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1 *Malmgrenia louiseae* sp. nov., a new scale worm species (Polychaeta: Polynoidae) from
2 Southern Europe with a key to European *Malmgrenia* species.

3
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29
30 *Malmgrenia louiseae* sp. nov. is described from both the Western Mediterranean in the Gulf of
31 Lions, and the North-east Atlantic from off Portugal and the Bay of Biscay. The species was
32 found in muddy sediments in shallow water and is possibly associated with echiurids or
33 synaptid holothurians. *Malmgrenia louiseae* sp. nov. can be clearly distinguished from all
34 other known *Malmgrenia* species by the presence of an infra-acicular process in addition to
35 the supra-acicular process on the acicular lobe of the neuropodia, the lack of microtubercles
36 on the elytra, two kinds of notochaetae (stout with blunt tip and slender with fine pointed tip),
37 and exclusively unidentate neurochaetae. An identification key to the North-east Atlantic and
38 Mediterranean *Malmgrenia* species is provided.

39
40
41 **Key words:** Polychaeta, Polynoidae, Taxonomy, *Malmgrenia*, Mediterranean, North-east
42 Atlantic, Associations

43 44 45 INTRODUCTION

46
47 Five programs monitoring benthic communities, independently carried out in the Gulf of
48 Lions, Mediterranean, in Portuguese waters and in the Pertuis Charentais part of the Bay of
49 Biscay led to the collection of several specimens of an unknown polynoid species. The review

50 of these specimens during the 4th RESOMAR Benthos Taxonomic Workshop held in June
51 2013 in La Rochelle revealed that they belong to a hitherto unknown *Malmgrenia* species.
52 So far 10 species of *Malmgrenia* McIntosh, 1874 have been reported from the Mediterranean
53 and the North-east Atlantic to which the new species *M. louiseae* sp. nov., described herein,
54 has to be added (Table 1). They were either attributed to the genus *Malmgrenia* McIntosh,
55 1874 or *Malmgreniella* Hartman, 1967 by their respective original author and there has been
56 some controversy in the literature regarding the correct generic name to be used (Barnich &
57 Fiege, 2001; Muir & Chambers, 2008). Following ICZN Opinion 2233 (2009), which ruled
58 that the usage of the generic name *Malmgrenia* McIntosh, 1874 is to be conserved, at least the
59 North-east Atlantic and Mediterranean species should now be attributed to this genus.
60 Most of these species are known to live in association with echinoderms and other
61 invertebrates such as tubicolous or terricolous species (Barel & Kramers, 1977; Pettibone
62 1993). The potential associates are reported and a key to all *Malmgrenia* species found in the
63 area is given.

64
65

66 MATERIAL AND METHODS

67

68 The specimens were collected from subtidal grab samples (Van Veen or Smith-McIntyre) in
69 the following surveys or inventories of benthic macrofauna communities: CARTHAM in the
70 Mediterranean (ASCONIT, 2012), Guia marine outfall monitoring program, ACOSHELF and
71 MeshAtlantic in Portuguese waters, OBIONE in Bay of Biscay (Table 2; Figure 1).

72 The samples were washed with sea water onboard on a 1 mm mesh size and fixed in a 4%
73 formalin-sea water solution. They were sorted in the laboratory and the specimens preserved
74 in a 70% ethanol solution. All observations and measurements were carried out on fixed
75 specimens. The animals were very fragile and most of the elytra were lost and bodies
76 fragmented during the washing steps. Also, body fragmentation and elytra losses occurred
77 when live specimens were added to freshwater or alcohol.

78 The preserved specimens were studied and photographed using a stereomicroscope Leica
79 M205C coupled to a digital camera Leica IC80HD and the Leica Application Software.
80 Details of elytra and parapodia needed the use of a compound microscope (Leica DMIRB,
81 coupled with a digital camera Olympus DP70 and the DP Controller software). The
82 photographs of the holotype were used as basis for drawings of the animal with the free vector
83 graphics editor Inkscape.

84 Length (L) was measured from the anterior margin of the prostomium to the posterior border
85 of the last segment (pharynx not included, if everted) and width (W) was taken at the widest
86 segment, including parapodia but excluding chaetae.

87 The type material is deposited in the collections of the Muséum National d'Histoire Naturelle
88 de Paris, France (MNHN), the Museu Nacional de História Natural e da Ciência de Lisboa,
89 Portugal (MNHNC-UL) and the Senckenberg Museum Frankfurt, Germany (SMF).

