

1 Genital anatomy, jaw and radula of the species of the genus *Jeanneretia* (Helicoidea:
2 Cepolidae), endemic to western Cuba

3 Authors: Maïke Hernández Quinta¹, Thierry Backeljau^{2,3} and Manuel A. Bauzá
4 Hernández¹

5 **1.** Institute of Ecology and Systematics, Carretera Varona Km 3 1/5, Capdevila, Havana,
6 Cuba.

7 **2.** Royal Belgian Institute of Natural Sciences (RBINS), Vautierstraat 29, B-1000
8 Brussels, Belgium.

9 **3.** Evolutionary Ecology Group, University of Antwerp, Universiteitsplein 1, B-2610
10 Antwerp, Belgium

11 Corresponding author: M. Hernández (maïke@ecologia.cu)

12 **Abstract.** This study provides the first data on the genital anatomy, the jaw and the
13 radula of four *Jeanneretia* species (Helicoidea: Cepolidae). The auxiliary copulatory
14 organ in this genus is highly peculiar and differs from that of other cepolids. It consists of
15 an elongated pedunculated mucus gland inserted apically on a muscular papilla (dart
16 sac absent) and a structure of soft consistency, all covered by a sheath. Two accessory
17 tubular glands are inserted at the base of the atrial sac. Parts of the genitalia of
18 *Jeanneretia* spp. are unusually large (compared to the size of the animal), such as the
19 bursa copulatrix duct and flagellum, that can exceed 200 mm in length. Another
20 peculiarity of the genus is the presence of a fertilization pouch-spermathecal complex
21 with single exposed spermatheca. The jaw is oxygnath, solid and high arched, with a
22 well-developed, wide median projection, and slight striae. The radula **has** triangular,
23 monocuspid central and lateral teeth (central teeth smaller than the rest). The
24 transitional teeth **have** ectocones and the marginal teeth are multicuspid with a
25 mesocone and ectocones. The features of the reproductive system of *Jeanneretia*
26 deviate conspicuously from the pattern assumed to be typical of the Cepolidae.
27 However, the atrial sac, accessory gland and pedunculated mucus gland of the auxiliary
28 copulatory organ of *Jeanneretia* are considered homologous with respectively atrial sac,

29 accessory gland and pedunculated mucus gland of the auxiliary copulatory in other
30 cepolid genera.

31 **Key words.** Auxiliary copulatory organ, reproductive system, Stylommatophora, west
32 Indian

33 Hernández et al. Genitalia, jaw and radula in *Jeanneretia*

34

35 **Introduction**

36 The stylommatophoran land snail family Cepolidae Ihering, 1909, is one of the least
37 well-studied Helicoid families. It is distributed throughout the Greater Antilles and some
38 Lesser Antilles, Bahamas, Florida and the Florida Keys (Miller & Naranjo-Garcia 1991).

39 Ihering (1909) created the Cepolinae to include the genera *Cepolis* Montfort, 1810 and
40 *Polymita* Beck, 1837. According to Nordsieck (1987, 2017) Cepolidae are characterized
41 by a reproductive system with a single dart apparatus consisting of a dart sac with on its
42 apical side a pedunculated mucus gland, both covered by a sheath; at the base of the
43 dart apparatus there is a pair of accessory glands; there is no diverticulum. However,
44 these early diagnoses were largely based on details of the reproductive system of only a
45 small number of taxa, *Setipellis* Pilsbry, 1926, *Cepolis* Montfort, 1810, *Polymita* Beck,
46 1837 and *Dialeuca* Albers, 1850 (Baker 1943, Moreno 1950). Yet, for other cepolid
47 genera little, if any, information on genital anatomy is available. With respect to the
48 genus *Jeanneretia* Pfeiffer, 1877, for example, there are hitherto only genital data for *J.*
49 *parraiana* (d'Orbigny, 1841) (Poey 1856-1858) and *J. dermatina* (Shuttleworth, 1854)
50 (Baker 1943, copied by Schileyko 2004), but not for its type species *Helix multistriata*
51 Deshayes, 1832 (= *Helix bicincta* Menke, 1830).

52 The genus *Jeanneretia* comprizes five species that are characterized by their relatively
53 large (height: 13–27 mm), globose to subglobose, yellowish to brown shells, with or
54 without darker spiral bands. The shell sculpture consists mainly of weak to rather strong
55 spiral threads or ridges. The snails are endemic in western Cuba, where they mainly
56 occur in limestone areas of mountain regions, from the province of Matanzas westward
57 to the province of Pinar del Rio, and on the Isla de la Juventud. The center of species

58 diversity is in the Sierra de los Órganos, and at Pan de Guajaibón (Clench & Aguayo,
59 1951). Pilsbry (1889) placed *Helix dermatina* (from Puerto Rico) in the section
60 *Jeanneretia*. However, based on anatomical data Baker (1943) suggested that the
61 species may be nearer to the subgenus *Levicepolis* Baker, 1943 than to Cuban
62 *Jeanneretia*. Currently, *Jeanneretia* is supposed to comprize five species: *J. bicincta* (*J.*
63 *b. bicincta* Menke, 1830 and *J. b. pityonesica* Pfeiffer, 1854), *J. wrighti* (Pfeiffer, 1865),
64 *J. sagraiana* (d'Orbigny, 1841), *J. jaumei* Clench & Aguayo, 1951, and *J. parraiana*
65 (d'Orbigny, 1841). This latter species would in turn comprize five subspecies: *J. p.*
66 *parraiana*, *J. p. parallela* (Poey, 1858), *J. p. arangoi* Clench & Aguayo, 1951, *J. p.*
67 *carinata* Clench & Aguayo, 1951, *J. p. depressa* Clench & Aguayo, 1951. It is, however,
68 unclear to what extent these species and subspecies are valid as they are based on
69 shell characters only (Clench & Aguayo, 1951). Against this background, the present
70 contribution aims at providing the very first data on the genital anatomy, the jaw and the
71 radula of three *Jeanneretia* species: *J. bicincta*, *J. sagraiana*, *J. jaumei* and the five
72 subspecies of *J. parraiana*.

73 **Materials and Methods**

74 Adult *Jeanneretia* spp. were collected at several localities (including some type
75 localities) in western Cuba (Table 1; Fig. 1; Appendix 1). Specimens were drowned in an
76 airtight jar full of water for 12 hours, after which they were removed from their shells and
77 fixed in 70% ethanol. Specimens were identified conchologically using Clench & Aguayo
78 (1951) and type specimens in the malacological collections of the Museum "Felipe
79 Poey" (MFP, Cuba) and the Museum of Comparative Zoology (MCZ, USA). Specimens
80 were dissected using a Carl Zeiss Stereomicroscope. The reproductive tracts were
81 drawn from photographs taken with a Nikon camera; some reproductive tract details
82 were photographed with an eyepiece camera.

83 Table 1

84 Figure 1

85 Radulae and jaws were extracted manually, cleaned by soaking in 10% KOH solution for
86 about six hours followed by rinsing in ethanol. They were mounted for scanning electron

87 microscopy with a Thermofisher Quanta 200 Environmental and Zeiss Evo 40 VP. The
88 auxiliary copulatory organs (sensu Baur 2010) were carefully removed from the
89 reproductive apparatus and placed overnight in 10% KOH solution to dissolve all
90 tissues.

91 We used a slightly modified terminology of the morphology of the reproductive tract
92 proposed by Baker (1943) and Baur (2010). We measured six structures in the
93 reproductive apparatus (Fig. 2) using scale paper with error 1 mm: *Length of the*
94 *flagellum* (Lfl): from its insertion on the epiphallus to its terminal tip. *Length of the penis*
95 *+ distal epiphallus* (Lpe): from its joint with the vagina to the insertion point of the penis
96 retractor muscle. *Length of the proximal epiphallus* (Le): from the insertion point of the
97 penis retractor muscle to the ~~joint with~~ ~~continues into of~~ the vas deferens and the
98 flagellum. *Length of the bursa copulatrix duct* (Lbcd): from its joint with the oviduct to the
99 basis of the bursa copulatrix. *Length of the auxiliary copulatory organ* (Laco): from its
100 joint with the atrium to its distal end. *Length of the spermoviduct* (Lso): from the point
101 where the free oviduct merges with the vas deferens up to the split between the
102 albumen gland and the hermaphroditic duct.

103 The flagellum is the longest structure and may be a proxy for the genital size. From
104 these measurements the following allometric ratios were calculated: Lpe/Lfl, Le/Lfl,
105 Laco/Lfl, Lbcd/Lfl and Lso/Lfl.

106 Figure 2

107 For the *Jeanneretia parraiana* subspecies, the unequal variance Welch test (ANOVA)
108 was applied, to compare the means of the variables illustrated in Figure 2. This test was
109 used because the variances were different between the subspecies. Subsequently, a
110 Tukey pairwise test was performed.

111 Results

112 **Genital anatomy.** The ovotestis consists of multiple long acini embedded in the
113 digestive gland, with thin ducts of acini converging into the hermaphroditic duct. In the
114 portion closest to the albumen gland appears the seminal vesicle. The fertilization
115 pouch-spermathecal complex (FPSC) with a fertilization pouch (embedded in the

116 albumen gland) and a single, exposed spermatheca (Fig. 3A; position in the albumen
117 gland, Figs. 5, 6 and 7). The female portion (i.e. the uterine part containing the seminal
118 groove) of the spermoviduct is transversely sacculated. The spermoviduct itself is a
119 fusion of the free oviduct and the vas deferens. The vagina is short. The bursa copulatrix
120 is elongated and its duct is variable in length, but most often it is very long. There is no
121 diverticulum. The penis + distal epiphallus is slender and cylindrical, with oval and
122 wrinkled verge (Fig. 3C; position in the penis + distal epiphallus, Figs. 5, 6, 7 and 8). It
123 has a weak penial retractor muscle. The proximal epiphallus has the same diameter as
124 the penis + distal epiphallus. The upper part of the epiphallus continues into a very long
125 flagellum and is the point of insertion of the vas deferens. The auxiliary copulatory organ
126 differs from that in other cepolids (Fig. 4) as it consists of an elongated pedunculated
127 mucus gland inserted apically on a muscular papilla (dart sac absent) and a structure of
128 soft consistency (Fig. 4B), all covered by a sheath. Two accessory tubular glands are
129 inserted at the base of the atrial sac. The spermatophore of *Jeanneretia* is extremely
130 long (in *J. p. depressa* is approximately of 40 mm), due to the disposition that it adopts
131 after extraction, it is difficult to measure it accurately. It is thin and very fragile. It lacks
132 spines. The neck and body are short, while the tail is very long and cylindrical.

133 Figure 3

134 Figure 4

135 *Jeanneretia bicincta bicincta* (Menke, 1830), Figure 5, Table 2 and Appendix 2

136 The penis + distal epiphallus and proximal epiphallus are short, but **the** penis + distal
137 epiphallus is longer **than the compared to** proximal epiphallus. The bursa copulatrix duct
138 that is shorter than the flagellum. The spermoviduct is shorter than the flagellum or the
139 bursa copulatrix duct. The oviduct is long. The auxiliary copulatory organ is long, with
140 the accessory glands and the pedunculated mucus gland very long. All the allometric
141 ratios are very small, except Lbcd/Lfl.

142 Figure 5.

143 *Jeanneretia parraiana* (d'Orbigny, 1841), Figure 6, Table 2 and Appendix 2

144 In all the subspecies, the vagina (max 2 mm) and the oviduct are short and the
145 spermooviduct is shorter than the flagellum or the bursa copulatrix duct. The flagellum is
146 longer than the penis + distal epiphallus and proximal epiphallus jointly, and the penis +
147 distal epiphallus is longer than the proximal epiphallus. Table 2 provides an overview of
148 the statistical comparison and allometric ratios of the genital characters measured in the
149 five subspecies. This demonstrates that: (1) the length of the proximal epiphallus shows
150 no significant differences between the five subspecies, (2) the flagellum and auxiliary
151 copulatory organ of *J. p. arangoi* and *J. p. parallela* are significantly longer than in the
152 three other subspecies, and (3) the lengths of the penis + distal epiphallus, bursa
153 copulatrix duct and spermooviduct show variable patterns of significant differences
154 between the five subspecies. For example, the accessory glands are cylindrical and
155 very long in *J. p. parraiana*, *J. p. arangoi* and *J. p. parallela*, whereas in *J. p. depressa*
156 and *J. p. carinata* they are flattened and much shorter. In addition, the pedunculated
157 mucus gland in *J. p. parraiana*, *J. p. arangoi* and *J. p. parallela* are very long, whereas in
158 *J. p. depressa* and *J. p. carinata* they are much shorter. Only the allometric ratios L_{pe}/L_{fl}
159 and L_e/L_{fl} are similar between all the subspecies (Table 2).

160 Figure 6

161 *Jeanneretia sagraiana* (d'Orbigny, 1841), Figure 7, Table 2 and Appendix 2

162 The genitalia present the longest flagellum so far for the genus. The penis + distal
163 epiphallus is longer than the proximal epiphallus. The auxiliary copulatory organ is very
164 long and provided with a very long pedunculated mucus gland. The accessory glands
165 are robust and can reach a length of up to 30 mm. The bursa copulatrix duct is long and
166 the bursa copulatrix is elongated. The spermooviduct is relatively long. All the allometric
167 ratios are very small in comparison to the other species.

168 Figure 7

169 *Jeanneretia jaumei* Clench & Aguayo, 1951, Figure 8, Table 2 and Appendix 2

170 Genitalia (one specimen) with a long flagellum. Penis - epiphallus distal longer than the
171 proximal epiphallus. The auxiliary copulatory organ is long with a clavate-elongate
172 pedunculated mucus gland, and long and robust accessory glands. The bursa copulatrix

Comment [T1]: Note that part of these results are repeated in the Comparative overview you added further below starting from line 179.

173 duct long and is provided with an elongated bursa copulatrix. The spermoviduct is
174 relatively long. All the allometric ratios are very small in comparison to the other species.

175 Figure 8

176 Table 2

177 **Comparative overviewisons of genital features in *Jeanneretia* (Table 2).** *Jeanneretia*
178 **taxa exhibited the following differences and similarities in genital anatomy:**

179 **Flagellum:** With a flagellum of up to 100 mm of length, longest in *J. jaumei*, *J. sagraiana*
180 (mean: 201 mm), and *J. jaumei* (mean: 170 mm), followed by *J. p. arraiana arangoi* and
181 *J. p. parallela* (means: 128-142 mm) and shortest in ~~are longer than in~~ *J. p. parraiana*, *J.*
182 *p. carinata*, *J. p. depressa* and *J. b. bicincta* (means: 66-90 mm). *J. p. carinata* has the
183 smallest flagellum among all taxa.

184 **With a Penis + distal epiphallus:** of up to 10 mm inof length. Longest in *J. p. arraiana*
185 *arangoi* (mean: 11 mm), is slightly shorter greater inthan the rest of the other taxa
186 (means: 7-9 mm) and shortest in: *J. p. parraiana*, *J. p. carinata*, *J. p. depressa* and *J.*
187 *jaumei* are similar, as is *J. p. parallela* and *J. sagraiana*. While *J. b. bicincta* (mean: 5
188 mm) has a smaller penis + distal epiphallus than the rest of the taxa.

189 **Lpe/Lfl ratios:** equal in Despite the fact that *J. p. parallela*, *J. p. parraiana*, *J. p. arangoi*,
190 have different values, the ratio Lpe/Lfl are equal. but different among For the otherrest
191 of the taxa the ratios are different, wherewith *J. p. carinata* havinghas the highest value
192 and *J. jaumei* and *J. sagraiana* the lowest. (Table 2).

193 **with the longest pProximal epiphallus:** appearslength does not differ significantly among
194 the different (sub)species, but with a tendency of being longest in *J. sagraiana* (mean: 6
195 mm) while *J. p. parraiana*, *J. p. arangoi* and *J. p. parallela* are similar, as is *J. p.*
196 *carinata*, *J. p. depressa* and *J. jaumei*. *J. b. bicincta* has a smaller proximal epiphallus
197 than the rest of the taxa.

198 **Le/Lfl ratios:** equal in Despite the fact that *J. p. parallela*, *J. p. parraiana*, *J. p. arangoi*
199 have different values, the ratio Le/Lfl are the same., but different among For the rest of

Comment [T2]: I think we better do not use "up to" because we cannot know to what extent you observed the highest values. Moreover in Table 2 you provide mean values, so better use these mean values.

This also holds for the other characters you compare further below.
ALTERNATIVELY: instead of referring to the mean values, you can of course provide the highest INDIVIDUAL values you found or the RANGE (highest – lowest), but be consequent and apply the same sort of figures for all characters compared here. So either always the means of Table 2, OR the highest individual values ("up to"), OR the minimum-maximum values range.

Comment [T3]: I do not see from where this figure comes.... In Table 2 the figures I found are those I inserted, but these are not "up to" figures, but averages if I understand Table 2 correctly.

Comment [T4]: This info does not help to distinguish the taxa. Are the differences "significant"? From Table 2 it looks as if this is not at all obvious, so I would remove this sentence.

Comment [T5]: How meaningful is it that the ratio is equal in the first three subspecies, but different in the other taxa? Particularly since the ratio in the first three is 0.07, while the ratios of the others vary from 0.05 to 0.12, so that the ratio of the three falls within that range? Are the differences between the ratios statistically meaningful? If not, then there is no point to make.

Comment [T6]: Already mentioned in point (1) line 149.

Comment [T7]: Similar comment as for Lpe/Lfl. Is it meaningful? Are the mean ratios significantly different?

200 the other taxa the ratios are different among them, where with *J. p. carinata* has having
201 the highest value and *J. jaumei* the lowest (Table 2).

