16.01/10549 (1) (232-240 m deep); MNCN 16.01/10554 (1) (116-120 m deep); MNCN 16.01/10555 (1) (165-174 m deep); MNCN 16.01/10556 (12) (761-768 m deep); MNCN 16.01/10557 (152) (760-769 m deep); MNCN 16.01/10558 (4) (760-769 m deep).

Balearic Islands: MNCN 16.01/10559 (13) (72-74 m deep); MNCN 16.01/10560 (1) (76 m deep); MNCN 16.01/10561 (2) (55-60 m deep); MNCN 16.01/10652 (1) (3-6 m deep) (SEM); MNCN 16.01/10562 (1) (126-134 m deep); MNCN 16.01/10563 (3) (53-66 m deep); MNCN 16.01/10565 (1) (3-39 m deep); MNCN 16.01/10566 (3) (44 m deep).

Columbretes Islands: MNCN 16.01/10567 (11) (110-113 m deep); MNCN 16.01/10568 (8) (47 m deep); MNCN 16.01/10569 (1) (25-47 m deep); MNCN 16.01/10570 (1) (18 m deep); MNCN 16.01/10571 (1) (24 m deep); MNCN 16.01/10572 (3) (21 m deep); MNCN 16.01/10573 (10) (80-85 m deep); MNCN 16.01/10574 (1) (80-85 m deep); MNCN 16.01/10575 (2) (78-81 m deep); MNCN 16.01/10576 (2) (43 m deep).

Alborán Island: MNCN 16.01/10577 (2) (33-49 m deep); MNCN 16.01/10578 (1) (36 m deep); MNCN 16.01/10579 (3) (90-240 m deep); MNCN 16.01/10580 (2) (90-240 m deep); MNCN 16.01/10581 (2) (87-213 m deep); MNCN 16.01/10582 (2) (51-58 m deep).

Cape of Creus: (NE Spain): MNCN 16.01/10601 (2) (0.5-4 m deep, on *Mytilus* facies); MNCN 16.01/10604 (2) (3 m deep, on *Balanus perforatus*). On calcareous concretions: MNCN 16.01/10651 (1) (9 m) (SEM); MNCN 16.01/10603 (3) (12 m); MNCN 16.01/10602 (1) (16 m deep); MNCN 16.01/10605 (4) (27 m deep).

Additional material: MNCN: 16.01/2080 (1); /2081 (1); /2082 (1); /2083 (1); /2084 (1); /2085 (1); /2086 (2); /2087 (2); /2477 (2); /2513(3).

Description of syntypes. Three specimens all in bad condition. Cylindrical, broad body, thinner from

mid-body to posterior end, measuring 2.4 cm long (77 segments, complete specimen), 1.7 cm long (52 segments) and 2.5 cm long (53 segments), and from 2 to 1 mm wide in anterior and posterior ends respectively. Yellow in colour. Prostomium and palps not seen. Dorsal cirri whip-shaped, long through all body. All observed chaetae bidentate (posterior-most). Proventricle long, rectangular, extending through 10 to 12 chaetigers.

Description of Iberian individuals. Body cylindrical, broad (Fig. 2 A-B), abruptly thinner from mid-body to posterior end. Size variable, up to 6.5 cm long and 1.5 mm wide. Yellow (small specimens) to brownish (large specimens) in colour. Dark, thin, transverse bands sometimes present on anterior segments. Pair of lateral ciliated nuchal organs located between peristomium and prostomium, only visible under SEM (Fig. 2H). Prostomium pentagonal (Fig. 1A), with two pairs of small eyes arranged trapezoidally. Antennae long, progressively thinner from base to tip; median antenna inserted on middle of prostomium, longer than lateral ones, up to 0.8 mm for 40 articles. Lateral antennae inserted on anterior margin of prostomium, 0.26-0.80 mm long for 13-23 articles, up to 0.80 mm. Palps long, broadly triangular, fused at their bases, but clearly divergent all along their length (Fig. 1A, 2G); sensory organs as two ciliate bands on ventral side of each palp; lateral sensory organs absent (Fig. 2 C-D). Tentacular segment well defined, shorter than subsequent ones. Tentacular dorsal cirri longer than ventral ones, but shorter than dorsal cirri of first chaetiger, up to 1.10 mm long for 16 to 30 articles. Dorsal cirri whip-shaped, similar to antennae; first cirri longer than remaining ones, up to 1.40 mm for 24 to 40 articles. Second cirri smaller than subsequent ones, up to 0.52 mm long for 26 articles. Third, fourth and fifth cirri slightly longer (Table 1). Ventral cirri digitiform, shorter than parapodial lobes. Chaetae all bidentate (Fig. 1B, 1D, 1F, 2F, 2I), the anterior-most with a thin small main fang (Fig. 1B). Medium and posterior chaetae wider, with a longer, well-defined main fang (Fig. 1D, 1F, 2F, 2I). Small spines on upper side of main fang. Two chaetae per parapodia (occasionally 1 or 3), both with same morphology, but frequently of different sizes. Aciculae broad, either enlarged with a pointed tip (Fig. 1C), with a hooked tip directed upwards or with 90° bent, rounded tip (Fig. 1E, 1G), 1 to 6 per parapodia in anterior-most segments and only 1 in posterior-most

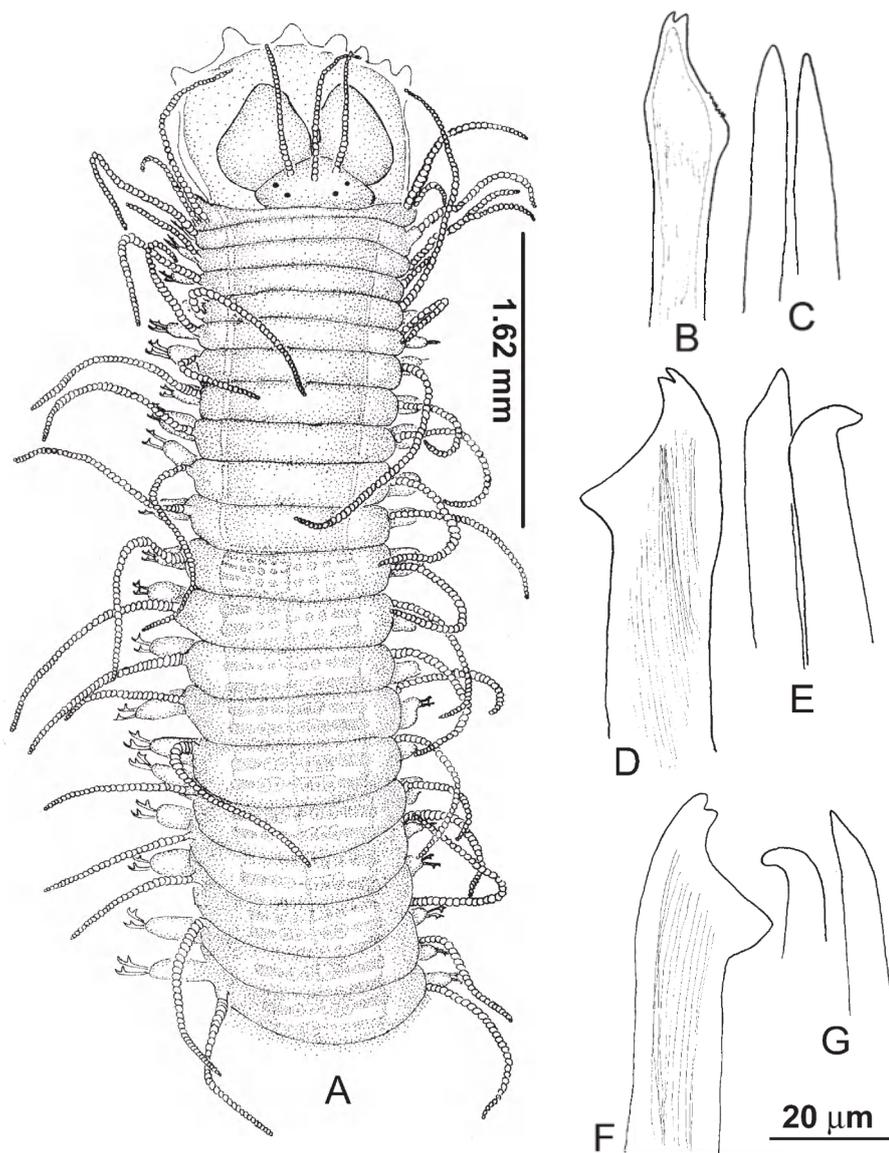


FIG. 1. – *Haplosyllis spongicola*. A, anterior dorsal view; B, D, F, anterior, medium and posterior chaetae respectively; C, E, G, anterior, medium and posterior aciculae respectively.

segments. Pharynx orange, similar in length to proventricle, with large tooth (Fig. 2C) surrounded by crown of soft papillae and an inner ring of short, numerous cilia (Fig. 2E). Proventricle long, rectangular, extending through 9 to 10 chaetigers (occasionally only 6 or reaching up to 13), with about 46 to 56 muscular cell-rows in the inner region. Pygidium with two long anal cirri, with 20 articles each. Annus surrounded by a ciliated region.

Reproduction. *Haplosyllis spongicola* reproduces by means of acephalous stolons with one pair of blackish ocular spots per parapodia. The presence

of ocular spots may be observed early during the formation of the stolon, with the reproductive segments still attached to the adult body. Stolons may have more than 30 segments, reaching up to 0.6 cm long (Martin *et al.* 2003).

Ecology. It is a common species from intertidal to circumlittoral and bathyal environments, and occurs both inside and outside all kinds of sponges and hard substrates. According to the present re-description and in comparison with the known data on other populations, mainly tropical, the species seems closer to a sponge specialized pred-

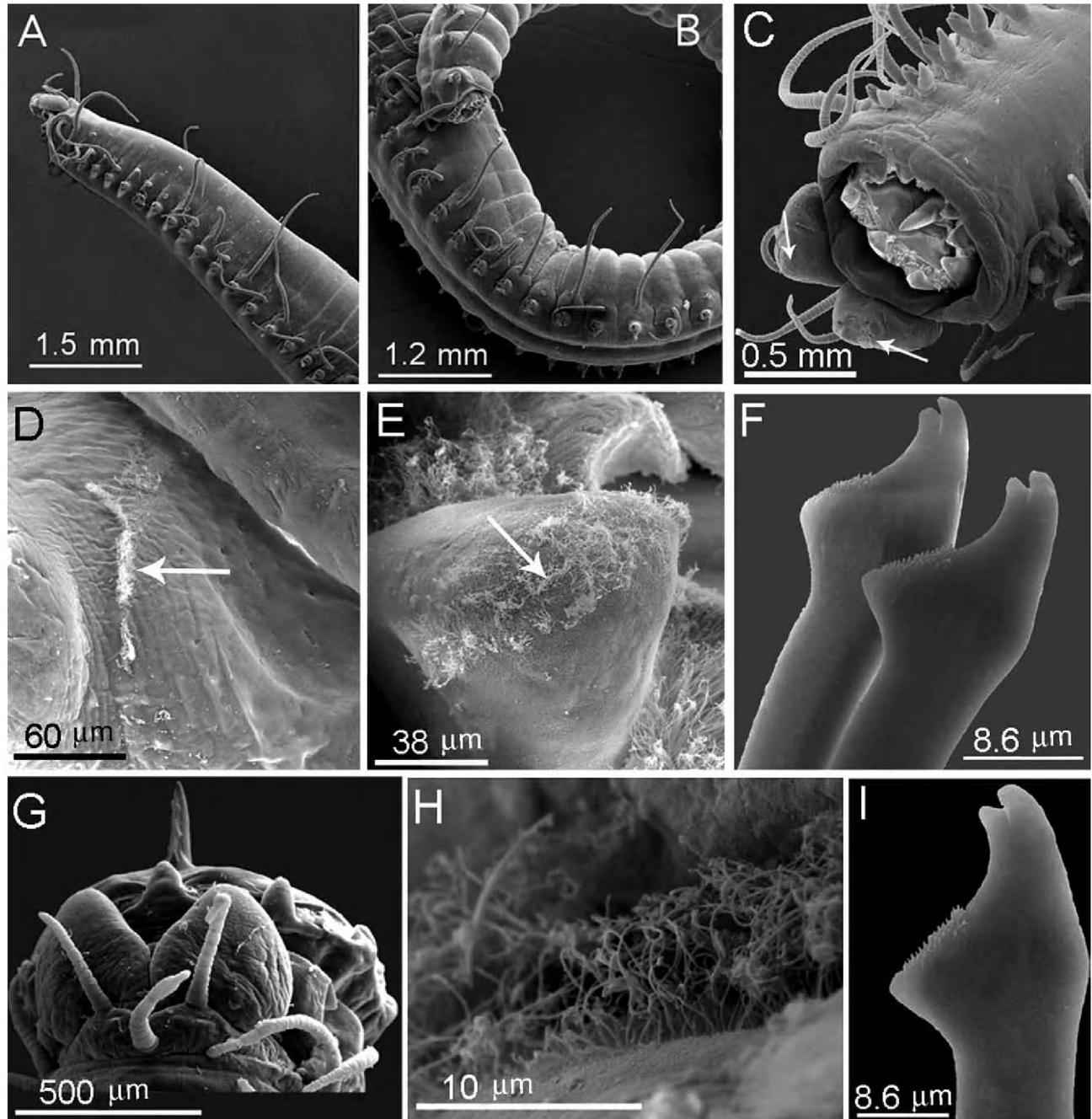


FIG. 2. – *Haplosyllis spongicola*. A, anterior region, lateral view; B, mid-body, lateral view; C, anterior end, ventral view with the arrow indicating the position of the ciliated sensory organs from ventral side of palps; D, detail of the ciliated sensory organs; E, ciliary band on pharyngeal papillae; F, Mid-body chaetae; G, anterior end, dorsal view; H, ciliated nuchal organs; I, detail of mid-body chaetae.

ator than to a strict sponge endo- or ectosymbiont (Martin and Britayev, 1998).

Distribution. Mediterranean and European Atlantic waters; other records in temperate and tropical seas must be reviewed.

Taxonomic remarks. The morphology of the Iberian specimens clearly agrees with that of the

Haplosyllis spongicola syntypes. Thus, *H. spongicola* is re-defined here as the large-sized morphotype having long cirri. The Mediterranean specimens with short cirri and trepan, up to now frequently confused with *H. spongicola*, clearly belong to *Geminosyllis* and will be discussed in the following section. We will also discuss the differences between *H. spongicola* and the other *Haplosyllis* species described here.

TABLE 1. – Summary of some morphological characters of *Haplosyllis spongicola* and *Haplosyllis carmenbritoae* sp. nov. from Spanish seas. *: palps plus prostomium plus 10 first segments. N: number of organisms; Min: minimum; Max: maximum; Av: average; SD: standard deviation; DT: dorsal tentacular. Measurements in mm.

	<i>Haplosyllis spongicola</i>					<i>Haplosyllis carmenbritoae</i> n. sp.				
	N	Min	Max	Av	SD	N	Min	Max	Av	SD
Body length*	13	0.80	1.59	1.23	0.28	4	1.25	1.61	1.38	0.17
Body width	13	0.38	0.82	0.5	0.52	4	0.29	0.55	0.38	0.12
Proventricle										
Length	13	0.71	2.54	1.33	0.52	4	0.42	1.09	0.69	0.28
Width	13	0.27	0.65	0.39	0.11	4	0.18	0.35	0.26	0.07
Segments	13	6	13	9.7	1.81	4	4	5	4.25	0.5
Palps length	13	0.1	0.31	0.23	0.07	4	0.17	0.26	0.21	0.03
Prostomium										
Length	13	0.13	0.25	0.17	0.04	4	0.15	0.18	0.16	0.02
Width	13	0.17	0.51	0.33	0.10	4	0.20	0.33	0.26	0.06
Central antennae										
Length	11	0.15	0.65	0.44	0.17	2	0.30	0.54	0.42	0.17
Articles	11	5	34	21	9.42	2	14	24	19	7.07
Lateral antennae										
Length	13	0.26	0.41	0.34	0.05	4	0.22	0.43	0.3	0.1
Articles	13	13	23	17	2.43	4	11	17	13	2.83
DT Cirrus										
Length	11	0.30	0.61	0.45	0.10	4	0.34	0.46	0.42	0.05
Articles	13	16	30	22.3	3.8	4	16	20	17	1.7
Dorsal cirrus										
Length 1	13	0.48	1.39	0.72	0.23	3	0.55	0.77	0.64	0.12
Articles 1	13	24	48	33	6.93	3	20	23	21	1.53
Length 2	13	0.15	0.52	0.33	0.11	3	0.22	0.33	0.26	0.06
Articles 2	13	8	26	17	5	3	10	15	12	2.65
Length 3	13	0.2	0.68	0.45	0.14	3	0.2	0.49	0.32	0.15
Articles 3	13	13	32	22	5.96	3	8	19	13	5.51
Length 4	13	0.36	0.85	0.59	0.18	4	0.32	0.59	0.11	0.42
Articles 4	13	19	47	27	7.91	4	13	24	17	4.79
Length 5	13	0.2	0.92	0.48	0.23	4	0.14	0.36	0.25	0.09
Articles 5	13	11	28	19.6	6.69	4	6	15	10	3.69

Haplosyllis carmenbritoae n. sp.
(Figs 3-4)

Material examined. Canary Islands: off Tabaiba, eastern coast of Tenerife. Collected at 100 m depth on calcareous concretions from *Dendrophyllia ramea* bottoms (January 17- 1982). Holotype: MNCN 16.01/10645; 6 paratypes: MNCN 16.01/10646.

Description. Body sub-cylindrical, ventrally flattened, small (1.25-1.65 mm palps length plus prostomium plus first 10 chaetigers), 0.29 to 0.55 mm width (excluding parapodia). Specimens without the most posterior segments, pale cream, with brown tonalities depending on the presence of dorsal granules. Two nuchal organs as pore regions at both sides of body, between prostomium and peristomium (Fig. 4E-F). Prostomium rounded, with two pairs of small eyes in trapezoidal arrangement (Fig. 3A), small specimens apparently without eyes. Antennae similarly wide from base to tip, with translucent edges and brown marks on each article. Median antenna inserted on middle of prostomium, slightly longer than lateral ones, up to 0.54 mm for 14 to 24 articles. Lateral antennae inserted on anterior margin of prostomium, 0.22 to 0.43 mm long

for 11 to 17 articles. Palps long, broad, fused at their bases but clearly divergent all along their length (Fig. 3A), slightly longer than prostomium; with sensory organs as pore areas on ventral side (Fig. 4A-B) and pore holes on lateral sides (Fig. 4C-D). Tentacular segment well defined, shorter than subsequent ones. Tentacular and dorsal cirri similar to antennae. Dorsal tentacular cirri longer than ventral ones and shorter than first dorsal cirri, up to 0.46 mm long for 16 to 20 articles. Cirri from the first to fifth chaetigers with a strongly specific length-pattern: first cirri longer than remaining ones, up to 0.59 mm for 20 to 23 articles; second smaller than the others, up to 0.33 mm with 10 to 15 articles; third and fourth similar and slightly longer, up to 0.59 mm for 8 to 24 articles; fifth shorter, up to 0.36 mm for 6 to 15 articles (Table 1). Ventral cirri shorter than parapodial lobes. All chaetae bidentate (Fig. 3B, 3D, 3F, Fig. 4H-L), anterior-most thin, with short main fang (Fig. 3B) and mid-body and posterior-most ones wider, with long main fang, longer when more posterior (Fig. 3D, 3F). Distal and proximal teeth clearly separated, long and well defined. Upper side of main fang with 4 to

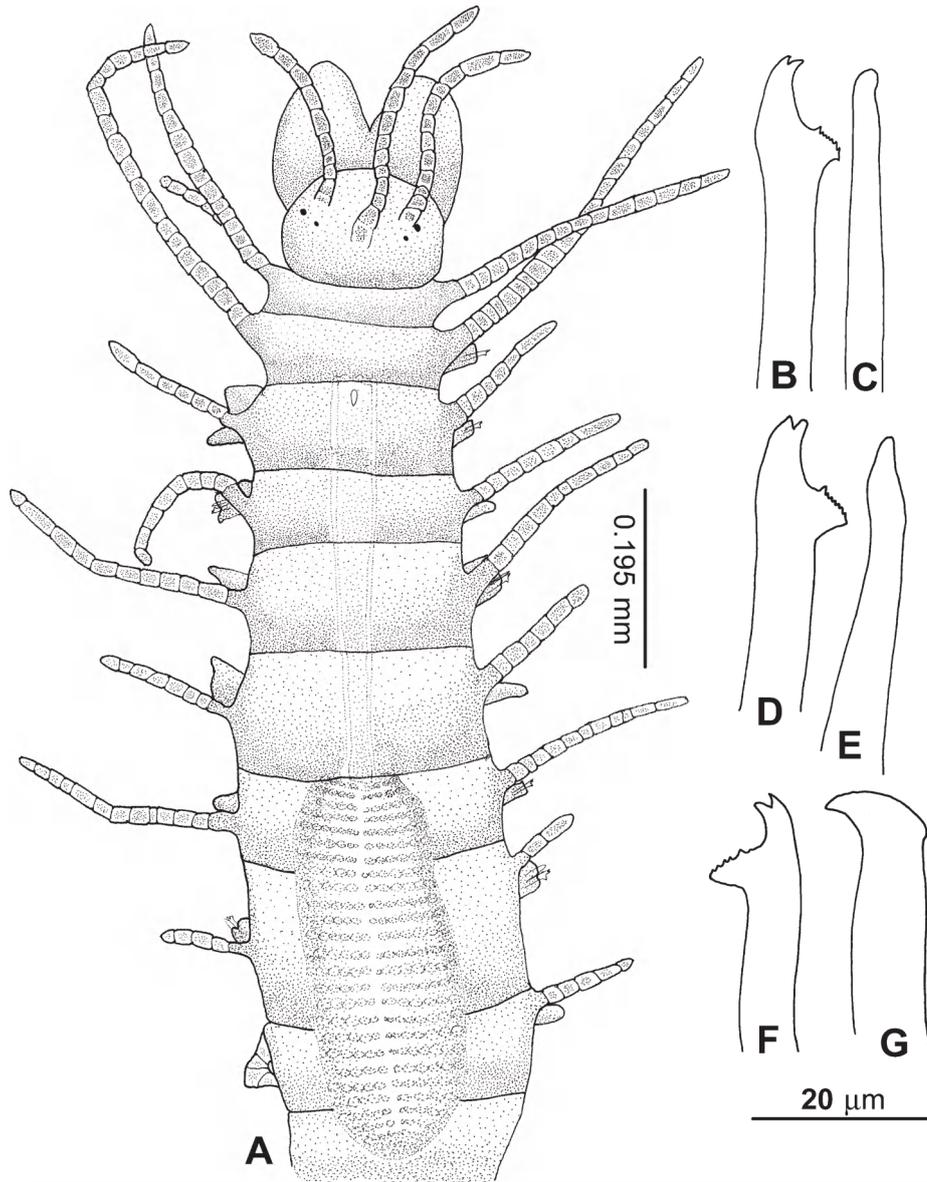


FIG. 3. – *Haplosyllis carmenbritoae* sp. nov. A, anterior dorsal view; B, D, F, anterior, medium and posterior chaetae respectively. C, E, G, anterior, medium and posterior aciculae respectively.

6 long spines followed by several smaller spines near the tip, visible both under SEM (Fig. 4H) and light microscope (Fig. 3B, 3D, 3F). Two chaetae per parapodium (sometimes 1 or 3) similar in shape but different in size. Aciculae broad, some enlarged, with rounded tip (3C, 3E) or with a hooked, pointed tip, directed upwards (Fig. 3G). 1 to 6 anterior aciculae per parapodia, only 1 in posterior ones. Pharynx orange, similar or longer than proventricule, long and thin, with a small tooth, surrounded by a crown of soft papillae and an inner ciliary ring (Fig. 4G). Proventricule long and rectangular, 0.42 to 1.09 cm long and up to 0.35 mm wide, extending

through 4 to 5 segments. Few last segments, pygidium and stolons not seen.

Etymology. The name refers to Mari Carmen Brito, polychaetologist from the University of La Laguna (Tenerife, Canary Islands).

Ecology. Collected at 100 m deep on calcareous aggregates in a community of the coral *Dendrophyllia ramea*.

Distribution. Canary Islands, Tenerife, off Tabaiba.

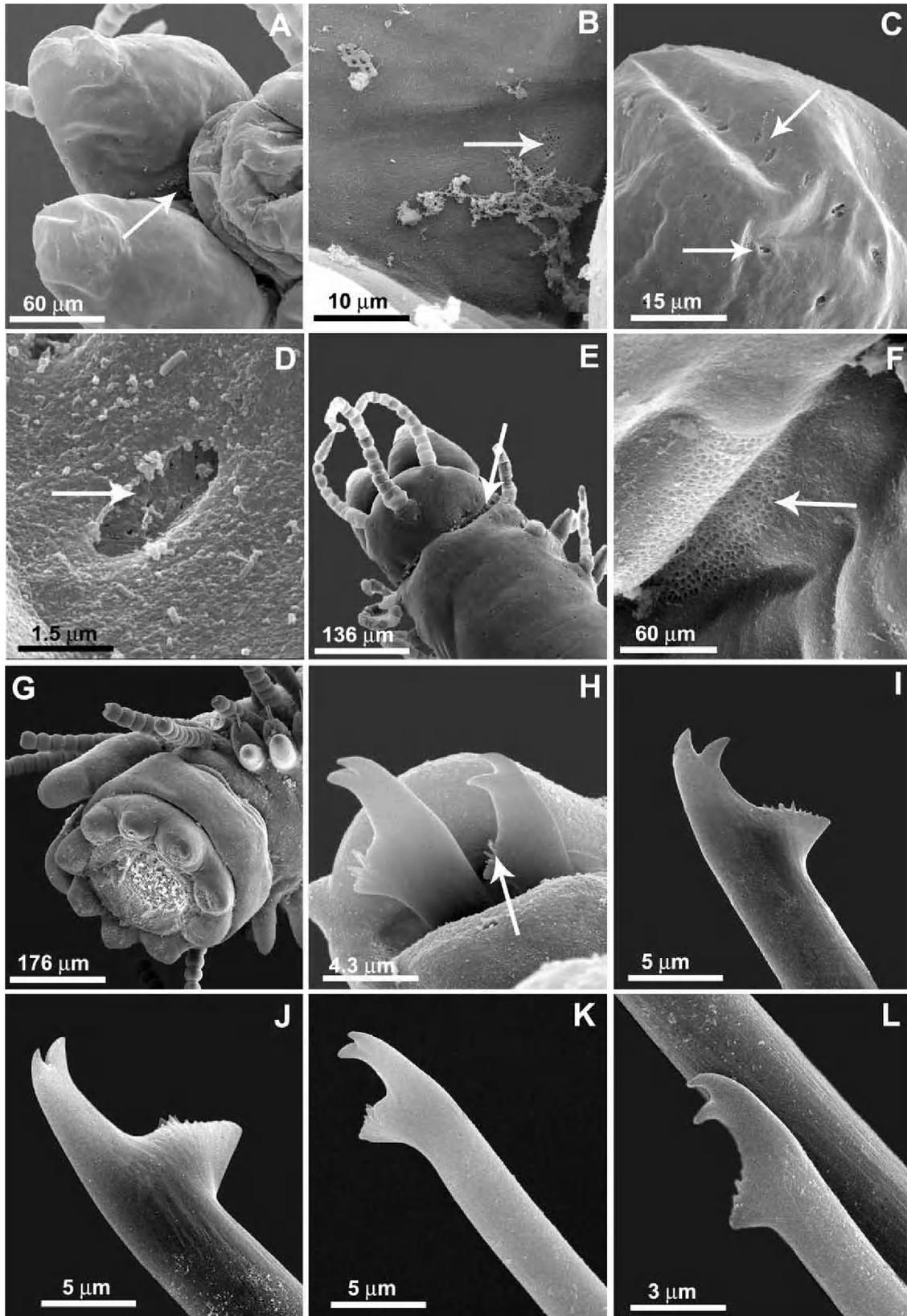


FIG. 4. – *Haplosyllis carmenbrittoae* sp. nov. A, ventral view of palps, with the arrow pointing to the ventral sensory organs; B, detail of ventral sensory organs of palps; C, lateral sensory organs of palps; D, detail of the same; E, anterior dorsal view, with the arrow indicating the position of nuchal organs; F, detail of nuchal organs; G, pharynx; H, anterior-most chaetae with the arrow pointing to the spines of the main fang; I–J, mid-body chaetae, K–L, posterior-most chaetae.

TABLE 2. – Summary of “dorsal cirri and chaetae” of *Haplosyllis* and *Geminosyllis* species/subspecies.

Species	Dorsal Cirri	Chaetae	Type locality	
<i>Syllis (Haplosyllis) hamata</i> Claparède, 1868	Longer than body width		Naples Gulf	
<i>Syllis (Haplosyllis) djiboutiensis</i> Gravier, 1900	Shorter than those of <i>S. hamata</i> . Second segment cirri more developed than the others.		Red Sea	
<i>Haplosyllis cephalata</i> Verrill, 1900	Tentacular and first chaetiger cirri longer than subsequent ones.	Simple bidentate	Bermudas	
<i>Haplosyllis palpata</i> Verrill, 1900	Longest cirri with 9-10 articles, half body width.	Simple bidentate	Bermudas	
<i>Syllis (Haplosyllis) depressa</i> var. <i>dollfusi</i> (Fauvel, 1933)	Not longer than half of body width.		Suez Gulf	
<i>Haplosyllis spongicola brevicirra</i> Rioja, 1941	Short cirri, with 5 to 9 articles.		Acapulco, México	
<i>Haplosyllis anthogorgicola</i> Utinomi, 1956	Tentacular and first chaetiger cirri very long, with 22-33 articles. Cirri of chaetigers 2-5 between 6-15 articles	Sensu Utinomi 1956 	Sensu Martin <i>et al.</i> , 2002 	Japan
<i>Haplosyllis trifalcata</i> (Day 1960)	Dorsal cirri short, 9-12 articles.		Southafrica	
<i>Haplosyllis agelas</i> Uebelacker 1982	Tentacular and cirri of first chaetiger long, subsequent ones short.		Bahamas	
<i>Haplosyllis chamaeleon</i> (Laubier, 1960)	Tentacular cirri (28 articles) and subsequent chaetigers long		Alborán Sea, Mediterranean	
<i>Haplosyllis villogorgicola</i> Martin <i>et al.</i> , 2002	Tentacular cirri with 15 articles. Dorsal cirri alternate between short and long.		Tenerife, Canary Islands	
<i>Haplosyllis basticola</i> Sardá, Avila and Paul, 2002	Cirri of first chaetiger with 10 articles, subsequent ones shorter. Only anterior body cirri articulated		Guam Island, Micronesia	
<i>Geminosyllis ohma</i> (Imajima and Hartman, 1964)	Anterior dorsal cirri with 30-35 articles. Medium body cirri with 30 articles		Buriles Islands North of Japan	

Taxonomic remarks. *Haplosyllis carmenbrittoae* n. sp. differs from *H. spongicola* in being much smaller, with a thin body and having cirri that are similarly wide all along their length. Unlike *H. spongicola*, the long spines on the main fang can be clearly observed under light microscopy in *H. carmenbrittoae* n. sp.. Under SEM it was possible to see four to six long spines followed by several shorter ones. The distal and proximal teeth also seem longer, with more pointed tips separated by a wider angle than in *H. spongicola*, which has numerous short spines on the upper margin of the main fang, as well as shorter and broader apical teeth with

rounded tips separated by a narrow angle. The sensory organs in *H. carmenbrittoae* n. sp. (i.e. nuchal and palps organs) are areas or holes with pores, while the corresponding organs are ciliated regions (except for the lateral sensory organs of the palps, which are absent) in *H. spongicola*. All individuals of *H. carmenbrittoae* n. sp. lack the posterior-most segments and the pygidium. However, this did not prevent us considering them as a new species due to the characteristic features of both the chaetae and sensory organs.

Haplosyllis carmenbrittoae n. sp. can be easily distinguished from *H. depressa* var. *dollfusi* Fauvel,

1933; *H. anthogorgicola*, Utinomi, 1956; *H. trifalcata*, Day, 1960; *H. chamaleon* Laubier, 1960; *H. agelas*, Uebelacker, 1982, because of chaetal shape (Table 2). In *H. spongicola brevicirra* Rioja, 1941 the description and illustrations are incomplete, the shape of both body appendages is unknown, as well as the type of sensory organs. However, it seems to have unidentate chaetae, which are absent in *H. carmenbrittoae* n. sp.

Haplosyllis villogorgicola Martin *et al.* 2002 is geographically the nearest species, but it has 3-5 hooked chaetae per parapodium, with a very short main fang and the apical teeth are much more enlarged than in *H. carmenbrittoae* n. sp. The mor-

phology of the appendages (antennae and cirri) is also different, more enlarged and sharper. It has also been described as a specific symbiont of the gorgonian *Villogorgia bebrycoides*.

Genus *Geminosyllis* Imajima, 1966

Diagnosis. Body sub-cylindrical, segments moderately long. Prostomium with four eyes. Three long antennae. Palps long, broadly triangular, fused at bases and completely separated all along its length. Two pairs of tentacular cirri; dorsal and ventral cirri on each parapodium. Antennae, tentacular and dorsal cirri moniliform. Pharynx with trepan composed

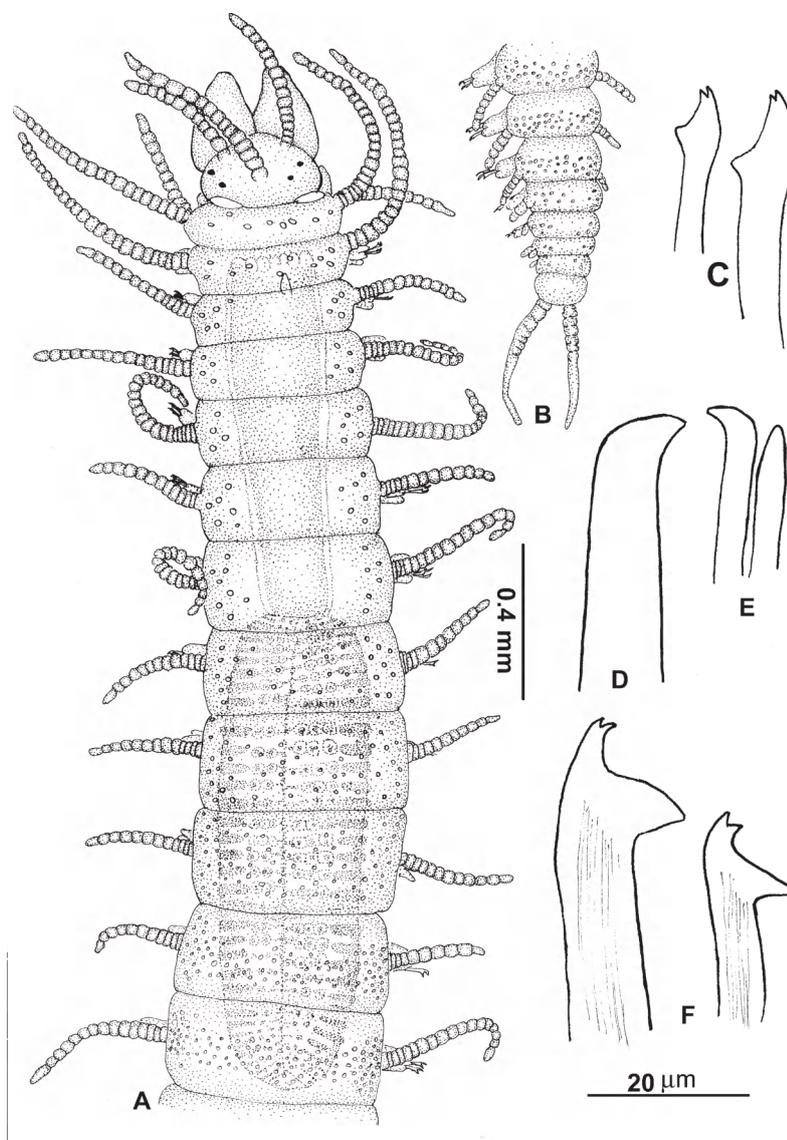


FIG. 5. – *Geminosyllis granulosa* sp. nov. A, anterior dorsal view; B, pigidium; C, anterior-most chaetae; D-E, aciculae; F, posterior-most chaetae.

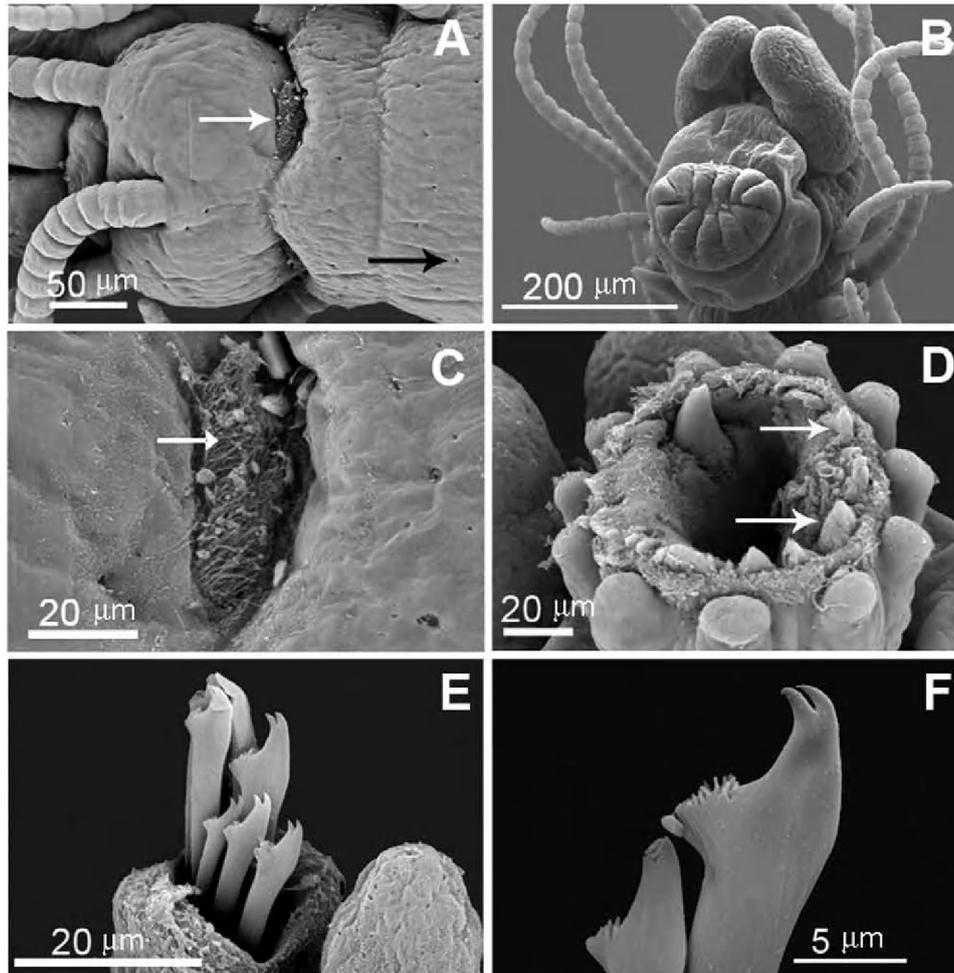


FIG. 6. – *Geminosyllis granulosa* sp. nov. A, anterior end, dorsal view, with the white arrow pointing to the nuchal organ and the black arrow to a pore hole; B, anterior end, ventral view; C, nuchal organs; D, pharynx and trepan, the arrows pointing to teeth; E-F simple bidentate mid-body chaetae.

of 9 to 11 teeth and a large mid-dorsal tooth. Simple chaetae, from 3 to 7 in each parapodium. Capillary chaetae absent.

Remarks. The presence of trepan as a diagnostic character for *Geminosyllis* is doubtful, as some specimens with a trepan share more characters with *Haplosyllis spongicola* than with *Geminosyllis* species. The situation of *Geminosyllis* in Japanese waters has some parallels with that of the Spanish species of the *H. spongicola* complex, as the presence of *H. spongicola spongicola* and *H. spongicola tentaculata* has been reported in addition to *G. ohma* (Imajima and Hartman, 1964), which was described as a new species from Japanese waters). In light of the present data, the situation does not seem clear enough, and will require further studies to assess whether these two genera are present in Japanese waters or not, and whether the species are the same as, or different from those in the Mediterranean.

***Geminosyllis granulosa* n. sp.**
(Figs 5-6)

Haplosyllis spongicola: San Martín (2003): 324, Fig. 179B (in part)
?Syllis spongicola spongicola Cognetti 1955: Cognetti (1955): 1-3,
Fig. 1a. Cognetti (1957): 10-14, Fig. 2a. Cognetti (1961): 294.

Material examined. Western Mediterranean, Nerja (Spain):
Collected on calcareous concretions between 3 and 4.5 m deep.
Holotype: MNCN 16.01/10606. 155 paratypes: MNCN
16.01/10607.

Additional material from Nerja: MNCN 16.01/10608 (10); MNCN
16.01/10609 (20); MNCN 16.01/10610 (22); MNCN 16.01/10611
(50); MNCN 16.01/10612 (13); MNCN 16.01/10613 (91); MNCN
16.01/10614 (63). SEM: MNCN 16.01/10648-50 (6).

Fauna Ibérica, Balearic Islands: MNCN 16.01/10583 (1) (10 m).
Columbretes Islands: MNCN 16.01/10584 (27) (10 m deep);
MNCN 16.01/10585 (5) (10 m deep); MNCN 16.01/10586 (5) (80
– 85 m deep).

Western Mediterranean, Cape of Palos (Murcia): collected on rhi-
zomes of *Posidonia*: MNCN 16.01/10625 (16); MNCN
16.01/10626 (1); MNCN 16.01/10627 (21); MNCN 16.01/10629
(2); MNCN 16.01/10630 (2); MNCN 16.01/10631 (11); MNCN
16.01/10632 (2); MNCN 16.01/10633 (24); MNCN 16.01/10634
(9); MNCN 16.01/10635 (13); MNCN 16.01/10636 (1); MNCN
16.01/10637 (24); MNCN 16.01/10638 (1); MNCN 16.01/10639
(5); MNCN 16.01/10640 (4); MNCN 16.01/10641 (24); MNCN
16.01/10642 (16); MNCN/10628 (1).

Western Mediterranean, Almeria (Spain). Roquetas: MNCN 16.01/10615 (1) (2 m deep); MNCN 16.01/10616 (2) (2 m deep); MNCN 16.01/10617 (21) (2 m deep); MNCN 16.01/10618 (4) (2 m deep); MNCN 16.01/10619 (2) (2 m deep); MNCN 16.01/10620 (3) (2 m deep); MNCN 16.01/10621 (3) (3 m deep). Genoveses: MNCN 16.01/10622 (7) (2 m).

Western Mediterranean, Cape of Creus (Spain), collected from calcareous concretions MNCN 16.01/10598 (1) (12 m deep); MNCN 16.01/10600 (1) (27 m deep); MNCN 16.01/10599 (2) (25 m deep).

Description. Body long, sub-cylindrical (Fig. 5A), small to medium size: 0.82 to 2.08 cm long (palps, plus prostomium plus 10 first chaetigers), 0.17 to 0.50 mm width (excluding parapodia); pale yellow, without colour marks and with pores connected to internal structures giving granulose aspect to body surface (Fig. 5A). Pore holes also visible under SEM (Fig. 6A). Nuchal organs as a pair of lateral ciliated regions between peristomium and prostomium, only visible under SEM (Fig. 6A, C). Prostomium rounded to oval (Fig. 5A, 6A), with two pairs of small red eyes in trapezoidal arrangement, anterior pair larger than posterior pair. Antennae slightly longer than palps; median antennae inserted near the mid-prostomium, between posterior eyes, reaching up to 0.7 mm long for 9 to 30 articles; lateral antennae inserted near anterior margin of pros-

tomium, reaching up to 0.43 mm for 6 to 17 articles. Palps long, broadly triangular, fused at their bases, but clearly divergent all along their length (Fig. 5A); sensory organs as two ciliated regions on ventral side of each palp; lateral sensory organs absent. Tentacular segment well defined, shorter than subsequent ones. Cirri and dorsal cirri similar to antennae. Dorsal tentacular cirri longer than ventral ones and shorter than first dorsal cirri, up to 0.60 mm long for 17 to 22 articles (only 7 in small specimens). Cirri from first to fifth chaetigers with strongly specific length pattern: first cirri longer than the remaining ones, up to 0.77 mm long for 18 to 30 articles (occasionally 11); second and third much shorter and similar in size, up to 0.46 mm long for 8 to 16 articles; fourth slightly longer, up to 0.57 mm long for 7 to 25 articles; fifth small, up to 0.38 mm long for 5 to 14 articles (Table 3). Mid-body long dorsal cirri with 11 to 17 articles (only 6 in some specimens). Mid-body short cirri with 4 to 13 articles. Ventral cirri shorter than parapodial lobes. Chaetae bidentate; anterior ones thin, with small main fang (Fig. 5C); mid-body and posterior ones wider, with longer and well-defined main fang (Fig. 5F; 6E-F). Upper side of

TABLE 3. – Summary Summary of some morphological characters of *Geminosyllis granulosa* sp. nov. and *Geminosyllis* sp. 1 from Spanish seas. *: palps plus prostomium plus 10 first segments. N: number of organisms; Min: Minimum; Max: maximum; Av: average; SD: standard deviation; DT: dorsal tentacular. Measurements in mm.

	<i>Geminosyllis granulosa</i> sp. nov.					<i>Geminosyllis</i> sp1				
	N	Min	Max	Av	SD	N	Min	Max	Av	SD
Body length*	34	0.82	2.08	1.34	0.38	13	0.79	2.26	1.19	0.43
Body width	34	0.17	0.50	0.35	0.08	13	0.27	0.98	0.52	0.22
Proventricle										
Length	34	0.40	0.15	0.79	0.23	13	0.71	2.43	1.29	0.58
Width	33	0.14	0.40	0.26	0.06	13	0.22	0.65	0.34	0.11
Segments	34	3.5	8	5.32	1.40	13	5	14	9.38	2.66
Palps length	34	0.10	0.30	0.20	0.04	13	0.15	0.41	0.26	0.08
Prostomium										
Length	34	0.08	0.20	0.14	0.03	13	0.10	0.27	0.18	0.05
Width	34	0.16	0.35	0.25	0.05	13	0.22	0.57	0.34	0.11
Central antennae										
Length	27	0.22	0.71	0.16	0.44	10	0.37	0.68	0.45	0.09
Articles	26	9	30	19	5.24	10	16	26	21	3.37
Lateral antennae										
Length	33	0.16	0.46	0.09	0.29	10	0.20	0.60	0.37	0.11
Articles	33	6	17	12	2.47	10	14	26	17	3.44
DT Cirrus										
Length	34	0.17	0.60	0.37	0.11	11	0.27	1.03	0.51	0.21
Articles	34	7	22	16	3.46	11	15	35	23	6.36
Dorsal cirrus										
Length 1	34	0.23	0.77	0.47	0.15	13	0.41	1.14	0.62	0.19
Articles 1	34	10	34	19	5.07	13	21	38	27	4.28
Length 2	33	0.08	0.38	0.22	0.08	11	0.22	0.72	0.36	0.14
Articles 2	33	4	14	9.7	3.13	11	14	29	18	4.21
Length 3	33	0.15	0.46	0.28	0.09	12	0.22	0.92	0.53	0.22
Articles 3	33	6	20	11.7	3.49	12	15	38	23	6.98
Length 4	33	0.14	0.57	0.36	0.13	12	0.20	1.09	0.61	0.27
Articles 4	33	7	25	14.67	4.36	12	13	34	23	6.80
Length 5	34	0.08	0.38	0.22	0.08	12	0.22	0.92	0.43	0.21
Articles 5	34	4	16	9.38	3.87	12	11	32	19	6.86

main fang with small spines apparently forming 2-3 rows (difficult to observe with light microscope). Some specimens with 2-3 chaetae per fascicule, others 3-7, all of same morphology but different in size (Fig. 6E-F). Aciculae broad, some with an oblique end and pointed tip clearly directed upwards, others with straight tip (Fig. 5D-E). Specimens from Cape of Palos have 90° bent end with rounded tip. Usually one acicula per parapodium. Pharynx long, similar in length to proventricle, broad and cylindrical. Anterior end surrounded by crown of 10 to 12 soft papillae (Fig. 6B) and trepan with one large, triangular tooth and 9 to 10 smaller triangular teeth (Fig. 6D). Proventricle long, rectangular, extending through 4 to 8 segments, with 40 to 57 muscular rows. Pygidium with two short anal cirri (Fig. 5B). Stolons not seen.

Etymology. The specific name refers to the granulate aspect of the dorsal surface of the specimens, which is due to the presence of internal glands with pore openings.

Ecology. Most specimens have been found on calcareous concretions of *Mesophyllum lichenoides* and *Lithophyllum expansum*, between 3 and 25 m in depth and among rhizomes of *Posidonia*, between 2 and 20 m in depth. Also found at 80 to 85 m in depth, associated with detritic bottoms.

Distribution. Spanish Mediterranean: Cape of Creus; Balearic Islands; Columbretes Islands; Málaga (Nerja); Almería; Cape of Palos (Murcia). Probably also present in other parts of the western Mediterranean.

Taxonomic remarks. *Geminosyllis granulosa* n. sp. has been repeatedly confused with the Mediterranean specimens identified as *H. spongicola* (San Martín, 2003: Fig. 179B), but careful observations reveal that the former can be clearly distinguished by the presence of 3 to 7 chaetae per parapodia and, more specifically, by the presence of a trepan. Moreover, *G. granulosa* n. sp. has a slender, medium-sized body, with numerous pores on the dorsum, while *H. spongicola* has a more robust body reaching a larger size. The dorsal cirri of *G. granulosa* n. sp. are short, broad, with the same width from base to tip and show a specific length pattern from the first to fifth anterior cirri. Seen under light microscopy, the chaetae strongly differ: in *H.*

spongicola the two distal teeth are short and wide, with a narrow angle and rounded tips, while in *G. granulosa* n. sp. they are enlarged and slender, with a wide angle and pointed tips. The aciculae seem to have differences at the population level, but not between species. The aciculae of both species from Nerja are very similar, but those of *G. granulosa* n. sp. from Cape of Palos are large, with a 90 degree-bent end. At this stage, it is not possible to assess whether this single difference can be considered species specific, which would lead to the existence of an additional new species in the complex.

Geminosyllis granulosa sp. nov. differs from *G. ohma* (Imajima and Hartman, 1964), the single previously known species of the genus, in being smaller, with short cirri. In addition, the prostomium is pentagonal in *G. ohma* and *H. spongicola*, while in *G. granulosa* it is round to oval. *G. ohma* has a smaller main fang and the aciculae have rounded tips. There is no mention of the presence of spines on the upper edge of the main fang in *G. ohma*, but it is not possible to dismiss their presence as the species has never been observed under SEM. *G. ohma* does not have pores on the dorsum, which is an important character for distinguishing the two species.

Geminosyllis sp. 1 (Figs 7-8)

Material examined. Western Mediterranean. Cape of Creus (Spain): MNCN 16.01/10587 (1) (15 m deep); MNCN 16.01/10588 (2) (9 m deep); MNCN 16.01/10589 (1) (8 m deep); MNCN 16.01/10590 (1); MNCN 16.01/10591 (1) (5 m deep); MNCN 16.01/10592 (6) (12 deep m); MNCN 16.01/10594 (2) (23 m deep); MNCN 16.01/10593 (1) (15 m deep); MNCN 16.01/10653 (2) (15 m deep) SEM: MNCN 16.01/10595 (1); MNCN 16.01/10596 (1) (25 m deep); MNCN 16.01/10597 (1). Cape of Palos: MNCN 16.01/10643(1); MNCN 16.01/10644 (1). Almería: MNCN 16.01/10624 (2); MNCN 16.01/10623 (1).

Description. Body long, sub-cylindrical (Fig. 7A), medium-sized: 0.79 to 2.26 cm long (palps, plus prostomium plus 10 first chaetigers), 0.27 to 0.98 cm wide (excluding parapodia). White-cream, without colour marks. Nuchal organs as pair of lateral ciliated regions between peristomium and prostomium, only visible under SEM (Fig. 8D). Prostomium oval to sub-pentagonal (Fig. 7A), 1 to 2 times wider than long, with two pairs of small eyes in trapezoidal arrangement, anterior pair larger than posterior pair. Antennae longer than palps, slightly thinner at the tip. Median antennae inserted near mid-prostomium, up to 0.68 mm long for 16 to 26 articles; lateral antennae inserted near anterior mar-

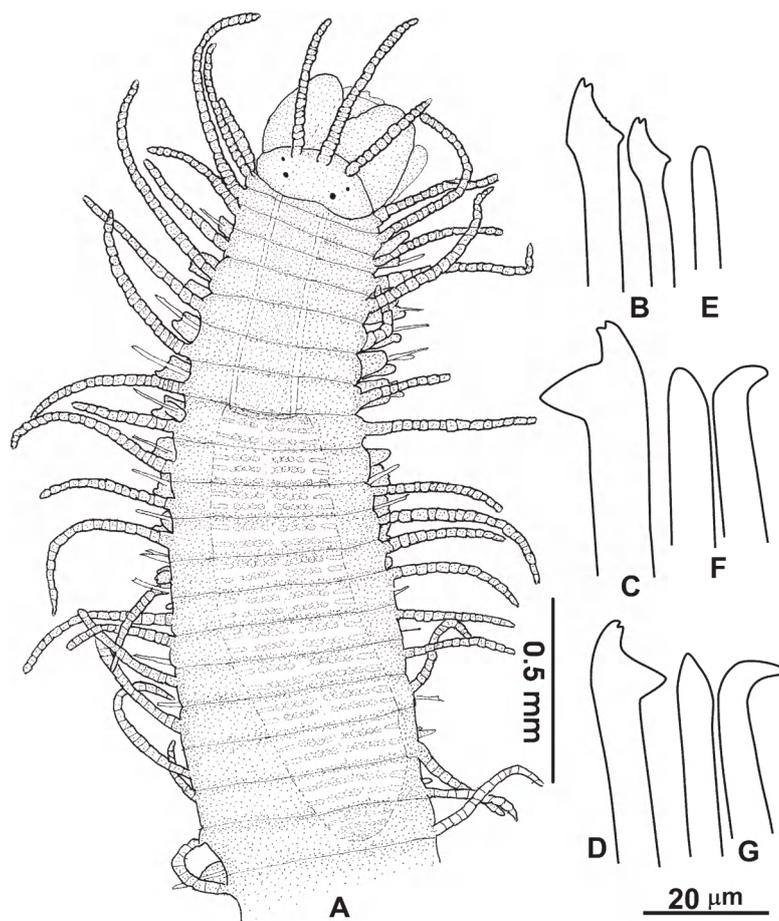


FIG. 7. – *Geminosyllis* sp. 1. A, anterior dorsal view; B, anterior body chaetae and aciculae; C, mid-body chaetae and aciculae; D, posterior-most chaetae and aciculae.

gin of prostomium, up to 0.60 mm for 14 to 20 articles. Palps long, broadly triangular, fused at their bases, but clearly divergent all along their length (Fig. 7A, 8A); ventral sensory organs not seen; lateral sensory organs absent. Tentacular segment well defined, shorter than subsequent ones. Dorsal tentacular cirri longer than ventral one and shorter than first dorsal cirri, up to 1 cm long for 20 to 35 articles (sometimes only 15). Ventral tentacular cirri shorter than dorsal ones. Dorsal cirri similar to antennae (Fig. 7A). Cirri from first to fifth chaetigers with strongly specific length pattern: first cirri longer than remaining ones, 0.62 mm long in average for 21 to 38 articles; second and third much smaller and similar in size, up to 0.92 mm long for 15 to 30 articles (sometimes up to 38); fourth slightly longer, reaching more than 1 cm with 13 to 34 articles; fifth small, up to 0.92 mm long for 11 to 32 articles (Table 3). Mid-body long dorsal cirri with 13 to 26 articles (reaching up to 37); mid-body short dorsal cirri with 7 to 20 articles. Ventral cirri shorter than

parapodial lobes. Chaetae bidentate; anterior ones thin, with small main fang (Fig. 7B); mid-body and posterior ones wider, with long and well-defined main fang (Fig. 7C-D; 8E-F). Under light microscopy, distal and proximal teeth small, short spines present on upper side of main fang; under SEM, teeth seem longer, spines decrease gradually in size towards the apex (Fig. 8E). Two chaetae per parapodium (occasionally three), with same morphology, but different sizes. Aciculae broad, some with oblique end and tip clearly directed upwards, others with straight tip (Fig. 7 E-G); two aciculae per parapodium. Pharynx long, wide and cylindrical; anterior end surrounded by soft wide papillae and an inner ciliary ring. Trepan with 9 to 10 triangular teeth (very small under light microscopy) and sharp, sub-terminal mid-dorsal tooth (Fig. 8B). Proventricle long and rectangular, extending through 5 to 14 segments. Pygidium with two short anal cirri. Stolons not seen.

Ecology. Found on rhizomes of *Posidonia*, on

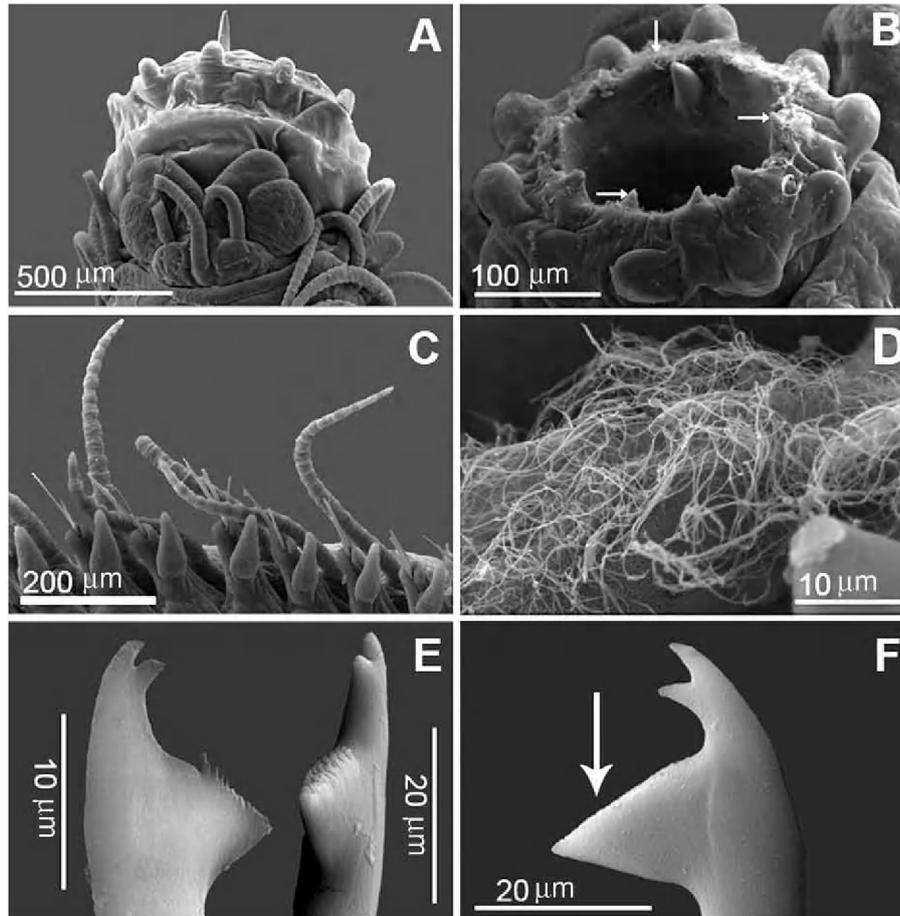


FIG. 8. – *Geminosyllis* sp. 1. A, anterior end, dorsal view; B, pharynx and trepan; C, parapodia and cirri from mid-body; D, nuchal organs; E-F mid-body chaetae with the arrow pointing to the main fang.

calcareous concretions of *Mesophyllum lichenoides* and *Lithophyllum expansum* and on facies of *Balanus perforatus* between 5 and 25 m deep.

Distribution. Known only from Spanish Mediterranean locations in the Cape of Creus and Cape of Palos, but probably present in other regions of the western Mediterranean.

Taxonomic remarks. It is very difficult to distinguish *Geminosyllis* sp. 1 from the above re-described *Haplosyllis* type species, *H. spongicola*. Their morphologies are almost identical and they also both have 1-3 chaetae per parapodium. The two species differ specifically in the presence/absence of the trepan (up to now considered as a diagnostic character for *Geminosyllis*) and also because *Geminosyllis* sp. 1 does not have a whip-shaped cirrus, the chaetal main fang is longer and the spines on its upper side are enlarged. As mentioned before, the existence of the specimens of *Geminosyllis* sp. 1 casts some doubts on

the distinction between *Geminosyllis* and *Haplosyllis*, based on the presence of the pharyngeal trepan. Until this situation is resolved, we have decided not to give a formal name to the taxon. With the current data, it is not possible to discard the idea that specimens of *Geminosyllis* sp. 1 could simply be juvenile forms of *H. spongicola* with a trepan.

Geminosyllis sp. 1 differs from other members of the genus as follows: it does not have the typical pores of *G. granulosa* n. sp., its body is much stronger, and the cirrus longer. *Geminosyllis* sp. 1 differs from *G. ohma* because this species has 3 to 7 chaetae per parapodia, a smaller main fang and aciculae with rounded tip.

Multivariate analysis. Nearly 56% of the inter-specific variability was explained by the selected morphological parameters used in the PCA (Fig. 9A). All mid-body chaetal parameters except the mid-joining point between teeth, the length of the palps and prostomium length and width, accounted

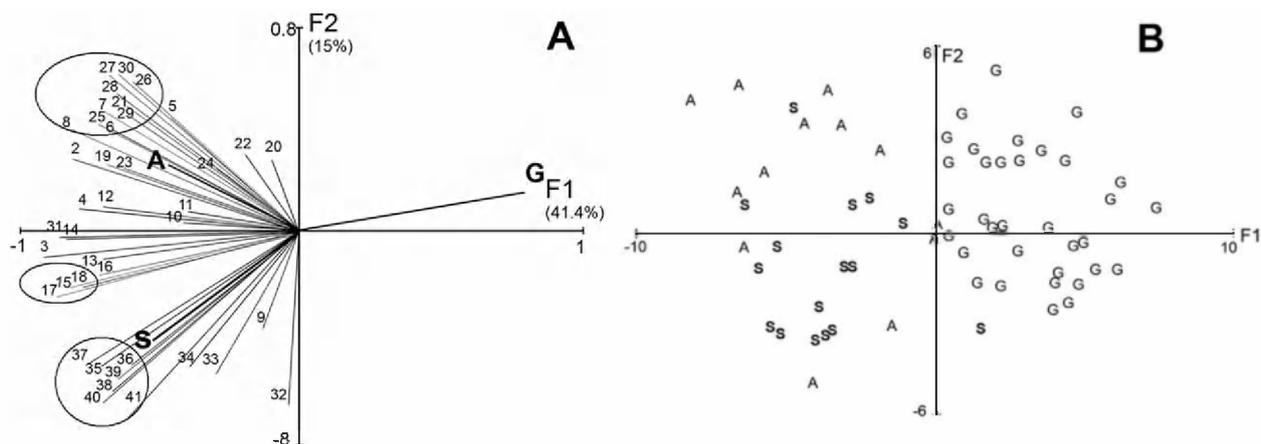


FIG. 9. – PCA diagrams for the first two factors, F1 and F2. A. Biplot of the 39 morphological characters and relative position of *Haplosyllis spongicola* (S), *Geminosyllis granulosa* sp. nov. (G) and *Geminosyllis* sp 1 (A). B. Distribution of all specimens of the three species.

TABLE 4. – Parameters and abbreviations used in the morphometric analysis. Factor 1 and 2 indicate the respective weights of each parameter in the PCA. The highest weights are indicated in bold. The parameters are represented by the corresponding numbers on Figure 9A.

Number	Parameters	Factor 1	Factor 2
2	Body width	0.76	0.37
3	Proventricule length	0.58	0.72
4	Proventricule width	0.61	0.50
5	Pharynx	0.60	0.05
6	Palps length	0.76	0.17
7	Prostomium length	0.79	0.17
8	Prostomium width	0.83	0.30
9	Central antennae length	-0.15	0.34
10	Lateral antennae length	0.29	0.25
11	Dorsal tentacular cirri length	0.33	0.24
12	First dorsal cirri length	0.56	0.43
13	Second dorsal cirri length	0.42	0.57
14	Third dorsal cirri length	0.60	0.63
15	Fourth dorsal cirri length	0.43	0.74
16	Fifth dorsal cirri length	0.39	0.61
17	Long cirri length of medium body	0.46	0.78
18	Short cirri length of medium body	0.44	0.72
19	Anterior-most chaetal width	0.67	0.33
20	Main fang length of anterior-most chaetae	0.25	-0.12
21	Main fang upper side of anterior-most chaetae	0.71	0.11
22	Main fang lower side of anterior-most chaetae	0.33	-0.06
23	Mid-joining point between teeth of anterior-most chaetae	0.59	0.29
24	Main fang basis of anterior-most chaetae	0.39	0.10
25	Medium-most chaetal width	0.77	0.18
26	Main fang length of medium-most chaetae	0.80	0.04
27	Main fang upper side of posterior-most chaetae	0.87	0.07
28	Main fang lower side of posterior-most chaetae	0.80	0.09
29	Mid-joining point between teeth of posterior-most chaetae	0.69	0.15
30	Main fang basis of posterior-most chaetae	0.85	0.05
31	Proventricule segments number	0.60	0.64
32	Central antennae articles number	-0.42	0.48
33	Lateral antennae articles number	-0.14	0.58
34	Dorsal tentacular cirri articles number	-0.05	0.62
35	First dorsal cirri articles number	0.17	0.84
36	Second dorsal cirri articles number	0.10	0.80
37	Third dorsal cirri articles number	0.20	0.87
38	Fourth dorsal cirri articles number	0.07	0.90
39	Fifth dorsal cirri articles number	0.10	0.84
40	Long medium body cirri articles number	0.07	0.93
41	Short medium body cirri articles number	-0.04	0.91

for the highest weights in factor 1 (Table 4), and are more correlated to *Geminosyllis* sp. 1 (Fig. 9A). The number of articles of first to fifth cirri and long and short cirri, showed the highest weights in fac-

tor 2 (Table 4), and are more correlated to *H. spongicola* (Fig. 9A). The length of the fourth dorsal cirri and mid-body long and short cirri are negatively correlated to *Geminosyllis granulosa* n. sp.

TABLE 5. – Selected parameters by discriminate analysis to separate 63 individuals of *H. spongicola*, *Geminosyllis granulosa* and *Geminosyllis* sp1 (Wilks' Lambda: 0.071, F(10,11) = 30.67, p < 0.001). Parameters names on table 4.

Parameters	Wilks' Lambda	Parcial Lambda	F-remove
4	0.01	0.86	3.01
3	0.02	0.65	9.89
6	0.01	0.84	3.45
10	0.01	0.88	2.45
16	0.01	0.81	4.44
27	0.01	0.84	3.46
25	0.01	0.83	3.73
23	0.02	0.61	12.11
15	0.01	0.78	5.07
28	0.01	0.84	3.44
39	0.01	0.79	4.77
40	0.02	0.63	10.8
37	0.01	0.84	3.51
34	0.01	0.83	3.86
31	0.01	0.73	6.93
32	0.01	0.80	4.57
29	0.01	0.84	3.43
30	0.01	0.83	3.67

The PCA clearly differentiates the specimens of *Geminosyllis granulosa* n. sp. from those of the other two species, which always remain mixed in the plot. (Fig. 9B).

The 18 parameters selected by the discriminant analysis using the forward stepwise method, presented significant discriminatory power (Wilk's Lambda < 0.05, F value > 1) (Table 5). These parameters contributed greatly to discriminating between the three species. Figure 10 shows the clearly distinguishable clusters, each one corresponding to the specimens of a single species.

DISCUSSION

Taxonomic study

Based on the syntypes and additional material from the Spanish seas, the type species of *Haplosyllis*, *H. spongicola*, is re-described and two new species are distinguished within the complex. The first one, *Haplosyllis carmenbrittoae* n. sp., is characterized by its small size, short cirri, chaetal shape and type of sensory and nuchal organs. The second species was assigned to genus *Geminosyllis* due to the presence of pharyngeal trepan. For the same reason, a third group of specimens was also assigned to *Geminosyllis*. However, they closely resemble *H. spongicola* in all remaining characters, casting some doubts on the taxonomic relevance of the presence of trepan at the genus level.

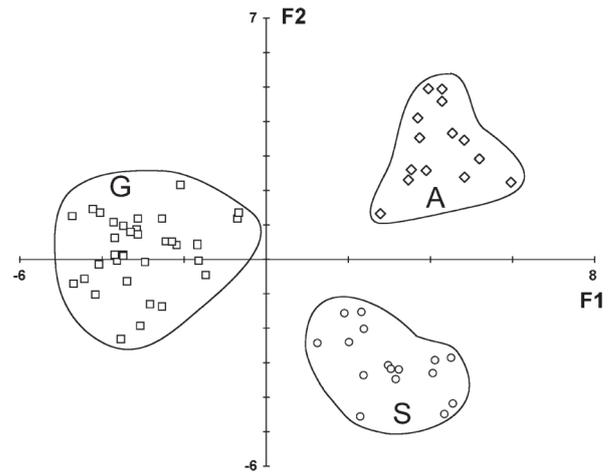


FIG. 10. – Canonical analysis based on the two discriminant functions F1 and F2. S: *Haplosyllis spongicola*, G: *Geminosyllis granulosa* sp. nov.; A: *Geminosyllis* sp. 1.

This paper also contributes to clarifying the doubtful taxonomic position of some *H. spongicola* subspecies. San Martín (2003) described Mediterranean *H. spongicola* including two different forms, with long cirri and short cirri. The former is assigned here to the type species, *H. spongicola*, while later it is considered as *Geminosyllis granulosa* n. sp. Besides the fact that the type material of two Mediterranean subspecies, *Syllis (Haplosyllis) spongicola spongicola* and *Syllis (Haplosyllis) spongicola tentaculata*, described by Cognetti (1955, 1957, 1961), were lost during a fire, it is also very probable that they could be synonyms of *Geminosyllis granulosa* n. sp. and *H. spongicola* respectively.

The size and shape of first to fifth dorsal cirri and tentacular dorsal cirri was revealed to be very important to effectively differentiate *Haplosyllis carmenbrittoae* sp. nov and *Geminosyllis granulosa* n. sp. from *H. spongicola*. Conversely, these structures do not allow us to discriminate between *Geminosyllis* sp. 1 and *H. spongicola*.

The species specific chaetal differences existing between species of the *Haplosyllis spongicola* complex (Martin *et al.*, 2002) are also useful for distinguishing *Haplosyllis* from *Geminosyllis*. The distal and proximal teeth are short with a small angle in *H. spongicola*, slightly longer in *Geminosyllis* sp. 1, and much longer in *Geminosyllis granulosa* n. sp. and *Haplosyllis carmenbrittoae*. The size of the main fang is clearly longer and wider in *Geminosyllis* sp. 1. Finally, the spines of the main fang revealed to be the most species specific chaetal feature.

The differences in chaetal morphology are frequently used to identify the species of both genera

(Table 2). Like in the case of the *Haplosyllis spongicola* complex, however, recent studies have revealed species specific variability that was overlooked in the original descriptions (e.g. Martin *et al.*, 2002 for *Haplosyllis anthogorgicola*), which shows that careful, classical studies often provide strong clues for clarifying the taxonomic status of the different species.

Morphometric analysis

The multivariate morphometric approach complements the morphological observations, and both contribute to a more accurate taxonomic assessment. Both the PCA and discriminant analysis segregate *Haplosyllis spongicola*, *Geminosyllis granulosa* and *Geminosyllis* sp. 1. This shows their usefulness in distinguishing cryptic species and defining the discriminant characters.

The discriminant analysis and the PCA showed the same patterns for the selected parameters. The chaetal characters have a high weight in the first factor of the PCA, and were also selected in the discriminant analysis, with the measurements related to the main fang length being particularly determinant for identifying the species. This supports the relevancy of chaetal features in traditional studies of *Haplosyllis*. However, they must be observed in detail (using SEM if possible), taking into account their morphometric measurements and their variability along the body. The length of the proventricle has also been selected as a discriminant character, in agreement with the high variability previously pointed out (Martin *et al.*, 2003). The number of articles of both cirri and antennae highly contributed to the second factor, while their length had a lower weight. However, it is recommended to use the former instead of the latter because the appendages can bend easily, and are strongly affected by different contraction levels depending on the fixation process. Moreover, their length-associated patterns of variability seem to be species specific in many cases. In fact, the comparison between *H. chamaeleon* and *H. villogorgicola*, used to assess the description of the latter as a new species (Martin *et al.*, 2002), already demonstrated the potentially high value of the appendix-length pattern in *Haplosyllis* as a discriminant character.

Morphometric approaches are very rare in studies dealing with polychaetes. A recent attempt made on worldwide populations of the *H. spongicola* complex revealed some inter-population segregation

by means of a PCA based on a few morphometric measures, which also evidenced some allometric intra-population relationships (Martin *et al.*, 2003). The biogeographical range covered by that study, however, was more extensive than that in the present paper, so that a higher number of species could be potentially involved. Lately, three new species of *Owenia* from Australian waters were defined based on classical taxonomical descriptions, clearly supported by robust morphometric analyses (Ford and Hutchings, 2005). The morphometry of uncini in the genus *Polycirrus* was intensively explored in order to characterize the different types, which probably has interesting phylogenetic implications (Glasby and Glasby, 2006).

In other invertebrate groups, PCA and discriminant analysis based on morphological/morphometric characters are habitually performed. For instance, clear results have been obtained using genitalia morphology of butterflies (Wakeham-Dawson *et al.*, 2004). Velásquez de los Ríos and Colmenares (1999) found the PCA to be very useful for segregating hymenopterans species from Venezuela. Therefore, multivariate statistical analysis has proved to be a useful tool for helping to distinguish cryptic species, as well as selecting the morphological characters to be used in identifying them, not only for insect taxonomists, but for polychaetes too.

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