90
91

92 SYSTEMATICS

93 Family POLYNOIDAE Kinberg, 1856

94 Genus *Malmgrenia* McIntosh, 1874

95

96 TYPE SPECIES *Malmgrenia andreapolis* McIntosh, 1874

97

98 DIAGNOSIS (emended to include new species described herein)

99 Body flattened dorsoventrally, short, up to 46 segments, more or less covered by elytra or
100 short tail uncovered (large specimens). Elytra 15 pairs on segments 2, 4, 5, 7, 9, 11, 13, 15,
101 17, 19, 21, 23, 26, 29, 32. Prostomium bilobed, without distinct cephalic peaks, with three
102 antennae; lateral antennae with ceratophores inserted terminoventrally; two pairs of eyes,
103 anterior pair usually dorsolaterally in front of widest part of prostomium, posterior pair
104 dorsally near hind margin of prostomium. Parapodia biramous, noto- and neuropodia with
105 elongate acicular lobe; tips of noto- and neuroacicula penetrating epidermis; neuropodia with
106 or without supra-acicular or sub-acicular process. Notochaetae with rows of spines and blunt
107 or pointed tips; neurochaetae more numerous, with rows of spines only distally and one or
108 two kinds of tips: bidentate with secondary tooth subdistally and/or unidentate with pointed or
109 knob-like tip.

110
111 *Malmgrenia louiseae* sp. nov. (Figure 2)

112
113 TYPE MATERIAL

114 **Holotype:** 1 complete specimen (cs) (MNHN POLY TYPE 1559), L 13.7 mm W 4.3 mm for
115 33 segments (fragmented); Gulf of Lions, Côte Catalane, CARTHAM B50, 24 August 2010,
116 3°09'57''E 42°35'19,6''N; 56 m, coastal mud, leg. C. Labrune and J-M. Amouroux.

117 **Paratypes:** 1 cs (MNHN POLY TYPE 1560), L 10.5 mm W 3.7 mm for 32 segments
118 (fragmented); Bay of Biscay, Pertuis Charentais, OBIONE, Antioche, 22 August 2011,
119 1°18'30''W 46°05'03''N, 35 m, coastal muddy sand, leg. J. Jourde and P-G. Sauriau.

120 1 cs (SMF 23918), L 12.5 mm W 3.8 mm for 34 segments (fragmented); Bay of Biscay,
121 Pertuis Charentais, OBIONE, Antioche, 28 March 2012, 1°18'30''W 46°05'03''N, 35 m,
122 coastal muddy sand, leg. J. Jourde and P-G. Sauriau.

123 1 cs (MB29-000340), L 22 mm W 5 mm for 36 segments (fragmented); off Portugal, Cascais-
124 Guia G29(2), October 2008, 9°24'58.50''W 38° 39' 37.86''N, 34 m, mud, leg. L. Sampaio and
125 V. Quintino.

126 2 anterior fragments (MB29-000340), L 5.5 mm W 4.5 for 12 segments and L 3 mm W 2.5
127 mm for 11 segments; off Portugal, Cascais-Guia G29(2), October 2008, 9°24'58.50'' W 38°
128 39' 37.86''N, 34 m, mud, leg. L. Sampaio and V. Quintino.

129
130 DIAGNOSIS

131 Elytral surface smooth, microtubercles totally absent, outer lateral elytral margin with few
132 small scattered papillae, posterior margin with fewer short papillae; neuropodia with an infra-
133 acicular process in addition to the supra-acicular process; two types of notochaetae: upper
134 ones stout with blunt tips and lower ones slender with very pointed tips; neurochaetae all
135 unidentate, upper tapering to long, pointed tips.

136
137 DESCRIPTION (based on holotype)

138 Prostomium bilobed, without cephalic peaks; median antenna with ceratophore in anterior
139 notch, style papillate, tapering to filiform tip; lateral antennae with ceratophores inserted
140 terminoventrally and with papillate, tapering styles; palps smooth, long, tapering; anterior pair
141 of eyes dorsolaterally in front of widest part of prostomium, posterior pair dorsally near hind
142 margin (Figure 2A). Tentaculophores inserted laterally to prostomium, without chaetae, with
143 a pair of papillate dorsal and ventral tentacular cirri, tapering to filiform tip. Second segment
144 with first pair of elytra, biramous parapodia, ventral buccal cirri obviously longer than the
145 following ventral cirri, papillate. 15 pairs of elytra for 33 chaetigers; elytra delicate, surface
146 smooth; outer lateral and posterior elytral margin with few short papillae; surface near the
147 outer lateral margin with very few scattered surface papillae of variable length (some as long
148 as the largest marginal papillae); faint pigmentation in form of isolated spot near place of