202 With the longest auxiliary copulatory organ: longest in appear *J. sagraiana* (mean: 20
203 mm) and *J. jaumei* (19 mm), respectively, followed by *J. p. arangoi* and *J. p. parallela*
204 (means: 17 mm) are similar, like, and significantly shorter in the other (sub)species
205 (means: 8-12 mm) *J. p. parraiana*, *J. b. bicincta* and *J. p. carinata*. While *J. p. depressa*
206 has a smaller auxiliary copulatory organ than the rest of the taxa.

207 Regarding the flagellum (L_{aco}/L_{fl} , ratios Table 2): largest in *J. b. bicincta* and *J. p.*
208 *carinata* (means: 0.17); means varying between 0.10 and 0.14 in the other taxa *J. p.*
209 *depressa* has proportionally smaller auxiliary copulatory organ than the rest of the taxa.
210 Meanwhile, *J. b. bicincta* has the largest ratio followed by *J. p. carinata*, *J. p. parallela*, *J.*
211 *p. arangoi*, *J. sagraiana* and *J. jaumei* respectively.

212 Regarding the Length of bursa copulatrix duct: longest in the dimensions of this variable
213 are different in all taxa. *J. p. arangoi* with (mean: 83 mm) and *J. sagraiana* with (mean: 75
214 mm), tendency to be shorter in surpass *J. p. parallela* (mean: 63 mm), *J. b. bicincta*
215 (mean: 58 mm); and *J. jaumei* (54 mm), and significantly shorter in *J. p. parraiana*
216 (mean: 44 mm), and *J. p. carinata* (mean: 44 mm) and with dimensions between 44–63
217 mm. *J. p. depressa* (mean: 33 mm) has the smallest value among all taxa.

218 Regarding the flagellum (L_{bcd}/L_{fl} , Table 2) ratios: *J. jaumei* has the bursa copulatrix
219 duct proportionally smaller than the rest of the taxa. Meanwhile, *J. p. carinata* and *J. b.*
220 *bicincta* have the largest ratios followed by *J. p. arangoi*, *J. p. parallela*, *J. p. parraiana*,
221 *J. p. depressa* and *J. sagraiana* respectively.

222 With a spermoviduct: Two groups of (sub)species can be distinguished, viz. those with
223 a long spermoviduct (means: 30-33 mm), i.e. of around 30 mm, *J. p. arangoi*, *J.*
224 *sagraiana*, *J. jaumei* and *J. p. parallela*, and those with a shorter spermoviduct (means:
225 20-25 mm), i.e. are longer than *J. p. parraiana*, *J. p. depressa*, *J. p. carinata* and *J. b.*
226 *bicincta* with dimensions around 20 mm.

Comment [T8]: No, the mean value of depressa is not significantly different from that of paraiana and carinata. So we cannot say that it is really the shortest.

Comment [T9]: Are the mean values significantly different?

Comment [T10]: Is this meaningful if we do not know whether the mean values are significantly different?

227 Regarding the flagellum (Lso/Lfl ratios: Table 2), *J. jaumei* and *J. sagraiana* have
228 proportionally smaller spermooviduct than the rest of the taxa. Meanwhile, *J. p. carinata*
229 and *J. b. bicincta* have the largest ratios followed by *J. p. parallela*, *J. p. depressa*, *J. p.*
230 *arangoi* and *J. p. parraiana* respectively.

Comment [T11]: Is this meaningful if we do not know whether the mean values are significantly different?

231 **Jaw and radular morphology.** The jaw is oxygnath (Fig. 9), solid, with a wide, well-
232 developed, median projection, high arched, almost smooth except for slight striae all
233 over the surface. The jaws vary in the degree of arching and in the size of the
234 median projection. It also varies with respect to its height near the median projection and
235 the lateral ends. The radula has a central monocuspid, pointed and triangular central
236 tooth that is smaller than the other teeth, and that is shorter than the base of the tooth.
237 Lateral teeth monocuspid, pointed, triangular. They are as long as their base. Between
238 the lateral and marginal teeth, there are transitional teeth with ectocones. Marginal teeth
239 multicuspid with the mesocone and ectocones smaller than the endocones. The latter
240 are frequently subdivided (Fig. 10).

241 Figure 9

242 Figure 10

243 Discussion

244 **Relationships within *Jeanneretia*.** Hitherto, only very few data were available on the
245 genital anatomy, and no data on the jaw and radula of the genus *Jeanneretia*. The
246 detailed new genital descriptions of *Jeanneretia* spp. and in particular of *J. bicincta* (= *Helix multistriata*, the type species of the genus), corroborate Baker's (1943) re-
247 assignment of *Helix dermatina* from *Jeanneretia* to *Levicepolis* on the basis of
248 characteristic differences of the accessory glands and the auxiliary copulatory organ.
249

250 *Jeanneretia sagraiana*, *J. jaumei* and *J. parraiana arangoi* have the longest flagellum
251 among all species, even the longest among the helicoids according to the review carried
252 out by Schileyko (2003, 2004, 2006a, 2006b). In both species there is a large difference
253 between the length of the flagellum and that of the other genital structures. Although
254 there is similarity between the genitalia of *J. sagraiana* and *J. jaumei* are similar, the
255 shells classification of these two sympatric species are very clear. The shell of these

Comment [T12]: OK, but in the comparisons you added above, it looks as if also *J. p. parallela* belongs to the group with the longest flagellum. So either add this subspecies here too, or adapt the comparisons above.

256 species is very different: in *J. sagraiana* the shell is depressed and has with a strong
257 sculpture, while in *J. jaumei* it is globose and with a fine sculpture.

258 With respect to the subspecies of *J. parraiana* the genital data seem to define two
259 groups based on characters of the reproductive system: (1) *J. p. parraiana*, *J. p. arangoi*
260 and *J. p. parallela* and (2) *J. p. depressa* and *J. p. carinata*. Nevertheless, the five
261 subspecies are distinguishable from each other. In the second group, *J. p. depressa* and
262 *J. p. carinata* can be distinguished by the similarity in the shape of the pedunculated
263 mucus gland (Figs. 4B and 5B). In addition, *J. p. depressa* stands out by the great
264 difference between the length of the flagellum and that of the other genital structures.
265 But too they are different in the length of the flagellum, of the auxiliary copulatory organ
266 and of the bursa copulatrix duct, for which it could be considered to be elevated both to
267 species. In the first group, the subspecific differences are less clear as *J. p. parraiana*, *J.*
268 *p. arangoi* and *J. p. parallela* are similar with respect to the shape of the pedunculated
269 mucus gland and the accessory gland. However, some of the allometric ratios, such as
270 L_{bcd}/L_{fl} and L_{so}/L_{fl} , differ between the three subspecies, such as, L_{bcd}/L_{fl} and L_{so}/L_{fl} .
271 *J. p. arangoi* separates of the other two subspecies and it could be considered to be
272 elevated to species. Overall, to what extent these subspecific differences and the
273 recognition of the two subspecies groups reflect taxonomically and evolutionarily
274 meaningful phenotypic patterns remains to be decided and will require molecular studies
275 and more detailed studies of shell shape and anatomy.

276 **Relationships of *Jeanneretia* to other Cepolidae.** The reproductive system of
277 *Jeanneretia* is similar to that of other cepolid genera, amongst others by the presence of
278 an auxiliary copulatory organ that is covered by a sheath. Yet, there are also some
279 remarkable differences: in the other cepolids the dart sac is located above the muscular
280 papilla (Fig. 4C, D, E), while in *Jeanneretia* and *Guladentia* Clench & Aguayo, 1951
281 there is no dart sac (Fig. 4A) but there is a non-calcareous "dart" which is fused to a
282 muscular papilla that opens directly into the atrial sac (M. Hernández unpublished
283 observations), which is a unique condition within the Stylommatophora. The auxiliary
284 copulatory organ of *Jeanneretia* also differs from other helicoids. In some families of
285 dart-bearing helicoids, such as Helminthoglyptidae, Xanthonychidae, Helicidae,

Comment [T13]: This is confusing: how can you distinguish these two subspecies if their pmg is similar... that is what is now written here. Moreover the comparison between Figs 4B and 5B is also confusing, because (1) Fig. 4B shows *Hemitrochus rufoapicata* and does not refer to the pmg, and (2) there is no Fig. 5B (at least the photo insert is not labelled as B).

Comment [T14]: I'm sorry but I do not understand what you want to say with this sentence. Apparently, you want to suggest that *J. p. depressa* should be regarded as a species, rather than a subspecies? But I do not understand why? The argument to do so is not clear. In fact I would not change the taxonomy of *Jeanneretia* in this paper, but wait for the DNA data to do so.

Comment [T15]: On what grounds would you consider *arangoi* as a good species, but keep the two other as subspecies? How does *arangoi* differs from the two other subspecies in such a way that it should be elevated to species?
Just as in my previous comment I would not do so in this paper but wait for the DNA data.
So in the introduction I would simply state state that in await of a future integrative taxonomic revision of the genus, we maintain for the time being the current (sub)specific interpretation.

286 Humboldtianidae, Camaenidae, Epiphragmophoridae and Bradybaenidae (Nordsieck
287 2017) it contains one or more dart sacs (Stylophore, according to Schileyko 1991), i.e. a
288 muscular structure (Nasim & Perveen 1984, In-Seon et al. 2004) that contains one or
289 more darts (Nordsieck 1987, Schileyko 1991). In these families the dart is calcareous,
290 the atrial sac is absent (except in Helminthoglyptidae) and the dart sac opens in, or is
291 located on, the vagina, whereas in *Jeanneretia* and *Guladentia* the dart is non-
292 calcareous, the dart sac is absent and the atrial sac opens into the atrium.

293 Schileyko (1984) and Hausdorf (1998) used sections (A1 to A5) to study the auxiliary
294 copulatory organ in Orthurethra, Limacoidea and Helicoidea. Following the criteria of
295 both authors, *Jeanneretia* and other cepolids have section A1 (atrial sac with accessory
296 glands) well developed; in section A2, *Jeanneretia* has **thea** muscular papilla with **thea**
297 non-calcareous “dart”, whereas other cepolids only have **thea** muscular papilla; section
298 A3 is absent in *Jeanneretia*, while other cepolids have a dart sac; section A4 in
299 *Jeanneretia* is well developed, while in other cepolids it is reduced; section A5 is present
300 in all cepolids, including *Jeanneretia*, and contains retractor muscles, a feature not
301 observed by Hausdorf (1998).

302 The homology of the auxiliary copulatory organ in different stylommatophoran taxa has
303 been much debated and Hausdorf (1998) concluded that a critical study is needed to
304 decide whether the auxiliary copulatory organs are homologous. In the case of
305 *Jeanneretia* and the other cepolid genera, we putatively suggest that the auxiliary
306 copulatory organs are homologous structures because they are structurally similar and
307 occupy the same position in the genital apparatus. The pedunculated mucus gland,
308 accessory gland (only present in Cepolidae, see Nordsieck 2017) and atrial sac of
309 *Jeanneretia* are homologous with respectively pedunculated mucus gland, accessory
310 gland and atrial sac in other cepolid genera. As such, it seems that in *Jeanneretia* the
311 dart sac is absent and the non-calcareous “dart” originates from the muscular papilla
312 (Fig. 4).

313 Other peculiarities of *Jeanneretia* are (1) the extremely long flagellum and bursa
314 copulatrix duct, and (2) the presence of a single spermatheca. A pair of accessory

315 glands in the auxiliary copulatory organ is only present in *Dialeuca* (Baker 1943) and
316 *Jeanneretia*. In other cepolids this pair of accessory glands appears as a bilobed or
317 unique accessory gland (Schileyko 2004, Hernández et al. 2020, M. Hernández
318 unpublished observations).

319 The jaw of *Jeanneretia* is extremely arched like most cepolid genera except for *Polymita*
320 and *Eurycampta* (Pilsbry 1894), although the median projection in *Jeanneretia* is more
321 marked. The radula also complies with the pattern similar to the other cepolid genera
322 except *Polymita* (Moreno 1950), which is disposed in a "v" and all teeth are equal.

323 The features of the auxiliary copulatory organ and the fertilization pouch-spermathecal
324 complex, are considered to be the most important source of systematic information
325 within the Helicoidea (e.g. Schileyko 1991, Nordsieck 1987). Yet, precisely both these
326 structures in *Jeanneretia* deviate conspicuously from the pattern assumed to be typical
327 of the Cepolidae (Figs 3A and B, 4). Therefore, the structure and functioning of the
328 auxiliary copulatory organ and the fertilization pouch-spermathecal complex of
329 *Jeanneretia* should be studied in more detail, and particularly the action and role of the
330 auxiliary copulatory organ during copulation (Hernández, 2015).

331 Acknowledgements

332 We thank the Global Taxonomy Initiative (GTI) of the CEBioS programme at RBINS,
333 financed by the Belgian cooperation for development for giving MHQ the opportunity to
334 visit the malacology lab of RBINS. To the ORSA for access to the areas and permission
335 to collect. Finally, thanks we are indebted to the anonymous reviewers for their helpful
336 comments and the Archiv für Molluskenkunde staff for their work in publishing this
337 research.

338

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Comment [T16]: It may be confusing that in former paper you use only the name "Hernández", while in this manuscript you sign as "Hernández Quinta".

Comment [T17]: While it is customary to thank the reviewers, it is not customary to thank the journal staff for the editorial and publishing work.

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402 **Tables**

403 **Table 1. Numbers of specimens studied per character (genitalia, jaw, radula) in each**
404 ***Jeanneretia* taxon material studied, numbers of specimens: genitalia, jaw, and radula.**

Species and subspecies	Numbers of specimens
<i>J. parraiana parraiana</i>	15: genitalia 15 and jaw 2
<i>J. parraiana depressa</i>	14: genitalia 14 and jaw 3
<i>J. parraiana carinata</i>	10: genitalia 10, jaw 1 and radula 1
<i>J. parraiana arangoi</i>	10: genitalia 10, jaw 2 and radula 1
<i>J. parraiana parallela</i>	12: genitalia 10 and jaw 2
<i>J. jaumei</i>	1: genitalia 1 and jaw 1
<i>J. sagraiana</i>	3: genitalia 3, jaw 1 and radula 1
<i>J. bicincta bicincta</i>	13: genitalia 13, jaw 3 and radula 1

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408 **Table 2.** Mean (mm **or dimensionless for ratios**), standard deviation and ratios of measurements of the morphological
 409 variables of the reproductive organs in the *Jeanneretia parraiana* subspecies and *J. bicincta*, *J. sagraiana* and *J. jaumei*.
 410 Lfl, Length of the flagellum; Lpe, Length of the penis **+ distal epiphallus distal**; Le, Length of the proximal epiphallus; Laco,
 411 Length of the auxiliary copulatory organ; Lbcd, Length of the bursa copulatrix duct; Lso, Length of the spermoviduct;
 412 Standard deviation, SD. **Values for the** *Jeanneretia parraiana* subspecies **they** were **statistically** compared **with a** Welch F
 413 test of unequal variances. In each character column, mean values with the same superscript are not significantly different
 414 according to the Tukey's pairwise test. **with the same superscript are not significantly different according to the Tukey's**

Taxa	Variables	Lfl	Lpe	Le	Leacao	Lbcd	Lso	Lpe/Lfl	Le/Lfl	Laco/Lfl	Lbcd/Lfl	Lso/Lfl
<i>J. p. arangoi</i> (11)	Average	142 ^a	11 ^a	5	17 ^a	83 ^a	32 ^a	0.07	0.04	0.13	0.60	0.24
	SD	56	4	3	5	40	8					
<i>J. p. parallela</i> (12)	Average	128 ^a	9 ^{ab}	5	17 ^a	63 ^{ab}	30 ^{abc}	0.07	0.04	0.14	0.51	0.25
	SD	20	2	1	3	16	5					
<i>J. p. parraiana</i> (15)	Average	90 ^b	7^b	5	11 ^b	44 ^{bc}	20 ^{bc}	0.07	0.04	0.12	0.49	0.22
	SD	8	3	1	2	12	4					
<i>J. p. depressa</i> (14)	Average	80 ^b	7 ^b	4	8 ^b	33 ^c	25 ^{bc}	0.09	0.06	0.10	0.42	0.31
	SD	14	1	1	1	7	5					
<i>J. p. carinata</i> (10)	Average	66 ^b	7 ^b	4	12 ^b	44 ^{bc}	21 ^{bc}	0.12	0.07	0.17	0.72	0.32
	SD	12	1	1	6	12	5					
	<i>F</i>	23.85	4.19	1.88	31.42	10.90	9.11					
	<i>df</i>	20.39	20.07	19.88	18.59	20.60	20.01					
	<i>p</i>	<0.001	<0.01	0.15	<0.001	<0.001	<0.001					
<i>J. bicincta</i> (13)	Average	70	5	3	11	58	22	0.08	0.05	0.17	0.77	0.32
	SD	15	1	1	2	21	3					
<i>J. sagraiana</i> (3)	Average	201	9	6	20	75	32	0.05	0.03	0.12	0.36	0.18
	SD	89	2	2	1	27	5					
<i>J. jaumei</i> (1)		170	8	4	19	54	31	0.05	0.02	0.11	0.32	0.18

Comment [T20]: Why no mean ratios? Why are they not tested in the parraiana subspecies?

Comment [T18]: Check of the Tukey test comparison below.

Comment [T19]: Replace everywhere in Table 2 the "Average" by "Mean" (as in caption)

415 | pairwise test.

416 Figure captions

417 **Figure 1.**

418 Sampling localities of *Jeanneretia* spp. in Cuba. White circle: *Jeanneretia parraiana*.
419 White triangle: *Jeanneretia sagraiana*. White rhombus: *Jeanneretia jaumei*. White box:
420 *Jeanneretia bicincta*. Bosque de la Habana (1), Cojímar (2), Hoyo del Guamá (3),
421 Maravillas de Viñales (4), La jaula, Escaleras de Jaruco (5), Laguna de Piedra (6),
422 Lomas de Aspiro Rangel (7), Lomas de Babiney (8), Mogote de la Microondas (9),
423 Mogote de Palmarito (10), Mogote de Santo Tomás (11), Mogote Dos Hermanas (12),
424 Mogote el Valle (13), Mogote frente a la Cueva del Indio, San Vicente (14), Mogote Pan
425 de Azúcar (15), Pan de Guajaibón (16), San Antonio de los Baños (17), Sierra de
426 Guane (18), Sierra de la Güira (19), Sierra Paso Real de Guane (20), Viñales and Sierra
427 de San Carlos (21).

428
429 **Figure 2.** General outline of the genitalia of *Jeanneretia* spp. Measurements are shown
430 as discontinue red lines. Laco, *Length of the auxiliary copulatory organ*; Lbcd, *Length of*
431 *the bursa copulatrix duct*; Le, *Length of the proximal epiphallus*; Lfl, *Length of the*
432 *flagellum*; Lpe, *Length of the penis + distal epiphallus*; Lso, *Length of the spermoviduct*.

433
434 **Figure 3.** Fertilization pouch-spermathecal complex (FPSC), typical of the genus
435 *Jeanneretia* (A), *Polymita muscarum* (Lea, 1834) (B) and verge typical of the genus
436 *Jeanneretia* (C). Scale bars = 1 mm.

437
438 **Figure 4.** Auxiliary copulatory organ in Cepolidae: *Jeanneretia parraiana parraiana*, with
439 part of the sheath indicated (A), soft, non-calcareous structure (B), *Hemitrochus*
440 *rufopapicata* (Poey, 1858) (C), *Cysticopsis cubensis* (Pfeiffer, 1840) (D), and *Eurycampta*
441 *bomplandi* (Lamarck, 1822) (E). Atrial sac (as), pedunculated mucus gland (pmg),
442 muscular papilla (mp). Scale bar = 1 mm.

443

444 **Figure 5.** Genital anatomy of *Jeanneretia bicincta bicincta*. Auxiliary copulatory organ
445 (aco), albumen gland (ag), accessory glands (agl), atrial sac (as), bursa copulatrix (bc),
446 bursa copulatrix duct (bcd), proximal epiphallus (e), flagellum (fl), fertilization pouch-
447 spermathecal complex (fpSC), hemaphroditic duct (hd), muscular papilla (mp), penis +
448 distal epiphallus (pe), pedunculated mucus gland (pmg), prostatic gland (pg), penial
449 retractor muscle (prm), spermo duct (so), verge (v), vas deferens (vd). Black bar = 2
450 mm, white bar = 1 mm.

451
452 **Figure 6.** Genital anatomy of the *Jeanneretia parraiana* subspecies, with part of the
453 sheath indicated. 1A, B: *J. p. parraiana*; 2A, B: *J. p. parallela*; 3 A-C: *J. p. arangoi*; 4A,
454 B: *J. p. depressa*; 5A, B: *J. p. carinata*. Auxiliary copulatory organ (aco), albumen gland
455 (ag), accessory glands (agl), atrial sac (as), bursa copulatrix (bc) bursa copulatrix duct
456 (bcd), proximal epiphallus (e), flagellum (fl), fertilization pouch-spermathecal complex
457 (fpSC), hemaphroditic duct (hd), muscular papilla (mp), penis + distal epiphallus (pe),
458 pedunculated mucus gland (pmg), prostatic gland (pg), penial retractor muscle (prm),
459 spermo duct (so), vas deferens (vd). Black bar = 2 mm, white bar = 1 mm.

460

461 **Figure 6.** Continuation.

462

463 **Figure 7.** Genital anatomy of *Jeanneretia sagraiana*. Auxiliary copulatory organ (aco),
464 albumen gland (ag), accessory gland (agl), bursa copulatrix (bc), bursa copulatrix duct
465 (bcd), proximal epiphallus (e), flagellum (fl), fertilization pouch-spermathecal complex
466 (fpSC), hemaphroditic duct (hd), penis + distal epiphallus (pe), prostatic gland (pg), penial
467 retractor muscle (prm), spermo duct (so), verge (v), vas deferens (vd). Scale bar = 1
468 mm.

469

470 **Figure 8.** Genital anatomy of *Jeanneretia jaumei*. Auxiliary copulatory organ (aco),
471 albumen gland (ag), accessory gland (agl), bursa copulatrix (bc), bursa copulatrix duct
472 (bcd), proximal epiphallus (e), flagellum (fl), hemaphroditic duct (hd), penis + distal

473 epiphallus (pe), prostatic gland (pg), penial retractor muscle (prm), spermoviduct (so),
474 verge (v), vas deferens (vd). Scale bar = 1 mm.

475 **Figure 9.** SEM photographs of the jaw of *Jeanneretia p. parraiana* (A), *J. p. arangoi* (B),
476 *J. p. paralella* (C), *J. p. carinata* (D), *J. p. depressa* (E), *J. bicincta* (F), *J. sagraiana* (G),
477 *J. jaumei* (H). Scale bar = 1 mm.

478
479 **Figure 10.** SEM photographs of the radula of *Jeanneretia bicincta*, A: central and lateral
480 teeth, B: lateral teeth and transitional teeth. *J. parraiana carinata*, C: central and lateral
481 teeth, D: marginal teeth. *J. p. arangoi*, E: central and lateral teeth, F: marginal teeth. *J.*
482 *sagraiana*, G: central and lateral teeth, H: transitional and marginal teeth. Central teeth
483 marked with a black arrow.

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488 Appendix 1. Taxa, localities, coordinates, voucher, date and collector. Acronym (ZCACC 8. A.) of the malacological wet
 489 collection of the Institute of Ecology and Systematics.

Taxa	Locality	Coordinates	Voucher	Date	collector
<i>J. p. parraiana</i>	Pan de Guajaibón	83.35W, 22.7897N	ZCACC 8. A. 0001	10.viii.2016	Hernández and Lajonchere
<i>J. p. parraiana</i>	Pan de Guajaibón		ZCACC 8. A. 0002	10.viii.2016	Hernández and Lajonchere
<i>J. p. parraiana</i>	Lomas de Aspiro-Rangel	83.1973W, 22.7097N	ZCACC 8. A. 0003	24.vii.2014	Hernández and Lajonchere
<i>J. p. parraiana</i>	Lomas de Aspiro-Rangel		ZCACC 8. A. 0004	24.vii.2014	Hernández and Lajonchere
<i>J. p. parraiana</i>	Mogote de la Microondas	83.3710W, 22.6610N	ZCACC 8. A. 0005	13.vi.2015	Hernández
<i>J. p. parraiana</i>	Mogote de la Microondas		ZCACC 8. A. 0006	13.vi.2015	Hernández
<i>J. p. parraiana</i>	Mogote de la Microondas		ZCACC 8. A. 0007	13.vi.2015	Hernández
<i>J. p. parraiana</i>	Mogote de la Microondas		ZCACC 8. A. 0008	13.vi.2015	Hernández
<i>J. p. parraiana</i>	Mogote de la Microondas		ZCACC 8. A. 0009	13.vi.2015	Hernández
<i>J. p. parraiana</i>	Sierra de la Güira	83.4263W, 22.6469N	ZCACC 8. A. 0010	13.vi.2015	Hernández and Blanco
<i>J. p. parraiana</i>	Sierra de la Güira		ZCACC 8. A. 0011	13.vi.2015	Hernández and Blanco
<i>J. p. parraiana</i>	Sierra Paso Real de Guane	84.0988W, 22.1627N	ZCACC 8. A. 0012	07.xi.2014	Hernández and Lajonchere
<i>J. p. parraiana</i>	Sierra Paso Real de Guane		ZCACC 8. A. 0013	07.xi.2014	Hernández and Lajonchere
<i>J. p. parraiana</i>	Hoyo del Guamá	83.7428W, 22.4921N	ZCACC 8. A. 0014	23.vi.2015	Hernández and García
<i>J. p. parraiana</i>	Hoyo del Guamá		ZCACC 8. A. 0015	23.viii.2015	Hernández and García
<i>J. p. depressa</i>	Mogote El Valle	83.7277W, 22.6222N	ZCACC 8. A. 0016	02.vii.2014	Hernández
<i>J. p. depressa</i>	Mogote El Valle		ZCACC 8. A. 0017	02.vii.2014	Hernández
<i>J. p. depressa</i>	Mogote El Valle		ZCACC 8. A. 0018	02.vii.2014	Hernández

<i>J. p. depressa</i>	Mogote El Valle		ZCACC 8. A. 0019	02.vii.2014	Hernández
<i>J. p. depressa</i>	Mogote El Valle		ZCACC 8. A. 0020	02.vii.2014	Hernández
<i>J. p. depressa</i>	Mogote El Valle		ZCACC 8. A. 0021	02.vii.2014	Hernández
<i>J. p. depressa</i>	Mogote El Valle		ZCACC 8. A. 0022	02.vii.2014	Hernández
<i>J. p. depressa</i>	Mogote El Valle		ZCACC 8. A. 0023	02.vii.2014	Hernández
<i>J. p. depressa</i>	Mogote El Valle		ZCACC 8. A. 0024	02.vii.2014	Hernández
<i>J. p. depressa</i>	Mogote El Valle		ZCACC 8. A. 0025	02.vii.2014	Hernández
<i>J. p. depressa</i>	Mogote de Palmarito	83.7141W, 22.6380N	ZCACC 8. A. 0026	05.vi.2014	Hernández
<i>J. p. depressa</i>	Mogote de Palmarito		ZCACC 8. A. 0027	05.vi.2014	Hernández
<i>J. p. depressa</i>	Mogote Dos Hermanas	83.7438W, 22.6180N	ZCACC 8. A. 0028	03.vii.2014	Hernández and Lajonchere
<i>J. p. depressa</i>	Mogote Dos Hermanas		ZCACC 8. A. 0029	03.vii.2014	Hernández and Lajonchere
<i>J. p. carinata</i>	Sierra de Guasasa	83.7046W, 22.6528N	ZCACC 8. A. 0030	05.vi.2013	Hernández
<i>J. p. carinata</i>	Sierra de Guasasa		ZCACC 8. A. 0031	05.vi.2013	Hernández
<i>J. p. carinata</i>	Sierra de Guasasa		ZCACC 8. A. 0032	05.vi.2013	Hernández
<i>J. p. carinata</i>	Sierra de Guasasa		ZCACC 8. A. 0033	05.vi.2013	Hernández
<i>J. p. carinata</i>	Sierra de Guasasa		ZCACC 8. A. 0034	05.vi.2013	Hernández
<i>J. p. carinata</i>	Sierra de Guasasa		ZCACC 8. A. 0035	05.vi.2013	Hernández
<i>J. p. carinata</i>	Sierra de Viñales	83.7461W, 22.6433N	ZCACC 8. A. 0036	26.viii.2014	Hernández
<i>J. p. carinata</i>	Sierra de Viñales		ZCACC 8. A. 0037	26.viii.2014	Hernández
<i>J. p. carinata</i>	Sierra de Viñales		ZCACC 8. A. 0038	26.viii.2014	Hernández
<i>J. p. carinata</i>	Sierra de Viñales		ZCACC 8. A. 0039	26.viii.2014	Hernández

<i>J. p. arangoi</i>	Mogote de Santo Tomás	83.8511W, 22.5416N	ZCACC 8. A. 0040	05.vi.2013	Hernández
<i>J. p. arangoi</i>	Mogote de Santo Tomás		ZCACC 8. A. 0041	05.vi.2013	Hernández
<i>J. p. arangoi</i>	Mogote de Santo Tomás		ZCACC 8. A. 0042	05.vi.2013	Hernández
<i>J. p. arangoi</i>	Mogote de Santo Tomás		ZCACC 8. A. 0043	05.vi.2013	Hernández
<i>J. p. arangoi</i>	Mogote Pan de Azúcar	83.8597W, 22.7502N	ZCACC 8. A. 0044	05.vi.2013	Lajonchere
<i>J. p. arangoi</i>	Sierra de San Carlos	83.9883W, 22.3677N	ZCACC 8. A. 0045	01.v.2013	Lajonchere
<i>J. p. arangoi</i>	Maravillas de Viñales	83.8260W, 22.5650N	ZCACC 8. A. 0046	04.vii.2014	Hernández
<i>J. p. arangoi</i>	Maravillas de Viñales		ZCACC 8. A. 0047	04.vii.2014	Hernández
<i>J. p. arangoi</i>	Maravillas de Viñales		ZCACC 8. A. 0048	04.vii.2014	Hernández
<i>J. p. arangoi</i>	Maravillas de Viñales		ZCACC 8. A. 0049	04.vii.2014	Hernández
<i>J. p. paralela</i>	Sierra de Guane	84.05W, 22.2083N	ZCACC 8. A. 0050	06.xi.2014	Hernández and Lajonchere
<i>J. p. paralela</i>	Sierra de Guane		ZCACC 8. A. 0051	06.xi.2014	Hernández and Lajonchere
<i>J. p. paralela</i>	Sierra de Guane		ZCACC 8. A. 0052	06.xi.2014	Hernández and Lajonchere
<i>J. p. paralela</i>	Sierra de Guane		ZCACC 8. A. 0053	06.xi.2014	Hernández and Lajonchere
<i>J. p. paralela</i>	Sierra de Guane		ZCACC 8. A. 0054	06.xi.2014	Hernández and Lajonchere
<i>J. p. paralela</i>	Sierra de Guane		ZCACC 8. A. 0055	06.xi.2014	Hernández and Lajonchere
<i>J. p. paralela</i>	Sierra de Guane	84.05W, 22.2083N	ZCACC 8. A. 0056	06.xi.2014	Hernández and Lajonchere
<i>J. p. paralela</i>	Sierra de Guane		ZCACC 8. A. 0057	06.xi.2014	Hernández and Lajonchere
<i>J. p. paralela</i>	Sierra de Guane		ZCACC 8. A. 0058	06.xi.2014	Hernández and Lajonchere
<i>J. p. paralela</i>	Sierra de Guane		ZCACC 8. A. 0059	06.xi.2014	Hernández and Lajonchere
<i>J. p. paralela</i>	Sierra de Guane		ZCACC 8. A. 0060	06.xi.2014	Hernández and Lajonchere

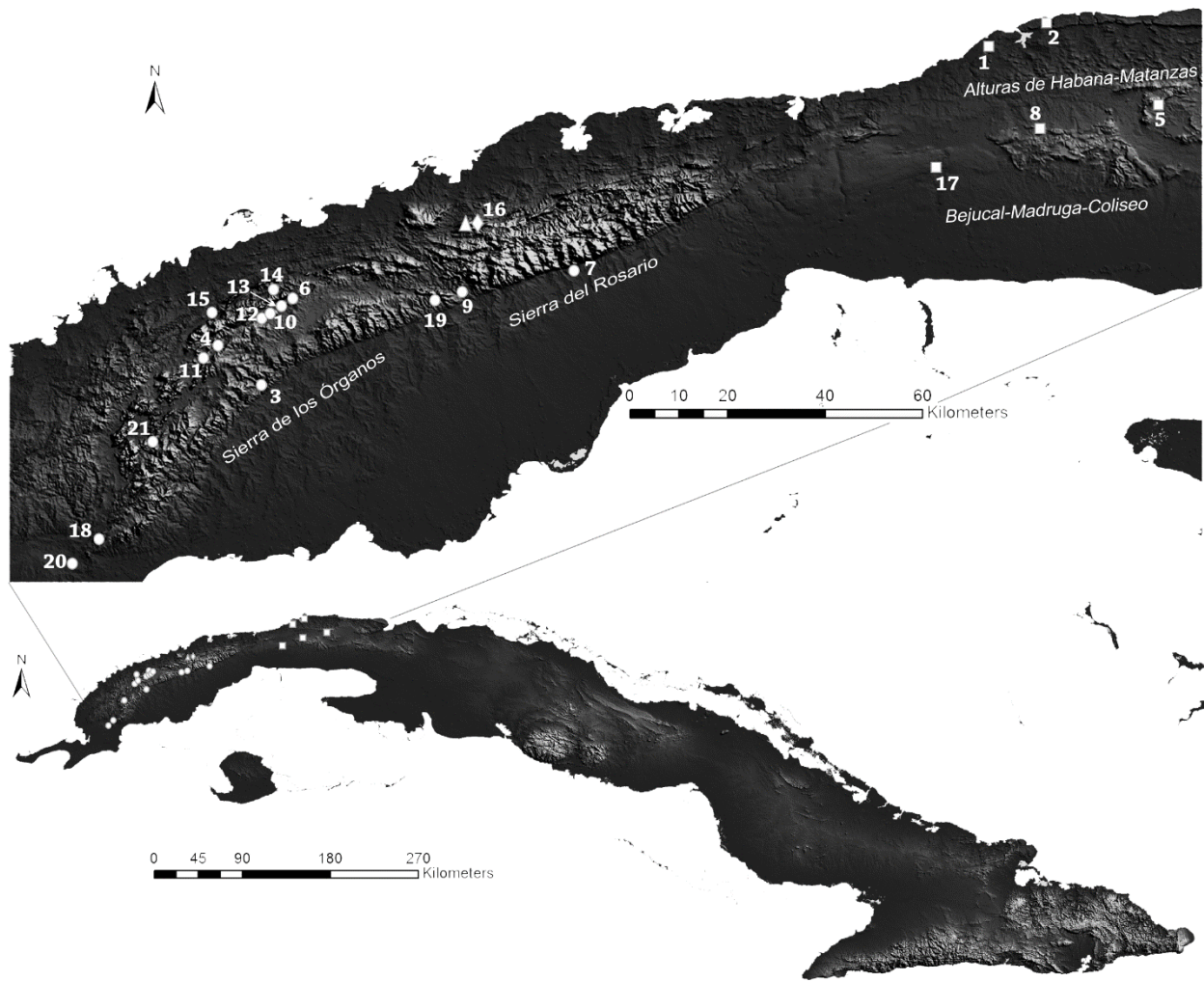
<i>J. p. parallela</i>	Sierra de Guane		ZCACC 8. A. 0061	06.xi.2014	Hernández and Lajonchere
<i>J. jaumei</i>	Pan de Guajaibón	83.35W, 22.7897N	ZCACC 8. A. 0062	23.xi.2016	García
<i>J. sagraiana</i>	Pan de Guajaibón	83.35W, 22.7897N	ZCACC 8. A. 0063	10.viii.2016	Hernández and Lajonchere
<i>J. sagraiana</i>	Pan de Guajaibón		ZCACC 8. A. 0064	10.viii.2016	Hernández and Lajonchere
<i>J. sagraiana</i>	Pan de Guajaibón		ZCACC 8. A. 0065	23.xi.2016	L. Y. García
<i>J. b. bicincta</i>	San Antonio de los Baños	82.5035W, 22.8946N	ZCACC 8. A. 0066	14.ix.2014	Hernández
<i>J. b. bicincta</i>	San Antonio de los Baños		ZCACC 8. A. 0067	14.ix.2014	Hernández
<i>J. b. bicincta</i>	San Antonio de los Baños		ZCACC 8. A. 0068	14.ix.2014	Hernández
<i>J. b. bicincta</i>	San Antonio de los Baños		ZCACC 8. A. 0069	14.ix.2014	Hernández
<i>J. b. bicincta</i>	Lomas de Babiney	82.2638W, 22.9466N	ZCACC 8. A. 0070	02.x.2016	Hernández and Bauzá
<i>J. b. bicincta</i>	Lomas de Babiney		ZCACC 8. A. 0071	02.x.2016	Hernández and Bauzá
<i>J. b. bicincta</i>	La jaula, Escañeras de Jaruco	82.0894W, 23.0183N	ZCACC 8. A. 0072	28.vi.2014	Hernández
<i>J. b. bicincta</i>	La jaula, Escañeras de Jaruco		ZCACC 8. A. 0073	28.vi.2014	Hernández
<i>J. b. bicincta</i>	La jaula, Escañeras de Jaruco		ZCACC 8. A. 0074	28.vi.2014	Hernández
<i>J. b. bicincta</i>	La jaula, Escañeras de Jaruco		ZCACC 8. A. 0075	28.vi.2014	Hernández
<i>J. b. bicincta</i>	La jaula, Escañeras de Jaruco		ZCACC 8. A. 0076	28.vi.2014	Hernández
<i>J. b. bicincta</i>	La jaula, Escañeras de Jaruco		ZCACC 8. A. 0077	28.vi.2014	Hernández
<i>J. b. bicincta</i>	Cojímar	82.2908W, 23.1636N	ZCACC 8. A. 0078	02.xi.2014	Lajonchere
<i>J. b. bicincta</i>	Cojímar		ZCACC 8. A. 0079	02.xi.2014	Lajonchere
<i>J. b. bicincta</i>	Bosque de la Habana	82.4067W, 23.1161N	ZCACC 8. A. 0080	10.x.2014	Lajonchere
<i>J. b. bicincta</i>	Bosque de la Habana		ZCACC 8. A. 0081	10.x.2014	Lajonchere

491 Appendix 2. Measurements of the morphological variables (mm) and ratios of the
 492 reproductive organs of the *Jeanneretia parraiana* subspecies and *J. bicincta*, *J.*
 493 *sagraiana* and *J. jaumei*. Lfl, Length of the flagellum; Lpe, Length of the penis **+/- distal**
 494 epiphallus **distal**; Le, Length of the proximal epiphallus; Laco, Length of the auxiliary
 495 copulatory organ; Lbcd, Length of the bursa copulatrix duct; Lso, Length of the
 496 spermoviduct

Taxa	Lfl	Lpe	Le	Leacao	Lbcd	Lso	Lpe/Lfl	Le/Lfl	Laco/Lfl	Lbcd/Lfl	Lso/Lfl
<i>J. p. parraiana</i>	85	9	5	12	39	25	0.11	0.06	0.14	0.46	0.29
<i>J. p. parraiana</i>	82	6	4	12	33	22	0.07	0.05	0.15	0.40	0.27
<i>J. p. parraiana</i>	90	8	4	11	38	12	0.09	0.04	0.12	0.42	0.13
<i>J. p. parraiana</i>	80	4	3	10	33	16	0.05	0.04	0.13	0.41	0.20
<i>J. p. parraiana</i>	85	6	4	11	38	18	0.07	0.05	0.13	0.45	0.21
<i>J. p. parraiana</i>	105	6	4	10	36	24	0.06	0.04	0.10	0.34	0.23
<i>J. p. parraiana</i>	89	6	4	13	49	24	0.07	0.04	0.15	0.55	0.27
<i>J. p. parraiana</i>	100	7	4	13	37	20	0.07	0.04	0.13	0.37	0.20
<i>J. p. parraiana</i>	95	7	4	9	41	16	0.07	0.04	0.00	0.43	0.17
<i>J. p. parraiana</i>	84	6	3	12	65	22	0.07	0.04	0.11	0.77	0.26
<i>J. p. parraiana</i>	90	6	3	9	67	-	0.07	0.03	0.13	0.74	-
<i>J. p. parraiana</i>	100	8	3	9	50	-	0.08	0.03	0.09	0.50	-
<i>J. p. parraiana</i>	-	8	3	-	-	-	-	-	-	-	-
<i>J. p. depressa</i>	76	7	3	8	21	20	0.09	0.04	0.11	0.28	0.26
<i>J. p. depressa</i>	63	6	4	9	28	22	0.10	0.06	0.14	0.44	0.35
<i>J. p. depressa</i>	-	8	3	9	47	30	-	-	-	-	-
<i>J. p. depressa</i>	87	6	4	10	29	29	0.07	0.05	0.11	0.33	0.33
<i>J. p. depressa</i>	70	9	4	9	36	29	0.13	0.06	0.13	0.51	0.41
<i>J. p. depressa</i>	100	7	5	-	33	30	0.07	0.05	0.00	0.33	0.30
<i>J. p. depressa</i>	87	9	4	8	29	25	0.10	0.05	0.09	0.33	0.29
<i>J. p. depressa</i>	85	7	5	8	34	30	0.08	0.06	0.09	0.40	0.35
<i>J. p. depressa</i>	89	8	6	7	38	24	0.09	0.07	0.08	0.43	0.27
<i>J. p. depressa</i>	-	7	3	8	30	19	-	-	-	-	-

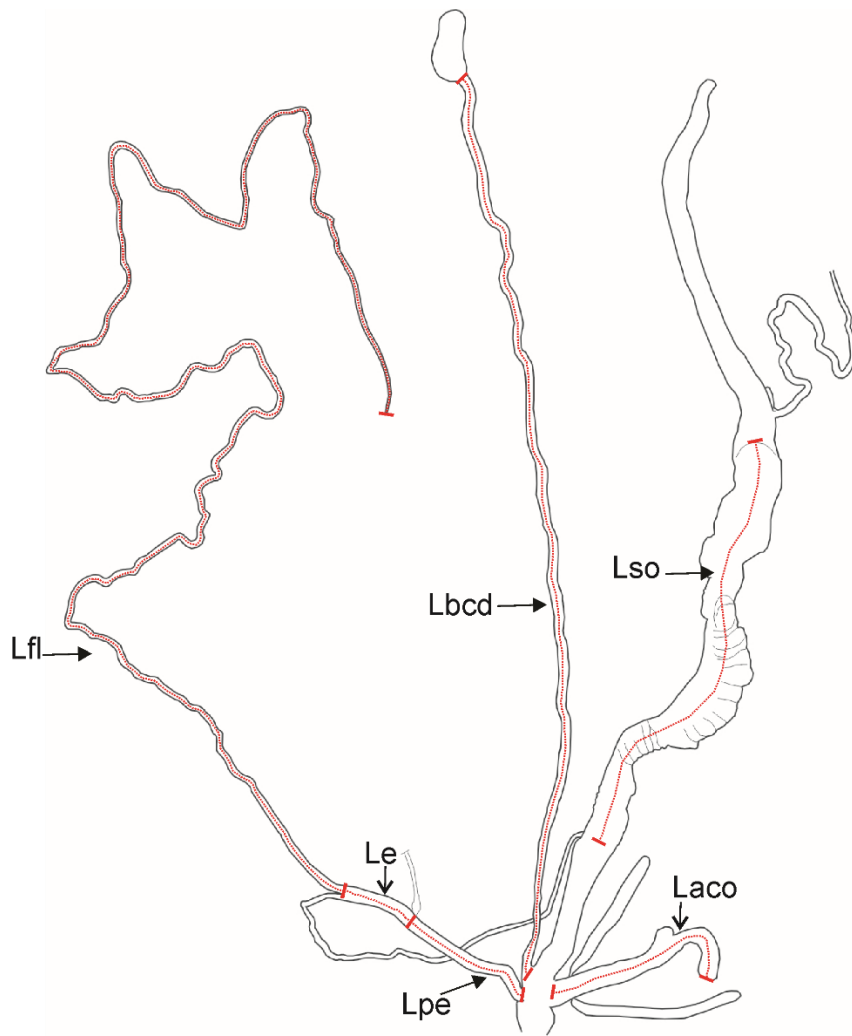
<i>J. p. depressa</i>	90	7	5	7	32	24	0.08	0.06	0.08	0.36	0.27
<i>J. p. depressa</i>	81	-	-	7	-	25	0.00	0.00	0.09	0.00	0.31
<i>J. p. depressa</i>	51	7	4	6	42	16	0.14	0.08	0.12	0.82	0.31
<i>J. p. carinata</i>	62	7	4	7	33	-	0.11	0.06	0.11	0.53	-
<i>J. p. carinata</i>	70	6	5	8	62	32	0.09	0.07	0.11	0.89	0.46
<i>J. p. carinata</i>	-	8	3	6	45	24	-	-	-	-	-
<i>J. p. carinata</i>	64	8	4	-	55	20	0.13	0.06	-	0.86	0.31
<i>J. p. carinata</i>	45	7	4	6	35	20	0.16	0.09	0.13	0.78	0.44
<i>J. p. carinata</i>	80	8	4	7	30	24	0.10	0.05	0.09	0.38	0.30
<i>J. p. carinata</i>	54	6	4	8	60	15	0.11	0.07	0.15	1.11	0.28
<i>J. p. carinata</i>	70	6	5	16	35	20	0.09	0.07	0.23	0.50	0.29
<i>J. p. carinata</i>	63	8	4	15	35	15	0.13	0.06	0.24	0.56	0.24
<i>J. p. carinata</i>	57	8	3	16	50	16	0.14	0.05	0.28	0.88	0.28
<i>J. p. parallela</i>	130	11	8	15	55	30	0.08	0.06	0.12	0.42	0.23
<i>J. p. parallela</i>	90	7	5	20	75	27	0.08	0.06	0.22	0.83	0.30
<i>J. p. parallela</i>	127	8	4	18	60	25	0.06	0.03	0.14	0.47	0.20
<i>J. p. parallela</i>	140	10	5	21	65	31	0.07	0.04	0.15	0.46	0.22
<i>J. p. parallela</i>	110	8	5	18	65	38	0.07	0.05	0.16	0.59	0.35
<i>J. p. parallela</i>	130	8	4	18	42	30	0.06	0.03	0.14	0.32	0.23
<i>J. p. parallela</i>	160	9	6	16	47	25	0.06	0.04	0.10	0.29	0.16
<i>J. p. parallela</i>	150	13	5	15	77	30	0.09	0.03	0.10	0.51	0.20
<i>J. p. parallela</i>	120	8	6	15	60	29	0.07	0.05	0.13	0.50	0.24
<i>J. p. parallela</i>	138	12	4	18	100	30	0.09	0.03	0.13	0.72	0.22
<i>J. p. parallela</i>	108	7	3	11	50	40	0.06	0.03	0.10	0.46	0.37
<i>J. p. arangoi</i>	85	7	4	11	29	21	0.08	0.05	0.13	0.34	0.25
<i>J. p. arangoi</i>	86	6	4	15	56	20	0.07	0.05	0.17	0.65	0.23
<i>J. p. arangoi</i>	118	8	3	17	103	38	0.07	0.03	0.14	0.87	0.32
<i>J. p. arangoi</i>	190	15	5	19	130	36	0.08	0.03	0.10	0.68	0.19
<i>J. p. arangoi</i>	98	-	-	-	35	-	-	-	-	0.36	-
<i>J. p. arangoi</i>	260	14	13	22	80	38	0.05	0.05	0.08	0.31	0.15

<i>J. p. arangoi</i>	118	8	3	17	103	38	0.07	0.03	0.14	0.87	0.32
<i>J. p. arangoi</i>	190	15	5	19	130	36	0.08	0.03	0.10	0.68	0.19
<i>J. p. arangoi</i>	160	16	5	22	110	25	0.10	0.03	0.14	0.69	0.16
<i>J. p. arangoi</i>	161	14	6	20	160	-	0.09	0.04	0.12	0.99	-
<i>J. p. arangoi</i>	91	5	2	8	-	40	0.05	0.02	0.09	-	0.44
<i>J. bicincta</i>	-	-	-	10	75	24	-	-	-	-	-
<i>J. bicincta</i>	100	5	3	-	55	18	0.05	0.03	0.00	0.55	0.18
<i>J. bicincta</i>	62	5	4	11	35	20	0.08	0.06	0.18	0.56	0.32
<i>J. bicincta</i>	62	5	4	11	35	20	0.08	0.06	0.18	0.56	0.32
<i>J. bicincta</i>	94	5	4	10	74	19	0.05	0.04	0.11	0.79	0.20
<i>J. bicincta</i>	72	5	3	10	30	26	0.07	0.04	0.14	0.42	0.36
<i>J. bicincta</i>	-	-	-	17	87	-	-	-	-	-	-
<i>J. bicincta</i>	53	5	2	7	20	19	0.09	0.04	0.13	0.38	0.36
<i>J. bicincta</i>	65	5	3	12	70	21	0.08	0.05	0.18	1.08	0.32
<i>J. bicincta</i>	71	5	4	14	65	24	0.07	0.06	0.20	0.92	0.34
<i>J. bicincta</i>	60	5	3	12	74	24	0.08	0.05	0.20	1.23	0.40
<i>J. bicincta</i>	63	6	3	11	53	26	0.10	0.05	0.17	0.84	0.41
<i>J. bicincta</i>	63	6	3	11	75	21	0.10	0.05	0.17	1.19	0.33
<i>J. sagraiana</i>	113	7	4	19	46	28	0.06	0.04	0.17	0.41	0.25
<i>J. sagraiana</i>	205	9	6	22	70	33	0.04	0.03	0.11	0.34	0.16
<i>J. sagraiana</i>	291	10	7	21	100	37	0.03	0.02	0.07	0.34	0.13
<i>J. jaumei</i>	170	8	4	19	54	31	0.05	0.02	0.11	0.32	0.18



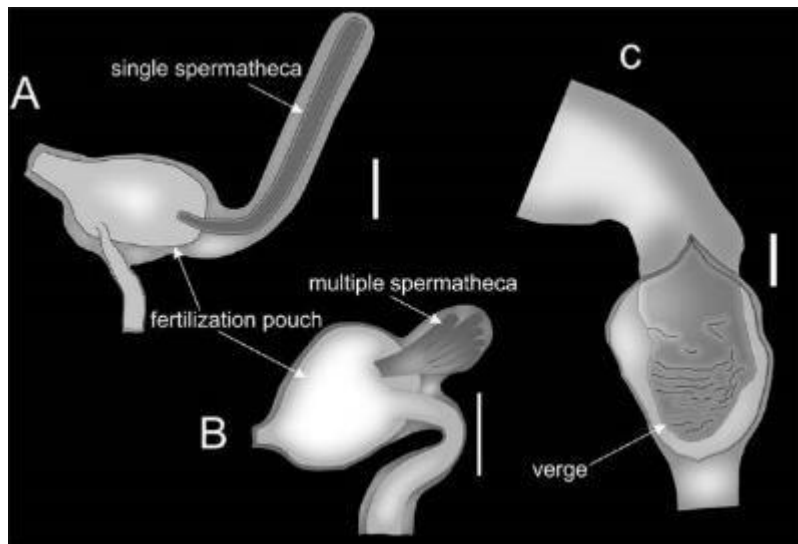
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2 **Figure 1.** Sampling localities of *Jeanneretia* spp. in Cuba. White circle: *Jeanneretia*
3 *parraiana*. White triangle: *Jeanneretia sagraiana*. White rhombus: *Jeanneretia jaumei*.
4 White box: *Jeanneretia bicincta*. Bosque de la Habana (1), Cojímar (2), Hoyo del
5 Guamá (3), Maravillas de Viñales (4), La jaula, Escaleras de Jaruco (5), Laguna de
6 Piedra, La Jutía (6), Lomas de Aspiro Rangel (7), Lomas de Babiney (8), Mogote de la
7 Microondas (9), Mogote de Palmarito (10), Mogote de Santo Tomás (11), Mogote Dos
8 Hermanas (12), Mogote el Valle (13), Mogote frente a la Cueva del Indio, San Vicente
9 (14), Mogote Pan de Azúcar (15), Pan de Guajaibón (16), San Antonio de los Baños
10 (17), Sierra de Guane (18), Sierra de la Güira (19), Sierra Paso Real de Guane (20),
11 Viñales and Sierra de San Carlos (21).

12



13
14 **Figure 2.** General outline of the genitalia of *Jeanneretia* spp. Measurements are shown
15 as red lines. Laco, Length of the auxiliary copulatory organ; Lbcd, Length of the bursa
16 copulatrix duct; