



Seamounts, canyons and slope: The preference of a new stilipedid amphipod (Crustacea: Amphipoda) for the Bay of Biscay

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ABSTRACT

North Atlantic specimens attributed to the genus *Stilipes* were first reported by Lagardère in 1977, and subsequently sampled during different research programmes on suprabenthic communities from the southern Bay of Biscay and the Galicia Bank. Their morphological study showed that they belong to a new species to science, discriminated from the four known species *S. distinctus* Holmes 1908; *S. lacteus* (K.H. Barnard, 1931); *S. sanguineus* (Hurley, 1954) and *S. macquariensis* Berge 2003. The new species was sampled in the near-bottom water layer with several multinet suprabenthic sledges. Within its known distributional area, *Stilipes lagarderei* sp. nov. is living between 462 and 1060 m depth on muddy bottoms in the canyons and on fine and medium sands on the seamounts. This upper bathyal species is very rare with a maximum abundance registered on the Galicia Bank (12.9 ind./100 m²). Considered to be a mesopelagic species, as for its congeners, the data herein presented demonstrate that *Stilipes lagarderei* sp. nov., colonizes the near-bottom environment, thus exhibiting a suprabenthic behavior. An identification key to the known *Stilipes* species is provided. Ecological notes and biological comments of the new species are also presented.

1. Introduction

According to Berge (2003), and Horton et al. (2022), the genus *Stilipes* comprises four species: *S. distinctus* Holmes, 1908 from the northern hemisphere, *S. lacteus* (K.H. Barnard, 1931), *S. sanguineus* (Hurley, 1954) and *S. macquariensis* Berge, 2003 from the southern hemisphere. *S. lacteus* and *S. sanguineus* were first described under the genus *Cacao* K. H. Barnard, 1931 (reference to the “chocolate and milk” coloration of the body in the former) and originally placed in the invalid family Tirionidae (now Synopiidae). Later on, *Cacao* was synonymized with the senior genus *Stilipes* Holmes, 1908 (family Stilipedidae) by Shoemaker (1964). In the Bay of Biscay (NE Atlantic), an undescribed upper slope species ascribed to genus *Stilipes* was first reported by Lagardère (1977). This undescribed species was subsequently sampled by suprabenthic sledges in the SE Bay of Biscay and reported by Dauvin and Sorbe (1995), Bachelet et al. (2003) as *Stilipes* sp. and by Sorbe and Weber (1995), Frutos and Sorbe (2017), and Ríos et al. (2022) as *Stilipes* sp.A. New specimens were recently sampled during investigations on

suprabenthic assemblages from the Capbreton and Avilés canyons as well as from the Le Danois and Galicia banks (OXYBENT, ECOMARG and INDEMARES programmes). The present work aims to describe this new *Stilipes* species, the first one to be reported from the North Atlantic Ocean, and also to give some information on its ecology and biology. An identification key to all known species is provided as well.

2. Material and methods

The *Stilipes* specimens examined in the present study were sampled in the SE Bay of Biscay (Arcachon Plateau, Aquitanian and Cantabrian slopes, Capbreton and Avilés canyons and Le Danois Bank) and on the Galicia Bank (a seamount off NW Iberian Peninsula, ca. 200 km from the Galician coast) during several oceanographic cruises (Fig. 1 and Table 1). They were collected during daytime (except haul TS09-A) with different near-bottom samplers: three types of suprabenthic sledges equipped with a variable number of superimposed plankton nets (0.5 mesh size), an opening-closing system of the nets activated by contact

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with the sea floor and TSK flowmeters; and, a 3.5 m-beam trawl, non-closing device (0.65 m vertical opening, 10 mm mesh-size at the cod end). The ‘Arcachon’ sledge TS-A (see Sorbe, 1983) is equipped with four nets in order to double sample the 0–50 and 50–100 cm near-bottom water layers (N1, N2). The ‘Roscoff’ sledge TS-R (see Dauvin et al., 1995) has four superimposed nets in order to sample the 10–40, 45–75, 80–110 and 115–145 cm near-bottom water layers (N1 to N4). The ‘Coruña’ sledge TS-C (see Frutos, 2006) is equipped with two nets in order to sample the 0–65 and 65–90 cm near bottom water layers (N1, N2). The sledges were towed over the bottom at a speed of 1–2 knots. The flowmeter measurements were used to calculate the haul length over the bottom as well as the water volume filtered by the nets. The beam trawl (see Serrano et al., 2017) was towed over the bottom at a speed of 2 knots during 15 min. The bottom area swept by the trawl is calculated from data (haul length) given by a Simrad ITI acoustic system fixed on the device. Sledges during ECOMARG and INDEMARES cruises were equipped with acoustic system on the frame as well.

On board, samples were preserved with a solution of 4% formalin in seawater. Only the specimen collected by means of a beam trawl was preserved in ethanol. Later on, at the laboratory, the collected fauna was sorted into major zoological groups and the *Stilipes* specimens were picked up, counted and transferred to 70% ethanol before detailed morphological study. Entire specimens were drawn with a Nikon SMZ 1000 stereomicroscope equipped with a *camera lucida*. Their body length (BL) was measured on manually extended individuals from the anterior margin of the cephalon to the telson apex. Picture of the holotype habitus was taken with a Nikon Digital Sight DS-U1 camera attached to a Nikon SMZ 1500 stereomicroscope using NIS-Elements D3.0 software. Dissected appendages were mounted in dimethyl hydantoin formaldehyde and then figured with an optical microscope ZEISS 474620-9900 equipped with a *camera lucida*. The morphological and setal nomenclatures used for the present description follows Barnard and Karaman (1991) and Garm (2004), respectively.

The holotype and paratypes are deposited at the Museo Nacional de Ciencias Naturales, Madrid (MNCN). Additional material are also deposited in the Muséum National d’Histoire Naturelle, Paris (MNHN).

3. Results

3.1. Systematics

Order Amphipoda Latreille, 1816.

Suborder Amphilochoidea Boeck, 1871

Superfamily Iphimedioidea Boeck, 1871

Family Stilipedidae Holmes, 1908

Stilipes Holmes, 1908

Stilipes, Holmes 1908: 536; Barnard and Karaman 1991: 707; Berge 2003: 2–3.

Cacao, K.H. Barnard 1931: 427 (type species: *C. lacteus* K.H. Barnard, 1931), 1932: 152–153; Hurley 1954: 804.

Type species: *Stilipes distinctus* Holmes, 1908

Species included: *S. distinctus* Holmes, 1908; *S. lacteus* (K.H. Barnard, 1932); *S. lagarderei* sp. nov.; *S. macquariensis* Berge, 2003; *S. sanguineus* (Hurley, 1954).

Stilipes lagarderei sp. nov.

(Figs. 2–11).

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Stilipes sp., Lagardère 1977: 381; Dauvin and Sorbe 1995: 458; Bachelet et al 2003: 139,151.

Stilipes sp.A, Sorbe and Weber 1995: 185, 193; Frutos and Sorbe 2017: appendix 1; Ríos et al. 2022: 8, 15.

3.1.1. Material examined

Holotype: 1 brooding (full marsupium) female, BL = 18 mm, MNCN 20.04/10041; Galicia Bank, RV *Miguel Oliver*, INDEMARES BANGAL0711 cruise, 3 August 2011, beam trawl, haul V6, 42°49.19'N 11°46.90'W, 909–887 m depth, medium sand bottom, temperature: 10.9 °C, salinity: 35.98; one vial.

Paratypes: 1 immature female, BL = 10.5 mm, MNCN 20.04/10042; Galicia Bank, RV *Cornide de Saavedra*, ECOMARG 09 cruise, 22 July 2009, “Coruña” suprabenthic sledge, haul TS4-C, 42°42.23'N

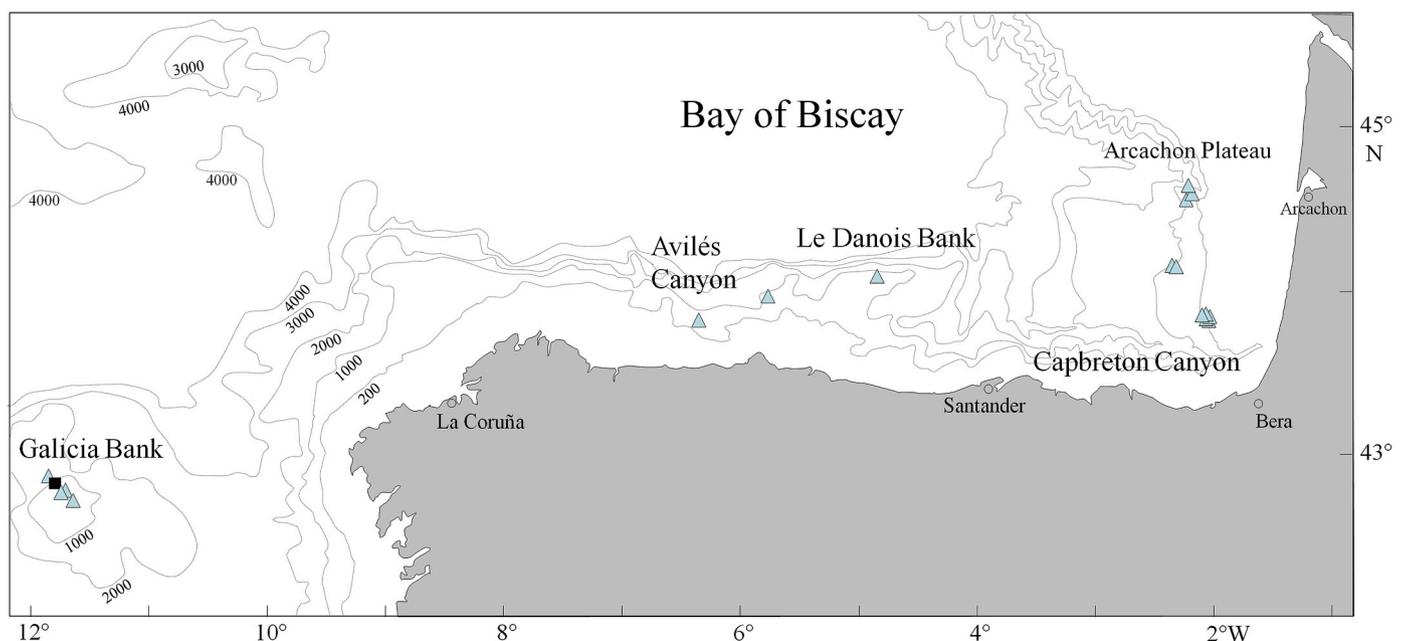


Fig. 1. Sampling stations where the amphipod *Stilipes lagarderei* sp. nov. was collected on the Galicia Bank and southern Bay of Biscay (NE Atlantic Ocean) with bottom trawling devices. Square: beam trawl; triangle: suprabenthic sledges. Isobaths in metres.

11°39.28'W, 734–735 m depth, 65–90 cm near-bottom water layer, medium sand bottom, temperature: 11.3 °C, salinity: 35.87; dissected, three slides and one vial. 1 immature female, BL = 7.8 mm, MNCN 20.04/10043; data as for paratype MNCN 20.04/10042, 0–65 cm near-bottom water layer; dissected, one slide and one vial. 1 male, BL = 14 mm, MNCN 20.04/10044; data as for paratype MNCN 20.04/10042, 0–65 cm near-bottom water layer; dissected, one slide and one vial. 1 immature female, BL = 7.8 mm, MNCN 20.04/10045; data as for paratype MNCN 20.04/10042, 0–65 cm near-bottom water layer; one vial.

3.1.2. Other material examined

1 male BL = 6.7 mm, 1 juvenile BL = 3.8 mm, MNCN 20.04/10046; data as for paratype MNCN 20.04/10042; one vial. 3 males BL = 6.7–10.0 mm, 2 immature females BL = 6.9–9.2 mm, 6 juveniles BL = 3.6–5.5 mm, MNCN 20.04/10047; data as for paratype MNCN 20.04/10042, 0–65 cm near-bottom water layer; one vial. 1 immature female BL = 6.8 mm, 1 juvenile BL = 3.6 mm, MNCN 20.04/10048; Galicia Bank, RV *Cornide de Saavedra*, ECOMARG 09 cruise, 22 July 2009, “Coruña” suprabenthic sledge, haul TS5-C, 42°47.94'N 11°45.86'W, 857 m depth, 65–90 cm near-bottom water layer, medium sand bottom, temperature: 11.3 °C, salinity: 35.99; one vial. 1 damaged specimen, 2 juveniles, 1 male BL = 7.0 mm, MNHN-IU-2014-4528, Capbreton Canyon, RV *Côtes de la Manche*, OXYBENT 1 cruise, 25 October 1997, “Roscoff” suprabenthic sledge, haul TS05-R, 44°09.92'N 2°20.94'W, 1013 m, muddy bottom, oxygen concentration at sediment-water interface: 4.36 ml l⁻¹; one vial. 3 juveniles, 1 male BL = 15.1 mm, MNHN-IU-2014-4529, Capbreton Canyon, RV *Côtes de la Manche*, OXYBENT 6 cruise, 6 December 1998, “Roscoff” suprabenthic sledge, haul TS04-R, 43°49.34'N 2°02.82'W, 561–567 m, muddy bottom, oxygen concentration at sediment-water interface: 4.71 ml l⁻¹; one vial. 2 juveniles, 3 males BL = 13.0–14.1 mm, 1 brooding (empty marsupium) female BL = 17.2 mm, MNHN-IU-2014-4530, Capbreton Canyon, RV *Côtes de la Manche*, OXYBENT 8 cruise, 19 April 1999, “Roscoff” suprabenthic sledge, haul TS05-R, 43°49.34'N 2°02.74'W, 550 m, muddy bottom, oxygen concentration at sediment-water interface: 4.60 ml l⁻¹; one vial. 1 male BL = 16.6 mm, MNHN-IU-2014-4531, Capbreton Canyon, RV *Côtes de la Manche*, OXYBENT 9 cruise, 22 June 1999, “Roscoff” suprabenthic sledge, haul TS04-R, 43°49.05'N 2°02.52'W,

500–510 m, muddy bottom, oxygen concentration at sediment-water interface: 4.78 ml l⁻¹; one vial. 3 juveniles, MNHN-IU-2014-4532, Capbreton Canyon, RV *Côtes de la Manche*, OXYBENT 10 cruise, 29 April 2000, “Roscoff” suprabenthic sledge, haul TS07-R, 43°49.14'N 2°02.64'W, 536–545 m, muddy bottom, oxygen concentration at sediment-water interface: 4.92 ml l⁻¹; one vial. 1 juvenile BL = 3.7 mm, MNHN-IU-2016-5889, Arcachon Plateau, RV *Côte d'Aquitaine*, ESSAIS II cruise, 18 May 1989, “Roscoff” suprabenthic sledge, haul TS11-R, 44°32.89'N 2°14.24'W, 923–924 m; one vial. 1 female BL = 10.7 mm, MNHN-IU-2016-5890, Arcachon Plateau, RV *Côte d'Aquitaine*, SUPRABATH I cruise, 29 April 1990, “Roscoff” suprabenthic sledge, haul TS21-R, 44°35.22'N 2°12.79'W, 690–685 m; one vial. 1 damaged specimen, MNHN-IU-2016-5891, Le Danois Bank, RV *Vizconde de Eza*, ECOMARG 03 cruise, 17 October 2003, “Arcachon” suprabenthic sledge, haul TS3-A, 44°05.85'N 4°51.08'W, 574 m depth, 50–100 cm near-bottom water layer, fine sand bottom, temperature: 10.9 °C, salinity: 35.56; one vial. 2 males BL = 7.5–8.0 mm, MNHN-IU-2016-5892, Cantabrian Slope, RV *Vizconde de Eza*, INDEMARES 0511 cruise, 14 May 2011, “Coruña” suprabenthic sledge, haul TS4-C, 43°57.59'N 5°45.99'W, 530–535 m depth, 65–90 cm near-bottom water layer, fine sand bottom, temperature: 11.5 °C, salinity: 35.64; one vial. 1 damaged specimen, MNHN-IU-2016-5893; Galicia Bank, RV *Miguel Oliver*, INDEMARES BANGAL0711 cruise, 20 July 2011, “Coruña” suprabenthic sledge, haul TSI-C, 42°51.34'N 11°50.11'W, 1058–1060 m depth, 0–65 cm near-bottom water layer, medium sand bottom, temperature: 10.8 °C, salinity: 35.97; one vial. 1 juvenile BL = 4.1 mm, 1 damaged specimen, MNHN-IU-2016-5894; Galicia Bank, RV *Miguel Oliver*, INDEMARES BANGAL0711 cruise, 3 August 2011, “Coruña” suprabenthic sledge, haul TS6-C, 42°48.19'N 11°45.66'W, 854–857 m depth, 0–65 cm near-bottom water layer, medium sand bottom, temperature: 11.1 °C, salinity: 35.99; one vial.

Type locality. Galicia Bank, off NW Iberian Peninsula (north-east Atlantic).

Etymology. This species is named in honor our colleague and friend Jean Paul Lagardère who first mentioned the presence of genus *Stilipes* in the Bay of Biscay. He carried out a pioneering work on deep-sea peracarids from that area and introduced the senior author (JCS) to the study of this deep near-bottom motile crustacean fauna (oceanographic

Table 1

Haul characteristics and abundance of the amphipod *Stilipes lagarderei* sp. nov. at different sampling stations in the NE Atlantic Ocean (S Bay of Biscay and NW Iberian Peninsula). TS-R: Roscoff sledge (N1, N2, N3, N4: 10–40 cm, 45–75 cm, 80–110 cm, 115–145 cm near-bottom sampled water layers); TS-A: Arcachon sledge (N1, N2: 0–50 cm, 50–100 cm near-bottom sampled water layers); TS-C: Coruña sledge (N1, N2: 0–65 cm, 65–90 cm near-bottom sampled water layers). V: beam trawl (non opening-closing device). ?: data not available; -: not sampled.

Cruise	Haul code	Site	Date	Time ^a	Position ^a		Depth ^b	Number of individuals				Abundance ^c
					N	W		N1	N2	N3	N4	
ESSAIS II	TS11-R	Arcachon Plateau	18/05/89	15:00	44°32.89'	2°14.24'	923–924	0	0	1	?	0.4
ECOFER I	TS05-R	Arcachon Plateau	01/07/89	13:20	44°35.57'	2°11.21'	523–522	0	0	1	0	0.2
SUPRABATH I	TS21-R	Arcachon Plateau	29/04/90	10:53	44°35.22'	2°12.79'	690–685	0	1	0	0	0.6
ECOMARGE 93	TS09-A	Arcachon Plateau	23/06/93	21:43	44°38.03'	2°13.08'	693–695	0	1	–	–	3.2
OXYBENT 1	TS05-R	Aquitainian Slope	25/10/97	14:32	44°09.92'	2°20.94'	1013–1013	?	2	2	0	1.0
OXYBENT 4	TS03-R	Capbreton Canyon	23/07/98	14:20	43°49.29'	2°02.72'	553–544	0	2	0	0	0.5
OXYBENT 6	TS04-R	Capbreton Canyon	06/12/98	15:16	43°49.34'	2°02.82'	561–567	0	4	0	0	1.0
OXYBENT 8	TS05-R	Capbreton Canyon	19/04/99	13:28	43°49.34'	2°02.74'	550–550	?	4	2	1	1.2
OXYBENT 9	TS04-R	Capbreton Canyon	22/06/99	18:29	43°49.05'	2°02.52'	510–500	0	0	0	1	0.3
OXYBENT 10	TS07-R	Capbreton Canyon	29/04/00	15:00	43°49.14'	2°02.64'	545–536	0	4	0	0	1.2
OXYBENT 10	TS13-R	Aquitainian slope	01/05/00	07:53	44°09.18'	2°20.05'	991–990	1	0	0	0	0.3
ECOMARG 03	TS3-A	Le Danois Bank	17/10/03	10:28	44°05.85'	4°51.08'	574–574	1	?	–	–	0.3
ECOMARG 09	TS4-C	Galicia Bank	22/07/09	12:24	42°42.23'	11°39.28'	734–735	14	3	–	–	12.9
ECOMARG 09	TS5-C	Galicia Bank	22/07/09	14:12	42°47.94'	11°45.86'	857–857	0	2	–	–	1.6
INDEMARES 0710	TS5-C	Avilés Canyon	23/07/10	08:52	43°49.31'	6°21.61'	500–462	0	2	–	–	0.6
INDEMARES 0511	TS4-C	Cantabrian Slope	14/05/11	13:43	43°57.59'	5°45.99'	530–535	0	2	–	–	1.6
INDEMARES 0711	TSI-C	Galicia Bank	20/07/11	12:41	42°51.34'	11°50.11'	1058–1060	1	0	–	–	0.5
INDEMARES 0711	TS6-C	Galicia Bank	03/08/11	08:35	42°48.19'	11°45.66'	854–857	2	0	–	–	1.2
INDEMARES 0711	V6	Galicia Bank	03/08/11	07:11	42°49.19'	11°46.90'	909–887	1	–	–	–	<0.1

^a Time and position of the research vessel at the end of the wire out.

^b Water depth below the research vessel at the beginning and at the end of the haul over the sea floor.

^c Cumulative abundance (ind./100 m²) in the whole near-bottom water layers sampled by the corresponding sledge.



Fig. 2. *Stilipes lagarderei* sp. nov., (brooding female holotype MNCN 20.04/10041). Habitus, lateral view; preserved in ethanol. Scale bar: 1 mm.

cruises on board of RV *Job Ha Zelian*). In the same way, the senior author introduced the junior one (IF) to the study of deep-sea peracarids also in the same area (oceanographic cruise on board RV *Côte d'Aquitaine*).

3.2. Diagnosis

Body without dorsal teeth. Bulging head with minute rostrum, sub-rostral lamina evenly convex anteriorly. Eyes large, round and prominent. Accessory flagellum 1-articulate and minute. Upper lip distally convex and rounded. Mandible incisor broad, right *lacinia mobilis* absent, molar absent. Maxilla 1 palp 2-articulate, distal article broadly expanded; inner plate with one distal row of plumose setae. Maxilliped palp greatly exceeding outer plate. Coxa 1 broadly expanded distally. Gnathopods 1–2 simple. Pereopod 7 distinctly longer than pereopods 5–6. Epimeral plate 3 with inferoposterior corner angular, more or less pointed. Urosome 1 not carinated, dorsally humped. Uropod 2 not reaching end of uropod 3. Telson distally excavate, longer than wide, without short setae on distal lobes.

3.3. Description

The morphological characteristics refer to mature female holotype and immature female paratypes; and male paratype for pereopod 5.

Body (Figs. 2 and 3) whitish and mouthparts yellow in ethanol preserved specimens. Rostrum minute, prolonged in smooth sub-rostral lamina evenly convex anteriorly (Fig. 4F). Eyes large, round and prominent. Epistome unproduced. Body dorsally smooth, but urosomite 1 dorsally with a deep excavation anteriorly and a rounded hump not carinated. Coxa 1 distally expanded, partly covering the head below eyes; coxa 2 elongate. Pereopods 5–7 and antennae elongate.

Antenna 1 (Fig. 4B) shorter than antenna 2; peduncle article 1 longer than article 2 and 3 combined. Primary flagellum elongate with 27 articles, first 4 articles short and strongly setose, remaining ones elongating toward apex. Accessory flagellum rudimentary, uniaarticulate, with 2 distal simple setae (Fig. 4A).

Antenna 2 (Fig. 4C) peduncle articles 2 and 3 wider than long; article

4 nearly as long as wide, with many setae along anterior margin and two long and two short setae at inferodistal corner; article 5 slightly longer than article 4, with many ungrouped short setae along anterior margin. Flagellum with 39 articles, first one the longest, proximal ones wider than long and remaining ones elongating toward apex and furnished only with very minute setae.

Upper lip (Fig. 4E) unlobed, shorter than broad, distally convex and rounded; inner face with a median distal depression to accommodate incisor anterior distal angle of both right and left mandibles, seen by transparency.

Mandibles (Fig. 5A and B) short. Incisor broad, with smooth and irregular cutting edge. *Lacinia mobilis* absent on right mandible, large and toothed all along anterior part of cutting edge on left mandible. Accessory setal row with 5 short simple setae on left mandible, apparently only 2 on right one. Molar absent. Palp 3-articulate, article 2 longer than 3; articles 2 and 3 with one longitudinal row of serrulate setae; article 3 with one longitudinal row of serrulate setae and 3 distal simple setae.

Lower lip (Fig. 4D) outer lobes slightly curved, converging distally, inner margins finely bristled. Inner lobes absent. Mandibular processes strong and acute.

Maxilla 1 (left, Fig. 5C) palp 2-articulate; article 1 small, sub-rectangular; article 2 broadly expanded distally and bearing distal low serrations ending by 1 short stout seta on distal corner, 12 short setae on outer and distal margins. Outer plate broad with two parallel rows of setae on distal margin: one row of 27 stout setae covering entire distal margin (only 20 on right plate) and one short brush of 17 long simple setae limited to inner distal corner (22 on right plate). Inner plate triangular, bearing 6 distal plumose setae (7 on right plate).

Maxilla 2 (Fig. 6A) inner and outer plates short, inner broader. Inner margin of inner plate strongly setose, with a mix of simple, pappose and serrate setae. Inner margin of outer plate strongly setose with one row of simple and serrate setae and another row of smaller simple setae.

Maxilliped (Fig. 6B) rather short, stout. Inner plate subrectangular, with 5 small nodular setae at mesiodistal corner, strongly setose on mesial and distal margins (simple and pappose setae). Outer plate ovate,

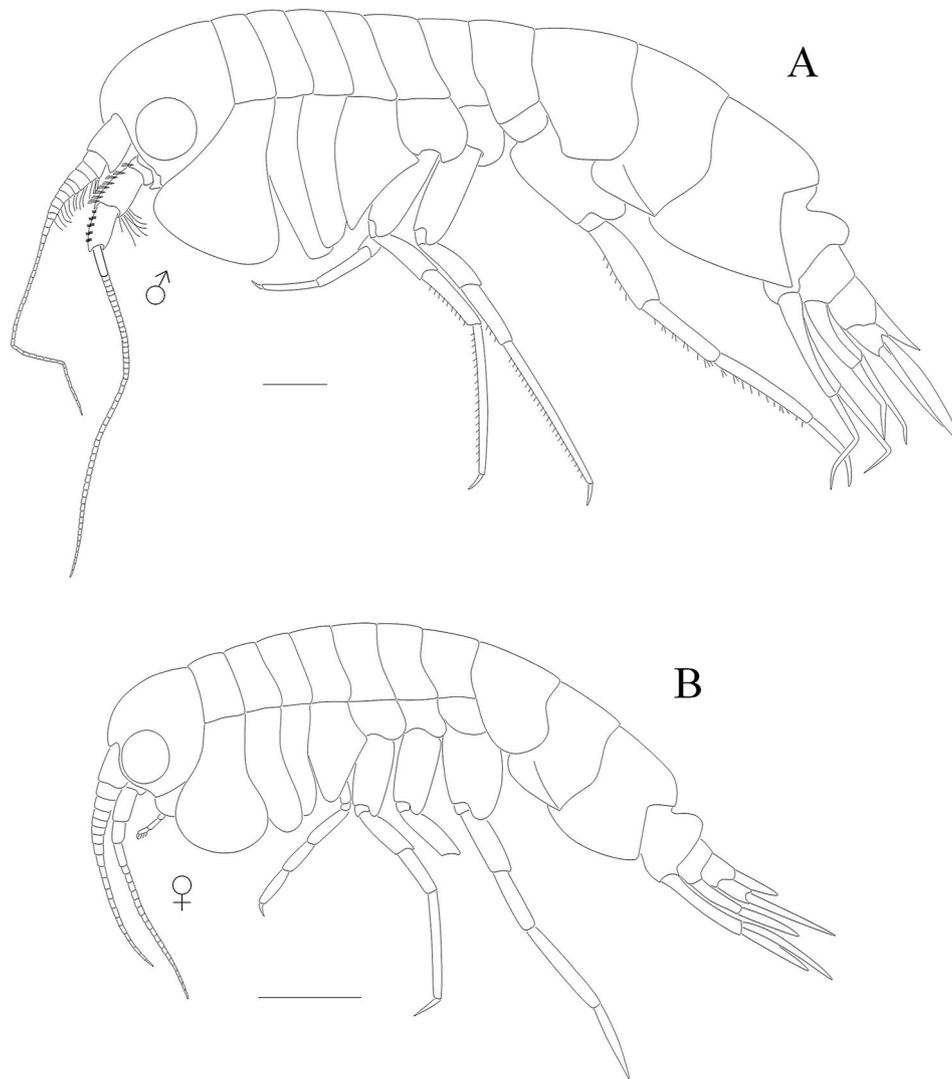


Fig. 3. *Stilipes lagarderei* sp. nov., (A, mature male 16.6 mm MNHN-IU-2014-4531; B, immature female paratype MNCN 20.04/10045). Habitus, lateral view. Scale bar: 1 mm.

broader than inner plate, reaching to middle of palp article 2, strongly setose all around (simple setae). Palp 4-articulate, greatly exceeding outer plate, article 1 laterally setose, article 2 straight, similar to article 1 and longer than 3, article 3 straight, ovate and bearing few serrate setae on distal part, article 4 short, with 2 subdistal minute setae.

Gnathopod 1 (Fig. 7A) simple, coxa distally expanded, partly covering the head below eyes. Basis with long simple setae on both anterior and posterior margins. Ischium short with few short and long simple setae on posterior margin. Merus with few simple setae along posterior margin. Carpus broad, with long simple setae along posterior margin. Propodus shorter than carpus, strongly setose with serrulate setae along posterior margin and several brushes of serrulate setae on inner face. Dactylus short, powerful and bearing few minute setae.

Gnathopod 2 (Fig. 7B) simple, alike gnathopod 1, similarly setose. Coxa long and narrow. Carpus more elongate. Dactylus short, powerful and bearing few small setae.

Pereopods 3–4 similar. Merus, carpus and propodus elongate.

Pereopod 3 (Fig. 8A) coxa long and narrow slightly shorter than pereopod 2 coxa. Basis without setae on anterior margin, few simple setae along posterior margin. Merus with few scattered serrate setae along posterior margin of merus. Carpus and propodus with brushes of serrate setae along posterior margin of carpus and propodus. Anterodistal corner of merus, carpus and propodus with two short simple

setae, one serrate and one short simple setae and two serrate setae, respectively. Dactylus short, powerful, with few minute setae.

Pereopod 4 (Fig. 8B) coxa 4 slightly shorter than coxa 3, tapering distally, posterior lobe roundly produced. Basis with few setae along anterior margin. Merus, carpus and propodus with brushes of serrate setae along posterior margin and few small simple and serrate setae along anterior margin. Dactylus short, powerful bearing few minute setae.

Coxae 5–7 without anterior lobe. Coxa 5 subrectangular, slightly excavate distally, posterior lobe inconspicuous. Coxae 6–7 with well developed posterior lobe.

Pereopods 5–6 (Fig. 8C and D) similar. Bases slightly expanded, twice as long as wide, with posterodistal lobe. Propodus length 2.1x carpus length. Merus, carpus and propodus setose along anterior margin. Dactylus short, powerful and naked.

Pereopod 7 (Fig. 8E) longer than pereopod 5 and 6. Basis more expanded than pereopod 5–6 bases (length/width = 1.6), with 6 short setae on anterior margin and very conspicuous posterodistal lobe. Merus weakly setose on anterior margin and with a (broken) posterodistal simple seta. Carpus and propodus with brushes of serrulate or simple setae along anterior margin. Propodus length 1.4x carpus length. Dactylus paddle-like, slightly shorter than propodus, bearing minute setae all along anterior margin.

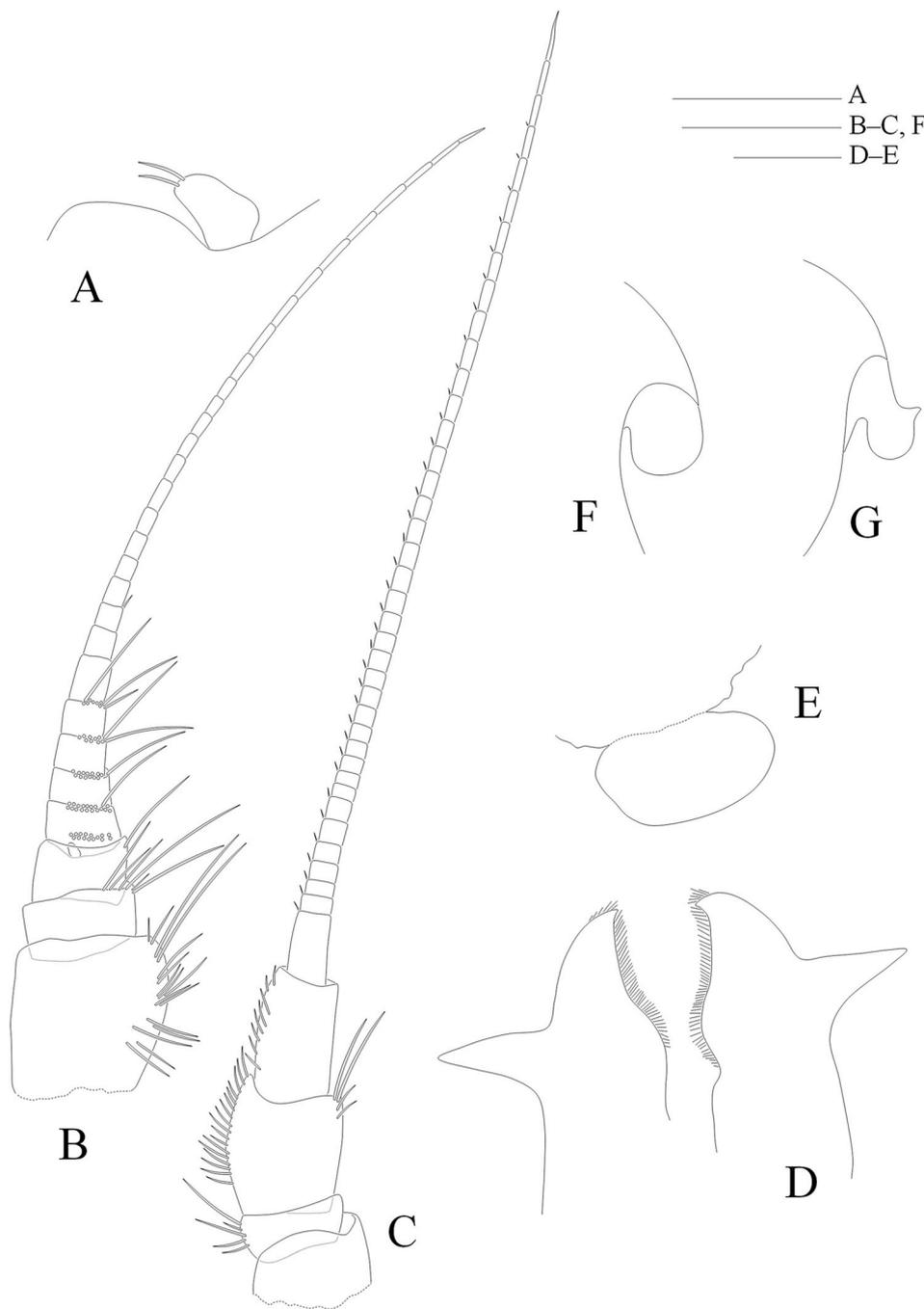


Fig. 4. *Stilipes lagarderei* sp. nov., (A–E, immature female paratype MNCN 20.04/10042; F, male paratype MNCN 20.04/10044); A, accessory flagellum of antenna 1; B, antenna 1; C, antenna 2; D, lower lip, posterior face; E, upper lip, ventral face; F, anterior part of head in lateral view, showing rostrum and smooth sub-rostral lamina (antennae removed). *Stilipes distinctus* (Holmes, 1908). G, anterior part of male head in lateral view, showing rostrum and toothed sub-rostral lamina (antennae removed), drawn after Shoemaker (1964). Scale bars: A: 0.1 mm; B–C, F: 0.5 mm; D–E: 0.3 mm.

Gills on pereopods 2–7.

Oostegites on pereopods 2–5, bearing long simple setae along whole margin in brooding female. Pear-shaped lamella on pereopods 2 and 3, broader in pereopod 2, and narrow lamella on pereopods 4 and 5, the latter the smallest.

Epimeral plates (Fig. 9): Epimeral plate 1 with parallel anterior and posterior margins, regularly rounded distally, without setae. Epimeral plate 2 subrectangular, anterior margin without setae, ventral margin slightly convex, posterodistal corner pointed and slightly produced, with a diagonal suture running across plate from it, posterior edge sinuous. Epimeral plate 3 without setae on anterior margin; ventral margin convex, posterodistal corner roundly quadrate, and posterior margin slightly convex in immature specimens, whereas ventral margin slightly straight, posterodistal corner produced and posterior margin slightly concave in mature specimens.

Uropods 1–3 (Fig. 10) biramous, rami lanceolate. Uropod 1 (Fig. 10A) peduncle slightly shorter than rami, outer rami slightly longer than inner one, short robust setae along inner and outer margins of both rami; outer margin of inner ramus and proximal inner margin of outer ramus very finely pectinate (continuous row of closely spaced short setae at high magnitude); rami apex pointed (although broken in paratype 2). Uropod 2 (Fig. 10B) peduncle shorter than rami; rami not reaching end of uropod 3; inner ramus 1.3x longer than outer one; short robust setae along inner and outer margins of both rami; outer margin of inner ramus and inner margin of outer ramus very finely pectinate; rami apex roundly pointed. Uropod 3 (Fig. 10C) peduncle conspicuously shorter than rami; inner ramus 1.2x longer than outer one; outer ramus uni-articulate; short robust setae along inner and outer margins of both rami; inner margin of outer ramus and distal margin of inner ramus very finely pectinate; rami apex roundly pointed.

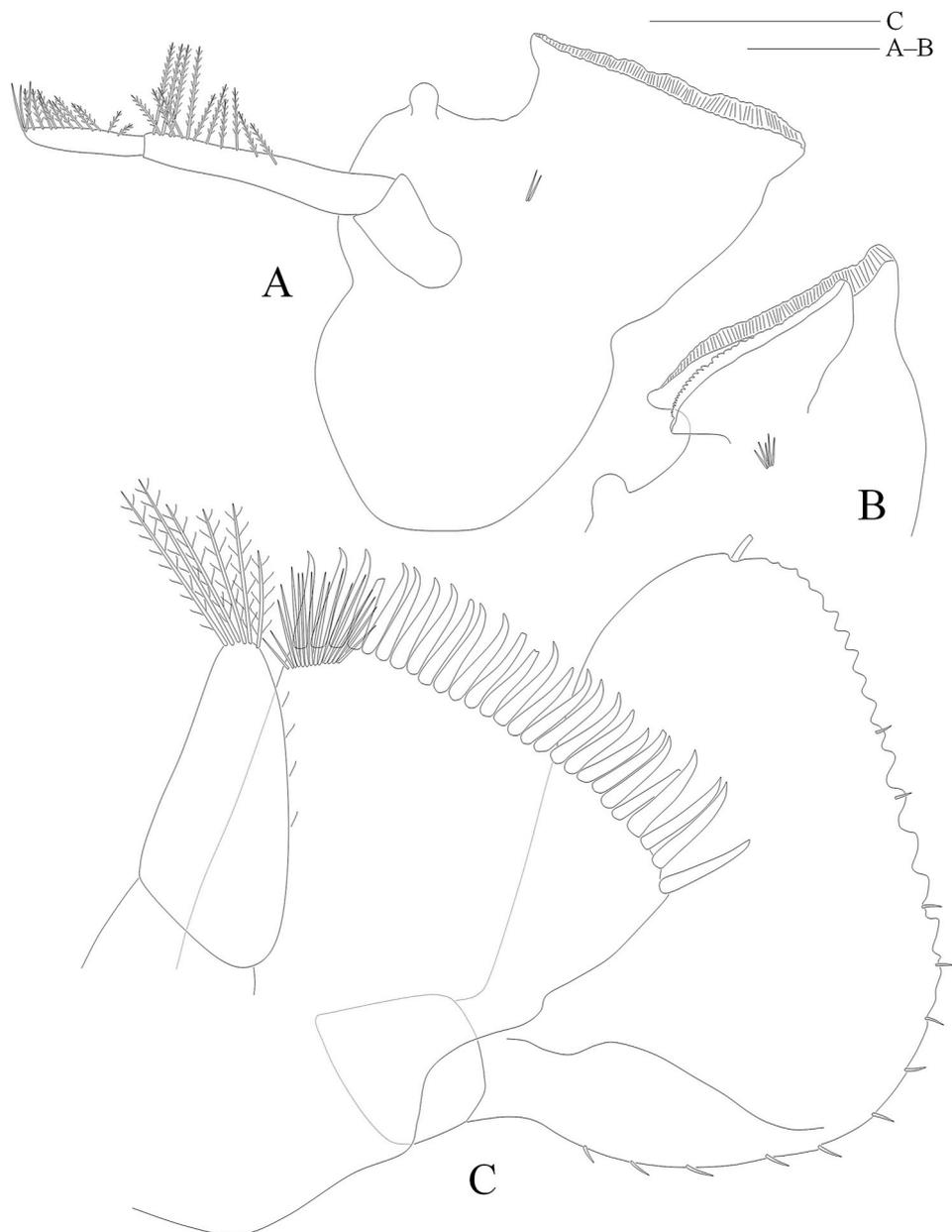


Fig. 5. *Stilipes lagarderei* sp. nov., (immature female paratype MNCN 20.04/10042). A, right mandible; B, left mandible; C, right maxilla 1, anterior face. Scale bars: 0.3 mm.

Telson (Fig. 10D) reaching beyond uropod 3 peduncle, longer than broad (length 1.2x width), narrowing distally, distal margin excavate (0.07x telson length).

Description of male (Figs. 3A, 4F and 8C, 9C–D, 11).

Similar morphology to female except antenna 2 peduncle with articles 4 and 5 more setose, somewhat tufted with setular bundles.

4. Discussion

4.1. Family remarks

In the last phylogeny and classification of Amphipoda (Lowry and Myers, 2017), the family Stilipedidae is divided into 3 subfamilies following the scheme proposed by Holman and Watling, 1983: *Alexandrellinae* Holman and Watling (1983), *Astyrinae* Pirlot, 1934 and *Stilipedinae* Holmes, 1908. The latter only encompasses the genus *Stilipes* Holmes, 1908. Andres and Lott (1986) questioned this taxonomic

composition, and the subsequent revision of Iphimediidae and similar families, rediagnosed Astyridae and Stilipedidae as two independent families (Coleman and Barnard, 1991). The latter classification was not retained by Barnard and Karaman (1991), and kept the family division into the 3 aforementioned subfamilies. The ulterior studies on different genera of the family carried out by Berge (2003) and Berge and Vader (2005a,b), did not achieve with a formal proposal about the monophyletic characteristic of the group (Serejo, 2014). Furthermore, recent phylogenetic analyses including *Alexandrellinae* and *Astyrinae* species did not support the monophyly of the family (Verheye et al., 2016, 2017).

Therefore, molecular analysis on *Stilipes* species would be essential to establish the phylogenetic relationship between the four currently accepted genera of the family: *Alexandrella* Chevreux, 1911, *Astyra* Boeck, 1871, *Eclysis* K.H. Barnard (1932), and *Stilipes* Holmes, 1908 (Horton et al., 2022). At the current stage, authors keep the discussion of the *Stilipes* species focused at the genus level, pending a deep revision of

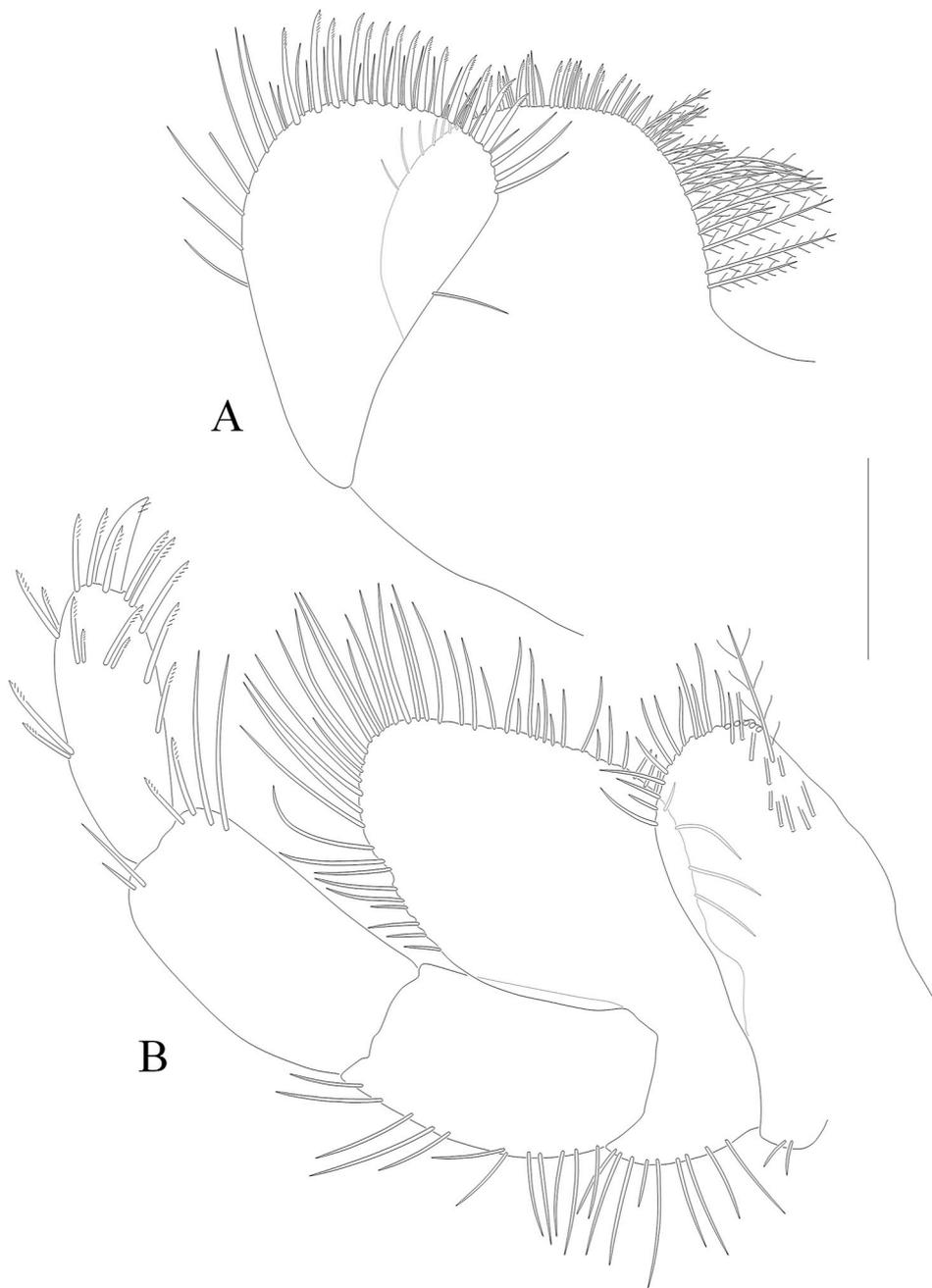


Fig. 6. *Stilipes lagarderei* sp. nov., (immature female paratype MNCN 20.04/10042). A, left maxilla 2, anterior face; B, left maxilliped, anterior face. Scale bar: 0.3 mm.

the group based on an integrative approach and waiting for a formal proposal of the statement of the family Stilipedidae.

4.2. Species remarks

As yet pointed out by Hurley (1954) and Birstein and Vinogradov (1972), the known *Stilipes* species are morphologically very close, with poorly defined differences between them. Berge (2003) first intended to build an identification key based on relative length of pereopods 5–7, of uropods 2–3 and shape of epimeral plate 3. Using this key, the North Atlantic specimens are very close to the North Pacific *S. distinctus*, at least at adult developmental stage: pereopod 7 longer than pereopods 5–6 (subequal in *S. lacteus*), posterodistal corner of epimeral plate 3 angular and more or less produced (evenly rounded in *S. macquariensis*), uropod 2 not reaching the distal end of uropod 3 (reaching beyond

uropod 3 in *S. sanguineus*). In the North Atlantic *Stilipes lagarderei* sp. nov., the shape of the epimeral plate 3 is fact depending on developmental stage: in the largest specimens (≥ 13 mm BL), the epimeral plate 3 posterodistal corner appears produced and pointed when its posterior margin is slightly concave; in smaller specimens (< 13 mm BL), its posterior margin is straight or even slightly convex, so that its posterodistal corner is not produced at all (only angular) or even more or less blunt (Figs. 3 and 9). Conversely, the relative length of pereopod 7, and uropod 2 are no size-dependent characters in the North Atlantic species.

Stilipes lagarderei sp. nov. can be distinguished from *S. distinctus* by the absence of short setae on telson distal lobes (present in *S. distinctus*), the absence of slight lateral ridges on urosomite 1 (present in *S. distinctus*), and distal margin of maxilla 1 inner plate bearing one row of plumose setae (2 rows of different length and type of setae each in *S. distinctus*).

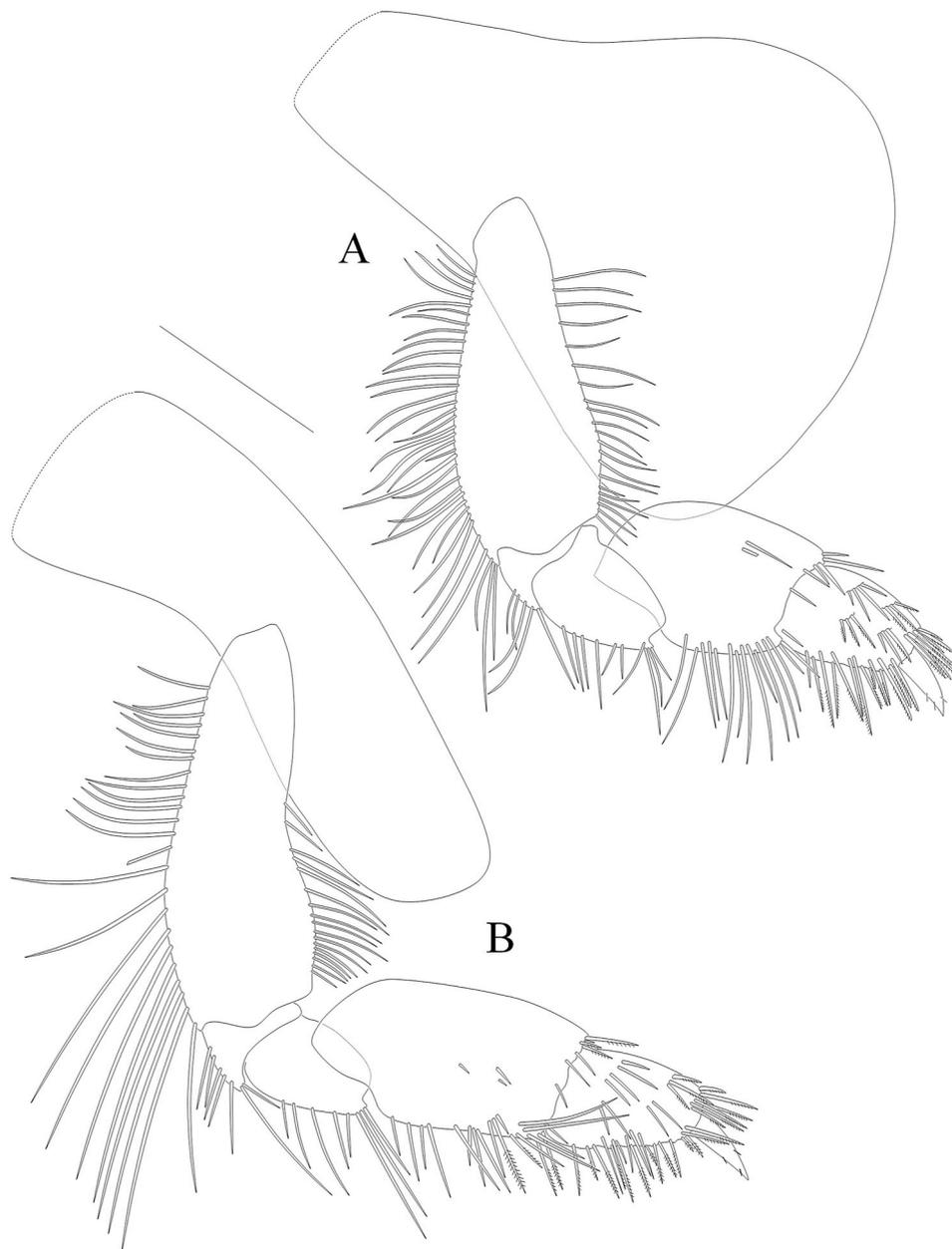


Fig. 7. *Stilipes lagarderei* sp. nov., (immature female paratype MNCN 20.04/10042). A, left gnathopod 1, inner face; B, left gnathopod 2, inner face. Scale bar: 0.5 mm.

Since Holmes (1908) established the genus *Stilipes*, its species have been described with a rostrum short (*S. distinctus* – Holmes, 1908; Shoemaker, 1964; Birstein and Vinogradov, 1972), minute (*S. lacteus* and *S. sanguineus* – K.H. Barnard, 1931, 1932 and Hurley, 1954; respectively) or even absent (*S. macquariensis* – Berge, 2003). Shoemaker (1964) noticed a peculiar downward-projection rostrum in *S. distinctus* and figured a sub-rostral lamina bearing an small anterior tooth on a 15 mm male (Fig. 4G). Specimens of *Stilipes lagarderei* sp. nov. have a sub-rostral lamina evenly rounded anteriorly, easily distinguished after antennae removal as figured for a 14 mm male (Fig. 4F). Such as unusual shape described by Shoemaker can be considered as other morphological characteristic to distinguish both

S. distinctus and *Stilipes lagarderei* sp. nov.

The upper lip of *Stilipes* was not included within the diagnostic characters of the genus nor in the description of the type species *Stilipes distinctus* (Holmes, 1908). Furthermore, additional specimens subsequently collected were described and figured with non-mention of such structure (Gurjanova, 1952; Shoemaker, 1964; Birstein and Vinogradov, 1972). The upper lip was first-time described in the diagnosis of the former genus *Cacao* as bilobed (K.H. Barnard, 1931), and consequently defined in *S. lacteus* and *S. sanguineus* as asymmetrically bilobed and asymmetrical with a slight notch showing the left side the longer, respectively (K.H. Barnard, 1932; Hurley, 1954). Later on, *S. macquariensis* was described with a “labrum” as long as broad, distally

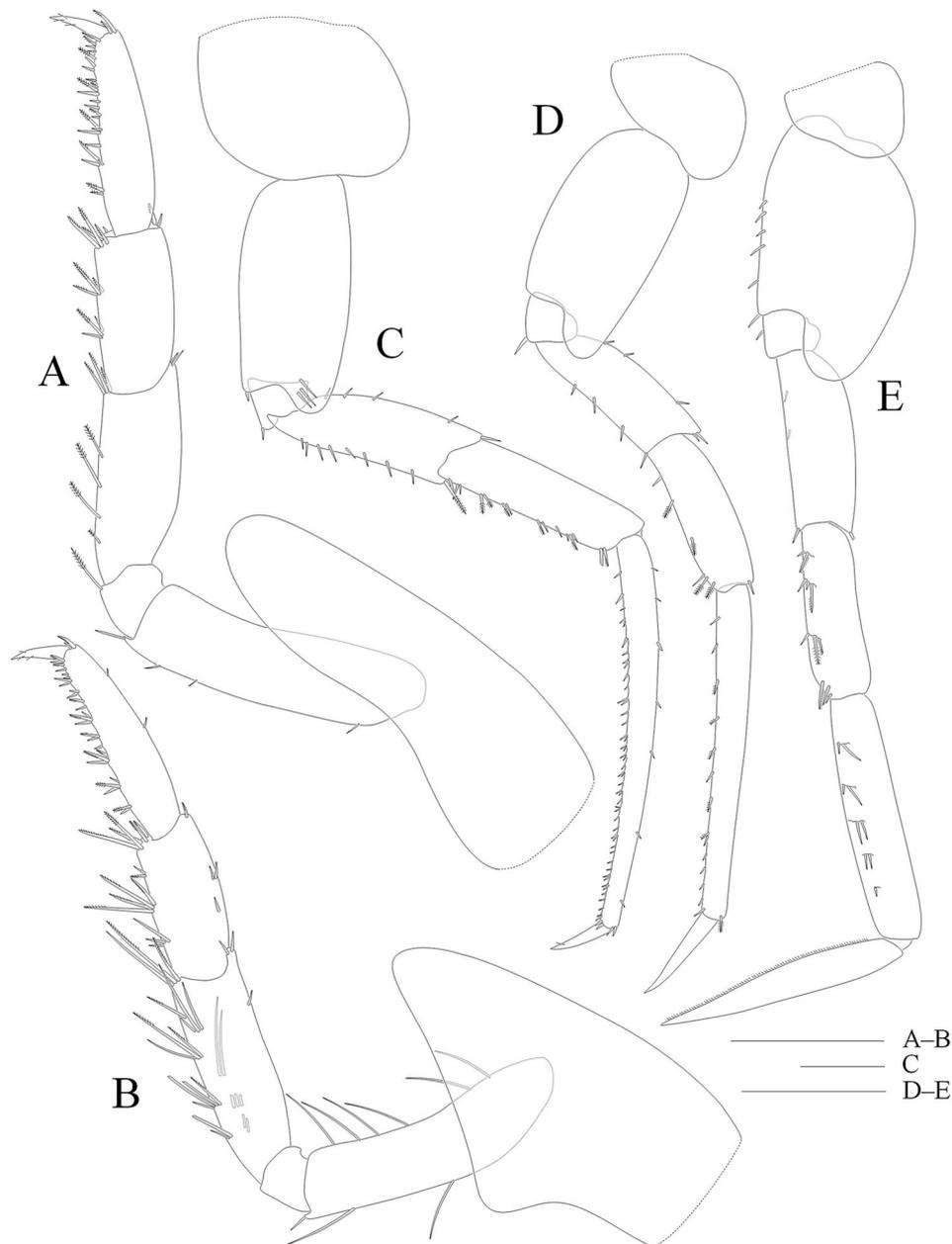


Fig. 8. *Stilipes lagarderei* sp. nov., (A–B, immature female paratype MNCN 20.04/10042; C, male paratype MNCN 20.04/10044; D–E, immature female paratype MNCN 20.04/10043). A, left pereopod 3, outer face; B, left pereopod 4, outer face; C, left pereopod 5, outer face; D, left pereopod 6, outer face; E, left pereopod 7, outer face. Scale bars: 0.5 mm.

convex and rounded, asymmetrical without left lobe (Berge, 2003). The taxonomical revision of the *Stilipes* species carried out by Berge (2003), brought to light the actually distally convex and rounded upper lip in *S. lacteus*, and asymmetrically incised one in *S. distinctus*. *Stilipes lagarderei* sp. nov. is characterized by upper lip unlobed, distally convex and rounded (Fig. 4E). Detailed examination of *in situ* upper lip on preserved specimens, has showed, by transparency, a median distal depression where both mandibles accommodate the incisor anterior distal angle (Fig. 11). This depression in the upper lip inner face could suggest a lobed margin that, in fact, it is not. Such misinterpretation seems to be happened for *S. lacteus*: upper lip originally described as asymmetrically

bilobed, it was subsequently redefined as distally rounded by Berge (2003), and figured with a dotted line in the median distal part, but with no further explanation. Nevertheless, the partly redescription of *S. distinctus* added by Berge (2003) in the aforementioned revision, also revealed the presence of a short and symmetrically weakly incised upper lip. Such as morphological feature (incised upper lip) is shared with *S. sanguineus* –asymmetrical as figured by Hurley (1954) – but it is simultaneously defining an additional distinction between *Stilipes lagarderei* sp. nov. and *S. distinctus*.

The family Stilipedidae and the genus *Stilipes* were erected to encompass the new species *Stilipes distinctus* by Holmes (1908); being all

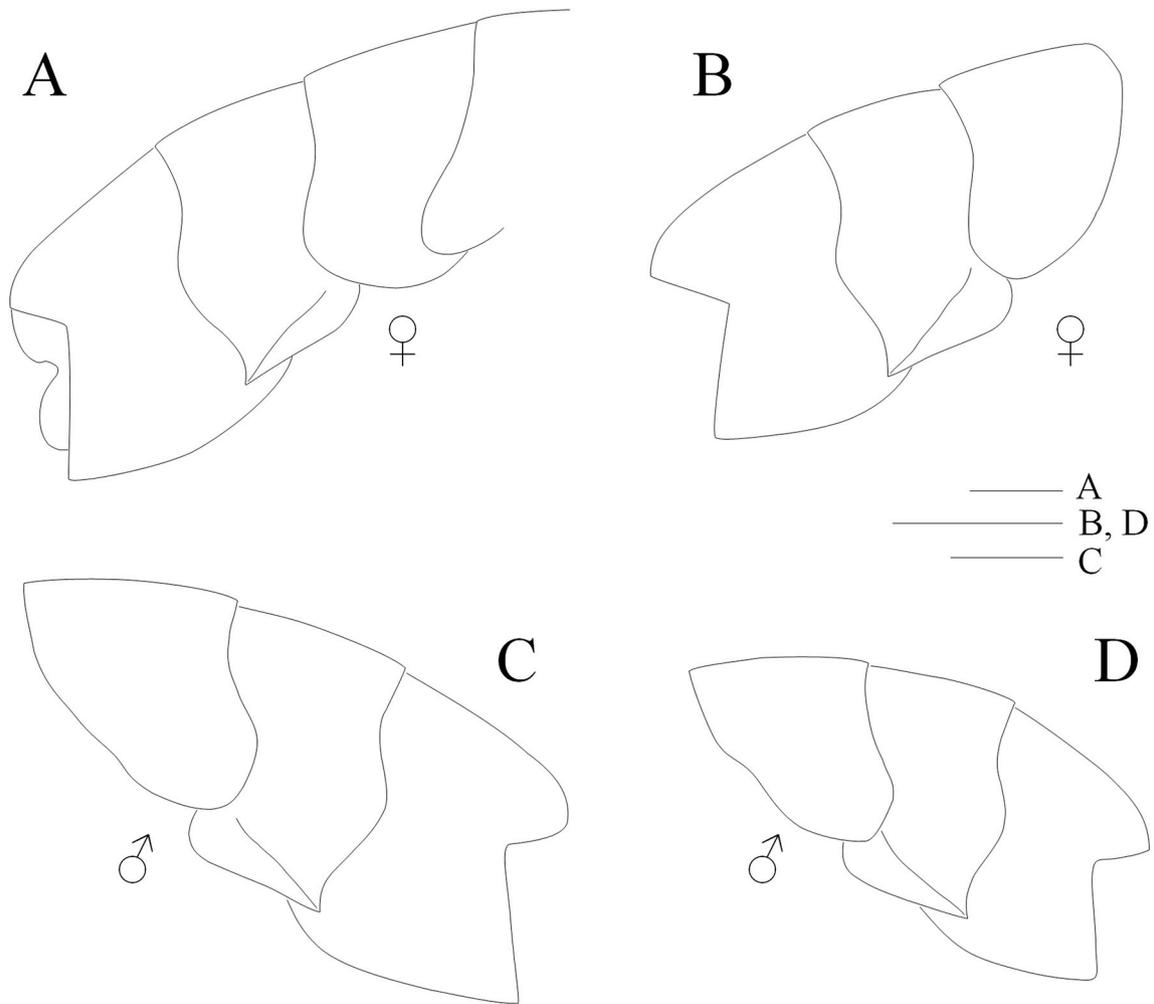


Fig. 9. *Stilipes lagarderei* sp. nov. (A, brooding female holotype MNCN 20.04/10041; B, immature female paratype MNCN 20.04/10042; C, mature male paratype MNCN 20.04/10044; D, immature male, MNCN 20.04/10047). Epimera 1–3, lateral view. Scale bars: 1 mm.

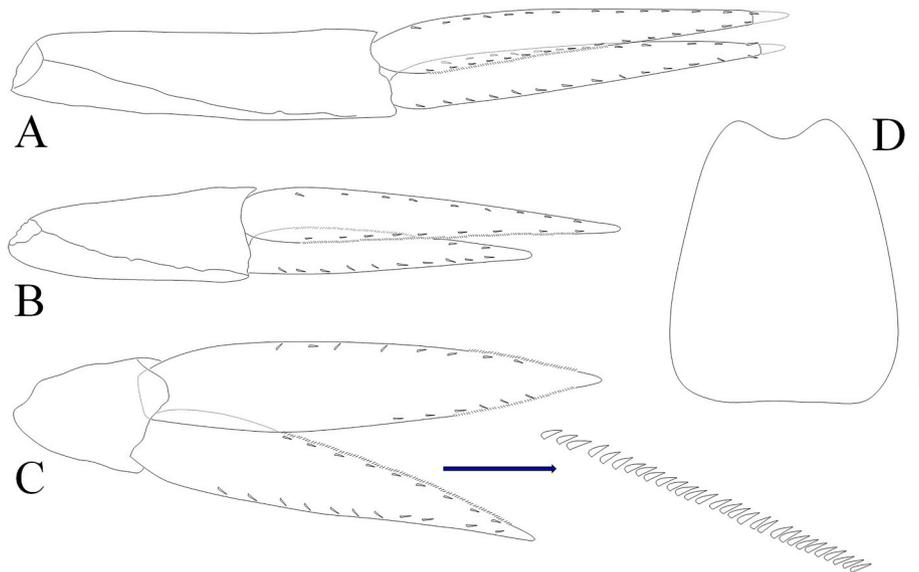


Fig. 10. *Stilipes lagarderei* sp. nov. (A–C, immature female paratype MNCN 20.04/10043; D, immature female paratype MNCN 20.04/10042). A, left uropod 1, dorsal view; B, left uropod 2, dorsal view; C, left uropod 3, dorsal view; D, telson, dorsal view. Scale bar: 0.5 mm.



Fig. 11. *Stilipes lagarderei* sp. nov. (mature male MNHN-IU-2014-4531) mouthparts, anteroventral view. Anterior distal angle of both left and right mandible incisors are visible by transparency through the distally rounded upper lip. Scale bar: 1 mm.

these taxa diagnosed with antenna 1 devoid of accessory flagellum. In the same way, and prior to be synonymized, the genus *Cacao* was also defined without accessory flagellum (K.H. Barnard, 1931). Later on, Birstein and Vinogradov (1972) and Berge (2003) revealed the presence of such as diagnostic character (defined as reduced or rudimentary unarticulated) in at least 3 species of the genus (not available material of *S. sanguineus*). *Stilipes lagarderei* sp. nov. also bears 1-articulate accessory flagellum on antenna 1. As figured in *S. distinctus* and *S. lacteus* by Birstein and Vinogradov (1972) and Berge (2003), respectively, in *S. lagarderei* sp. nov. the accessory flagellum has two distal

simple setae, whereas in *S. macquariensis* is figured with 2 simple and 1 plumose distal setae (Berge, 2003).

In the mandible description of *Stilipes* species, the cutting edge of *lacinia mobilis* has been described from partially – *S. macquariensis* by Berge (2003) and *S. distinctus* by Shoemaker (1964) – to fully dentate – *S. sanguineus* by Hurley (1954), *S. lacteus* by Berge (2003) and *S. distinctus* by Holmes (1908) and Birstein and Vinogradov (1972). Examination of specimens in the *Stilipes lagarderei* sp. nov. collection, suggests the degree of denticulation is related to developmental stage of individuals. However, the irregular shape of mandible incisor cutting edge would be due to its usage: the molt incisor with intact cutting edge is smooth and very wide.

As diagnostic morphological characteristic of the genus *Stilipes*, the maxilliped palp is greatly exceeding the outer plate, which reaches to middle of palp article 2. When compared the length of the palp article 2, however, all the five species could be easily distinguished: *S. macquariensis* shows the most stylized palp (4.0x length/width), whereas in *S. lacteus* and *S. distinctus* is moderately stylized (2.9x and 2.3x length/width, respectively). *Stilipes lagarderei* sp. nov. and *S. sanguineus* are characterized with a stout palp (1.8x and 1.7x length/width, respectively).

4.3. Key to known *Stilipes* species

Modified from Berge (2003). Distribution and ecological data according to Bowers (1906), Holmes (1908), K.H. Barnard (1932), Gurjanova (1952), Hurley (1954), Shoemaker (1964), Birstein and Vinogradov (1972), Lagardère (1977), Dauvin and Sorbe (1995), Sorbe and Weber (1995), Berge (2003), Petryashov (pers. comm.), and present study (see Fig. 12).



Fig. 12. Worldwide distribution of *Stilipes* species, based on data from Holmes (1908), K.H. Barnard (1932), Gurjanova (1952), Hurley (1954), Shoemaker (1964), Birstein and Vinogradov (1972), Dauvin and Sorbe (1995), Berge (2003), Petryashov (pers. comm.) and present study. ?: reported from the western Bering Sea by Gurjanova (1952) without mention of geographical coordinates.

- 1- Pereopod 7 distinctly longer than pereopods 5–6. 2
 - Pereopods 5–7 subequal in length. Maxilliped palp article 2 length/width = 2.9.
 *S. lacteus* (K.H. Barnard, 1931)
 Off Angola
 Epipelagic*; 0–230 m
- 2- Epimeral plate 3 posteroventrally angular or pointed. 3
 - Epimeral plate 3 posteroventrally evenly rounded. Maxilliped palp article 2 length/width =
 4.0. *S. macquariensis* Berge, 2003
 Off Macquarie Island
 Mesopelagic; 959.6 m**
- 3- Uropod 2 not reaching distal end of uropod 3 4
 - Uropod 2 reaching beyond distal end of uropod 3. Maxilliped palp article 2 length/width =
 1.7. *S. sanguineus* (Hurley, 1954)
 Off SE New Zealand
 ca. 503 m
- 4- Sub-rostral lamina with small tooth on anterior margin. Distal margin of maxilla 1 inner
 plate with 2 rows of setae, one with long pappopectinate and one with short pappose setae.
 Upper lip weakly divided in two symmetrical lobes by a median incision. Maxilliped palp
 article 2 length/width = 2.3 *S. distinctus* Holmes, 1908
 North Pacific***
 Mesopelagic; 0–1450 m
- Sub-rostral lamina evenly rounded anteriorly. Distal margin of maxilla 1 inner plate with
 one row of 6–7 plumose setae. Upper lip with distal margin evenly convex (without
 independent lobes). Maxilliped palp article 2 length/width = 1.8 *S. lagarderei* sp. nov.
 S Bay of Biscay, Galicia Bank
 Suprabenthic (mesopelagic?); 462–1060 m

*not bathypelagic as erroneously reported by Birstein and Vinogradov (1972).

**data misexpressed by Berge (2003), corrected according to Koslow and Kloser (1999) and Zeidler (2015) for the co-occurring species *Hyperoche luetkenides* Walker, 1906.

***off S California, off S Alaska, W Bering Sea, off E Kuril Islands, Sea of Okhotsk.

4.4. Ecological notes

According to Chevreux and Fage (1925), Le Danois (1948) and Ruffo (1993), the family Stilipedidae was not reported at medium latitudes in the NE Atlantic Ocean and Mediterranean Sea. Lagardère (1977) first mentioned the presence of *Stilipes* specimens on bathyal bottoms of the S Bay of Biscay. During more recent benthic surveys, this new *Stilipes* was again collected at bathyal depths (462–1060 m) in the southern part of the Bay of Biscay and on the Galicia Bank (off NW Iberian Peninsula). The literature shows that this species is probably absent in the N Bay of Biscay (Dewicke, 2002; Vanquickenberghe, 2005) as well as in more northern areas of the Atlantic Ocean (Lincoln, 1979; Palerud and Vader, 1991; Buhl-Jensen and Fosså, 1991; Brandt, 1996; Weisshappel and Svavarsson, 1998). Furthermore, *Stilipes* specimens were apparently not sampled during the BIOFAR (Faeroe Islands), BIOICE and IceAGE (Icelandic waters) benthic surveys (Sørensen, Svavarsson, Tendal, pers. comm.; Brix et al., 2018; Taylor et al., 2021). Due to poor sampling effort, the bathyal benthic fauna of meridional Atlantic areas is insufficiently known to conclude. Therefore, the geographical distribution of *Stilipes lagarderei* sp. nov. is restricted to medium latitudes in the NE Atlantic Ocean.

Within its distributional area (Fig. 1, Table 1), the abundance of *Stilipes lagarderei* sp. nov. was relatively low, being poorly represented

within the suprabenthic communities (mean abundance: $0.4 \pm 0.7\%$ of the total suprabenthic fauna collected in a haul; ranging between 0.01% of 2872.1 ind./100 m² on the Le Danois Bank, and 2.4% of 531.6 ind./100 m² on the Galicia Bank; Frutos and Sorbe, unpublished data). This very rare species showed a maximum value of 12.9 ind./100 m² on the Galicia Bank (ECOMARG 09 haul TS4-C). In this haul, the collected specimens were exceptionally abundant in the lower net of the sled (14 ind. vs. 3 ind. in the upper net), whereas in most other hauls this species was poorly represented in the lowermost net as well as in the upper ones. Furthermore, in the case of the 10 'Roscoff' sledge hauls (sledge with 4 superimposed nets N1–N4), the collected specimens showed the following relative vertical distribution: 3.8% in N1, 65.4% in N2, 23.1% in N3 and 7.7% in N4 (cumulative values from the whole hauls). As often observed for the slope euphausiids assemblages (Dauvin et al., 1995; Sorbe, 1999) as well as for the oceanic species *Meganctiphanes norvegica* (M. Sars, 1857) (Elizalde et al., 1993), the *Stilipes lagarderei* sp. nov. specimens seem to avoid a close contact with the sea floor.

As first pointed out by K.H. Barnard (1932), *Stilipes* species have been considered as pelagic fauna. They have been collected in the pelagic realm by means of both midwater trawls (Birstein and Vinogradov, 1972; Berge, 2003), and vertical hauls of plankton nets (K.H. Barnard, 1932; Shoemaker, 1964). Despite sampling was carried out at higher depths, equipment was operated far above the bottom, as noticed for

S. distinctus (0–320 m on 587–675 m depth and ca. 600 m on 2000 and 5000 m depth; Shoemaker, 1964 and Birstein and Vinogradov, 1972, respectively), and for *S. macquariensis* (959.6 m on ca. 1500 m depth; Koslow and Kloser, 1999; Berge, 2003). Furthermore, typical pelagic hyperiids such as *Scina crassicornis* (Fabricius, 1775), *Paraphronima crassipes* Claus, 1879, *Phronima sedentaria* (Forskål, 1775), *Phrosina semilunata* Risso, 1822, *Brachyscelus crusculum* Spence Bate, 1861, *B. globiceps* (Claus, 1879) and *Streetsia challengeri*, Stebbing, 1888 were accompanying fauna for *S. lacteus* and *Hyperoche luetkenides* co-occurred with *S. macquariensis* (K.H. Barnard, 1932; Zeidler, 2015). Therefore, and according to its known bathymetric range, *S. distinctus* and *S. macquariensis* can be considered as mesopelagic species whereas *S. lacteus* would be epipelagic. Conversely, *Stilipes* species have been collected during benthic studies as well. Thus *S. sanguineus* and *S. distinctus* were collected at bathyal depths by means of beam trawl or Sigsby trawl, the former in New Zealand waters (Hurley, 1954), and off California and the Sea of Okhotsk the latter (Bowers, 1906 and Petryashov, pers. comm.; respectively). Designed to collect bottom fauna, such as no-closing devices usually collect the big-sized peracarid specimens, and furthermore they could sample unintentionally pelagic species during its deployment through the water column (Frutos et al., 2017a, 2022; Ah Yong et al., 2022). Consequently, it is not possible to conclude an exclusive benthic behavior for them (see Hurley, 1954). In fact, a recent survey carried out in the Sea of Okhotsk sampling with an epibenthic sledge equipped with opening-closing system of the nets, did not reported any *S. distinctus* specimen as previously Gurjanova identified (Frutos and Jazdzewska, 2019; Petryashov, pers. comm.). During several surveys based on a multipurpose approach sampling, *Stilipes lagarderei* sp. nov. has been mainly collected in the near-bottom water layers by means of several suprabenthic sledges equipped with open-closing system of nets; and only the largest specimen was caught with a beam trawl. In addition, horizontal hauls with a WP2 plankton net performed at 8–40 m above the bottom on both the Galicia and Le Danois bank areas, did not reported *Stilipes lagarderei* sp. nov. specimens (Cartes et al., 2007, 2014). Although suspected to be a mesopelagic species as mentioned for *S. distinctus* and *S. macquariensis*, the data herein presented demonstrate that *Stilipes lagarderei* sp. nov. colonizes, at least temporarily, the near-bottom environment, thus exhibiting from time to time a suprabenthic behavior.

As shown in Table 1 and Fig. 1, *Stilipes lagarderei* sp. nov. inhabit several deep-sea areas: on the southern margin of the Cap Ferret Canyon (Arcachon Plateau, 522–924 m), on the Aquitanian slope (990–1013 m), in the Capbreton Canyon (500–567 m), on the Le Danois Bank (574 m), on the Cantabrian slope (530–535 m), in the Avilés Canyon (462–500 m) and on the Galician Bank (734–1060 m). Within its known distributional area, this species lives in upper bathyal bottoms, between 462 and 1060 m depth, where near-bottom temperature, salinity and oxygen concentration range between 9.5 and 11.3 °C, 35.56–35.99, and 4.36–4.92 ml l⁻¹ respectively (Jouanneau, Sánchez, González-Pola, pers. comm.).

From a hydrographic perspective, the distribution of *Stilipes lagarderei* sp. nov. is in the transition of the Easter North Atlantic Central Water (ENACW, from subsurface down to 500 m water depth with relatively minimal salinity), and the saline Mediterranean Outflow Water (MOW, between 700 and 1300 m water depth with a salinity maximum and oxygen minimum at ca. 1000 m water depth) (see Durieu de Madron et al., 1999; Iorga and Lozier, 1999). The MOW flows along the Iberian Peninsula slope and eastwards in the southern Bay of Biscay, which suggests the distribution of the new species would be superimposed to the along-slope flow of this water mass. However, the presence of the new species on the seamounts is probably related to its good swimming capability. The benthic community composition observed on seamounts is broadly similar to that of neighboring continental slopes, where the dispersal of sessile and mobile species is an important driver (Clark et al., 2010). As peracarid fauna, amphipods are brooders and the species dispersal is reduced and limited to the parental geographical distribution. Morphologically characteristics to swim actively (big rounded

head, maxillar palp covers the mandibles, coxa 1 folds over maxilliped protecting the anterior part of the body, well developed pleopods and a paddle-like pereopod 7 dactylus) together the effect of transport offshore by the currents, would allow *Stilipes lagarderei* sp. nov. to colonize seamount summits.

Defined as “horst” type seamount and with a top plateau raised at ca. 500 m depth, the Le Danois Bank is located in a suitable colonizing depth for the new species inhabiting the surrounding Avilés Canyon and Cantabrian Slope at similar depths (Fig. 1). Conversely, the presence of the species on the summit of the Galicia Bank, an isolated seamount located to 120 nautical miles off the NW Iberian margin, would suggest its occurrence in the corresponding mainland slope assemblage under the influence of the MOW, in accordance with the seamount epibenthic communities (Serrano et al., 2017). Therefore, due to its high swimming capacity, more southwards distribution of *Stilipes lagarderei* sp. nov. on the Iberian slope, and possible connectivity with other NE Atlantic seamounts would be expected, as it has been pointed out for the neritic mysid *Anchialina agilis* (G.O. Sars, 1877). Widely distributed on the southwestern European margin (Macquart-Moulin, 1993; Macquart-Moulin and Ribera Maycas, 1995; Cunha et al., 1997; Frutos, 2006; Sorbe et al., 2010; Frutos and Sorbe, 2014; Ríos et al., 2022), this good swimmer mysid inhabit the Gorrings, Josephine, Seine, Irving and Meteor seamounts; however, it seems not to be established on the Galician Bank because its summit is not at suitable depths for being settle (Dauvin and Sorbe, 2020).

According to sedimentary data available for the different sampling sites of this study (Weber, Anschutz, Parra, pers. comm.), *Stilipes lagarderei* sp. nov. lives on sandy mud bottoms (up to 97.6% of particles <62 µm in the substratum of station ESSAIS II TS11-R), fine sand bottoms (up to 90.9% of particles 62–500 µm in the substratum of station INDEMARES 0511 TS4-C), and medium sand bottoms (up to 25.1% of particles >500 µm in the substratum of station INDEMARES 0711 TSI-C). The substratum has a median grain size ranging between 86.6 and 366.0 µm, and organic content ranging between 1.46 and 7.33%.

S. sanguineus and *S. distinctus* live in deep-water canyon areas at ca. 500 m depth, on coarse shell-gravel and mud sediments off E New Zealand, and on gravel bottoms southern end of Alaska, respectively (Bowers, 1906; Hurley, 1954). In a similar bathymetrical range than its siblings, *Stilipes lagarderei* sp. nov. occurs in both the Capbreton and Avilés canyons on fine sediment bottom with higher organic content, where the species was not represented in the lower net of the samples (Table 1). Conversely, on the coarser sediments with less organic content characterizing the summit of both seamounts, the new species is more abundant in the lower net than in the upper one, with a maximum value on the Galicia Bank (12.9 ind./100 m²). Such as distribution suggests the species makes a selection of the distance to the bottom according to the sediment composition, avoiding the closer vicinity of the seafloor in areas of deposition of fine-grained material, temporally submitted to turbidity events (Anschutz et al., 2002; Gaudin et al., 2006; Bolliet et al., 2014; Frutos and Sorbe, 2017).

According to the habitat classification proposed by Sánchez et al. (2008), *Stilipes lagarderei* sp. nov., belongs to the *Phormosoma* – *Trachyrincus* community on the northern bank break at the Le Danois Bank, where the bathyal suprabenthic fauna is dominated by the amphipod *Pseudotiron bouvieri* Chevreux, 19895 (Frutos et al., 2017b; Frutos and Sorbe, unpublished data). Meanwhile, on the Galicia Bank summit the new species inhabit three benthic habitats (as defined by Serrano et al., 2017): the *Limopsis* and *Flabellum* assemblage, together with crawling crabs and shrimps (station ECOMARG O9 TS4-C); the bank summit with cold water coral reef of *Desmophyllum pertusum* (Linnaeus, 1758) and *Madrepora oculata* Linnaeus, 1758, and crawling decapods as *Munidopsis* spp., *Munida tenuimana* Sars, 1872 and *Bathynectes maravigna* (Prestandrea, 1839) (stations ECOMARG O9 TS5-C, INDEMARES 0711 TS6-C and V6); and the bank break *Cidaris* and *Thenea* assemblage also accompanied by the *Aristaeopsis edwardsiana* (J.Y. Johnson, 1868) and *Systemaspis debilis* (A. Milne-Edwards, 1881) shrimps (station INDEMARES 0711

TSI-C).

Spatial patterns on deep-sea suprabenthic peracarids are usually related to depth, with dominance of amphipods at the bathyal range (Frutos et al., 2017b). Population dynamics of good-swimmer peracarids are scarce and little is known on distribution of juveniles and adults of deep-sea species. They can colonize separate biotopes, as noted in the Bay of Biscay for the upper slope mysid *Boreomysis megalops* G.O. Sars, 1872 of which juveniles, after leaving the marsupium, move to shallower waters on the shelf break (Elizalde and Sorbe, 1993); or they can inhabit the same area developing a different swimming activity related to the food availability, to avoid predation or to morphological characteristics (Clutter, 1967; Hargreaves, 1985; Sainte-Marie and Brunel, 1985). Juveniles of *Stilipes lagarderei* sp. nov. (see next section) are equally represented in all sledge hauls, thus distributed at the same bathyal range than the adults. Furthermore, they showed a similar swimming activity than adults occupying the first 110 cm water layer above the bottom. However, only two large individuals (one 17.2 mm female and one 16.2 mm male at OXYBENT 8 TS05-R and OXYBENT 9 TS04-R, respectively) occurred at the highest water layer sampled by the “Roscoff” sledge, suggesting a possible better swimming condition for mature individuals.

4.5. Biological notes

A total of 55 specimens of *Stilipes lagarderei* sp. nov. were collected in the NE Atlantic. From 46 individuals available for examination, 28.2% were classified as males (presence of penile processes on ventral face of pereonite 7), 4.4% mature females (presence of oostegites on coxae 2–5), 15.2% immature females, and 52.2% as juveniles (without visible sexual characters). Therefore, the sex-ratio seems to be more in favor of males.

Other *Stilipes* species are represented by small number or individuals, usually collected in a sole station (K.H. Barnard, 1932; Hurley, 1954; Berge, 2003). Only females are known for *S. sanguineus* and *S. macquariensis*, all of them brooding; whereas for *S. distinctus* and *S. lacteus* both sexes are represented, with only mention of immature specimens in the latter (K.H. Barnard, 1932; Shoemaker, 1964; Birstein and Vinogradov, 1972).

The body length of *Stilipes lagarderei* sp. nov. ranges between 6.7 and 16.6 mm for males, 6.8 and 18.0 mm for females, and 3.6 and 5.5 mm for juveniles. As it is also reported in other *Stilipes* species, the two brooding females are the largest specimens of the collection (BL = 17.2 and 18.0 mm). Such as length allows to consider *Stilipes lagarderei* sp. nov. as medium-sized species between the bigger *S. distinctus*, *S. sanguineus* and *S. macquariensis* (21–22 mm length) and the smaller *S. lacteus* (14–15 mm length).

The mature females of *Stilipes lagarderei* sp. nov. bear oostegites on pereopods 2–5, but not so much information has been noticed through literature. In the description of *Stilipes* species, a small number of mature females has been reported: 1 *S. distinctus*, 5 *S. lacteus*, 3 *S. sanguineus*, and 1 *S. macquariensis*. All of them has been named as ovigerous female, but not information about the marsupium and its content has been referred. Hurley (1954) described *S. sanguineus* based on a 21 mm female and just mentioned “brood-pouch” in her characteristics. Later on, Berge (2003) revealed the presence of oostegites on pereopods 2–5 in the female of *S. distinctus* previously described by Shoemaker (1964), and, in addition, described *S. macquariensis* based on a female bearing oostegites on pereopods 2–4. Such characteristic for the latter certainly reinforces the differences with *Stilipes lagarderei* sp. nov. During the different surveys carried out in the Bay of Biscay area, two brooding females have been reported in the material examined. The 17.2 mm length female (MNHN-IU-2014-4530) sampled in the Capbreton Canyon (500 m) in spring (19 April 1999) was empty marsupium, whereas the holotype female (MNCN 20.04/10041) sampled at the Galicia Bank (887–909m) in summer (3 August 2011) was full. Apparently intact, its marsupium contained 29 ovoid eggs (mean major/minor axis: 0.85/0.66 mm).

Besides the first NE Atlantic record reported by Lagardère (1977), *Stilipes lagarderei* sp. nov. has been collected since 1989 to 2011 in the southern Bay of Biscay, and during a three-year monitoring survey of the Galicia Bank. Such as long-term occurrence allows us to recognize a well-established population in the area. That is also confirmed by the representation of all categories of individuals, from juveniles to mature males and females, in the suprabenthic samples collected during 22 years of sampling effort in the area.

CRedit authorship contribution statement

Inmaculada Frutos: Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The research data are available in the paper

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