149 attachment of elythrochore and on the inner lateral part (Figure 2B-C). Styles of dorsal cirri
150 papillate, tapering to filiform tip, extending beyond tips of neurochaetae; styles of ventral cirri
151 with few papillae, tapering, shorter than neuropodia (Figure 2D). Parapodia biramous, both
152 rami with single aciculum penetrating epidermis; notopodia with short, inconspicuous
153 rounded preacicular lobe and longer, pointed acicular lobe; neuropodia with subconical
154 prechaetal acicular lobe with longer, digitiform supra-acicular process and shorter, but
155 conspicuous sub-acicular process, postchaetal lobe rounded (Figure 2D). Notochaetae with
156 distinct rows of spines and of two kinds: upper ones stout with blunt tip and lower ones
157 slender, tapering to very fine tip, (Figure 2 E1-E2); neurochaetae with rows of spines only in
158 distal part; upper tapering to long, pointed, unidentate tip, lower ones with short bent enlarged
159 distal part ending in blunt tip, middle ones of intermediate shape with blunt distal part (Figure
160 2 E3-E5).

161

162 HABITAT

163 The species is currently known from muddy substrates, between 34 to 110 m depth (Table 2).
164 Several potential hosts were found in the stations where the new species was collected. Thus,
165 most of the Portuguese specimens were caught with the echiurid *Thalassema thalasseum*
166 (Pallas, 1766) and one with the synaptid holothurian *Leptosynapta inhaerens* (O. F. Müller,
167 1776). However, specimens of *Malmgrenia louiseae* sp. nov. were never observed in
168 immediate contact with the echiurid or the holothurian. In the Bay of Biscay, all the
169 specimens were collected with *Leptosynapta* cf. *bergensis* (Östergren, 1905) and one
170 specimen was observed in contact with the holothurian. The Mediterranean specimens were
171 collected with the synaptid *Oestergrenia digitata* (Montagu, 1815).

172

173 DISTRIBUTION

174 Currently known from type locality in the Western Mediterranean (Gulf of Lions) and North-
175 east Atlantic: Portuguese coasts (Cascais-Guia, Costa da Caparica and Figueira da Foz) and
176 Bay of Biscay (Pertuis Charentais).

177

178 ETYMOLOGY

179 The species is named in honor of Louise Jourde, first author's daughter, born a few months
180 before the beginning of this work.

181

182 REMARKS

183 *Malmgrenia louiseae* sp. nov. is unique due to its neuropodial sub-acicular process present in
184 addition to the supra-acicular process which is known from several other *Malmgrenia* and
185 many other polynoid species. It might be confused with *Malmgrenia liliana* (Pettibone,
186 1993), a species originally described from the South-west Atlantic (Pettibone, 1993), then
187 reported for the Mediterranean (Barnich & Fiege, 2001 & 2003) and now also recorded from
188 North-east Atlantic off Portugal (unpublished) and in Bay of Biscay (unpublished). In both
189 species elytra are devoid of microtubercles, with marginal papillae, and neurochaetae are
190 exclusively unidentate. However, in *M. liliana* there is only one kind of notochaetae (stout
191 with pointed tip) and the sub-acicular process is absent. The identification key given below
192 highlights further differences to other species in Europe.

193

194 KEY TO NORTH-EAST ATLANTIC AND MEDITERRANEAN *MALMGRENIA* SPECIES

195

- 196 1. Elytral margin with many long papillae 2
197 - Elytral margin with few scattered papillae or margin smooth 3

198

199	2.	Elytral surface covered more or less completely by microtubercles; neurochaetae all	
200		unidentate, tapering to long, pointed tips, supra-acicular process digitiform <i>M. polypapillata</i>	
201	-	Elytral surface with patch of microtubercles in anterior part; neurochaetae bi- and	
202		unidentate; supra-acicular process absent	<i>M. mcintoshi</i>
203			
204	3.	Elytral surface without microtubercles	4
205	-	Elytral surface with microtubercles	5
206			
207	4.	Neuropodial acicular lobe with digitiform to conical supra-acicular process; short and	
208		long notochaetae stout with pointed tip; neurochaetae unidentate	<i>M. lilianae</i>
209	-	Neuropodial acicular lobe distally bilobed with digitiform to conical supra-acicular	
210		process and shorter sub-acicular process; short notochaetae with blunt tip, long	
211		notochaetae with slender, pointed tip; neurochaetae unidentate	<i>M. louiseae</i> sp. nov.
212			
213	5.	Elytral surface covered more or less completely by microtubercles, neurochaetae usually	
214		all bidentate	<i>M. ljunghmani</i>
215	-	Elytral surface with patch of microtubercles in anterior part; neurochaetae bi- and	
216		unidentate	6
217			
218	6.	Neuropodia without supra-acicular process	<i>M. marphysae</i>
219	-	Neuropodia with supra-acicular process	7
220			
221	7.	Short notochaetae stout, with blunt tip; long notochaetae slender, with pointed tip; upper	
222		and middle neurochaetae bidentate, lower unidentate	<i>M. darbouxi</i>
223	-	All notochaetae stout with blunt or pointed tip	8
224			
225	8.	Antennae and cirri smooth (short and thick)	<i>M. castanea</i>
226	-	Antennae and cirri papillate	9
227			
228	9.	Supra-acicular process small, digitiform	<i>M. lunulata</i>
229	-	Supra-acicular process wide bulbous or subconical	10
230			
231	10.	Neurochaetae usually all bidentate, unidentate neurochaetae (if present) with pointed tip .	
232		<i>M. arenicolae</i>
233	-	Upper and lower neurochaetae usually unidentate with knob-like tip, middle neurochaetae	
234		bidentate	<i>M. andreapolis</i>
235			
236			

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262

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293

294 Figure captions

295

296 **Table 1.** *Malmgrenia* species known to occur in the Mediterranean and North-East Atlantic
297 (cf. Barnich & Fiege 2001 & 2003; Barnich 2011; Pettibone 1993).

298

299 **Table 2.** Localities, geographical coordinates (WGS 84), sediment, depth, number of
300 specimens collected and sampling dates of *Malmgrenia louiseae* sp. nov.

301

302 **Figure 1.** Sampling locations of *Malmgrenia louiseae* sp. nov. between 2002 and 2012.

303

304 **Figure 2.** *Malmgrenia louiseae* sp. nov., holotype (MNHN POLY TYPE 1559): (A) anterior
305 end, dorsal view; (B) left middle elytron (9th); (C) detail of lateral margin of same; (D) right
306 cirriferous parapodium of chaetiger 12, posterior view; (E) chaetae, E1: upper notochaetae,
307 E2: lower notochaetae, E3: upper neurochaetae, E4: middle neurochaetae, E5: lower
308 neurochaetae. Scale bars: A, 1 mm; B, D, 500 µm; E1, E2, C, 100 µm; E3, E4, E5, 50 µm.

309

310 **Table 1.**

Species	Mediterranean	North-East Atlantic
<i>M. andreapolis</i> McIntosh, 1874	X	X
<i>M. arenicolae</i> (de Saint Joseph, 1888)		X
<i>M. castanea</i> McIntosh, 1876	X	X
<i>M. darbouxi</i> (Pettibone, 1993)	X	X
<i>M. lilianae</i> (Pettibone, 1993)	X	X
<i>M. ljunghmani</i> (Malmgren, 1867)	X	X
<i>M. louiseae</i> sp. nov.	X	X
<i>M. lunulata</i> (Delle Chiaje, 1830)	X	X
<i>M. marphysae</i> McIntosh, 1876		X
<i>M. mcintoshi</i> Tebble & Chambers, 1982		X
<i>M. polypapillata</i> (Barnich & Fiege, 2001)	X	

311

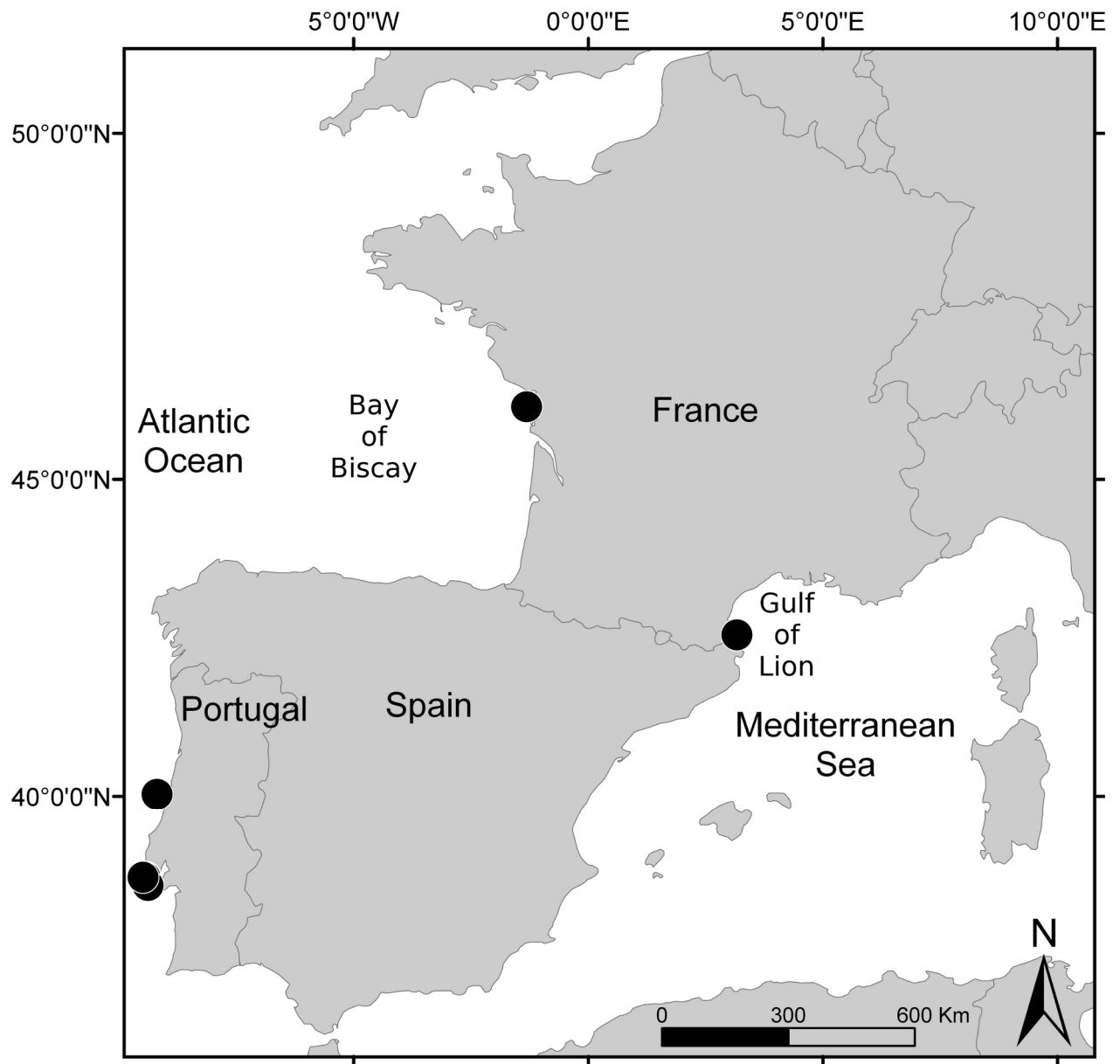
312 **Table 2.**

Localities	Coordinates	Sediment	Depth	N	Month/Year
Cascais-Guia	38° 39' 33.66"N 09° 28' 34.32"W	mud	76 m	1	10/02
Cascais-Guia	38° 39' 37.86"N 09° 24' 58.50"W	mud	34 m	1	10/02
Cascais-Guia	38° 39' 37.86"N 09° 24' 58.50"W	mud	34 m	7	01/06, 10/08, 09/09
Cascais-Guia	38° 39' 31.62"N 09° 26' 06.36"W	mud	48 m	1	10/07, 10/08
Cascais-Guia	38° 39' 33.66"N 09° 28' 34.32"W	mud	76 m	1	10/08
Costa da Caparica	38° 31' 29.81"N 09° 22' 01.26"W	mud	110 m	1	04/08
Figueira da Foz	40° 02' 18.23"N 09° 10' 28.50"W	mud	100 m	1	06/10
Gulf of Lions, Côte Catalane	42° 35' 19.60"N 03° 09' 57.00"E	sandy mud	56 m	2	08/10
Bay of Biscay, Pertuis Charentais	46° 05' 03.00"N 01° 18' 30.00"W	sandy-mud	38 m	15	08-09-10/11, 01-02-03/12

313

314

315 **Figure : 1**



316
317

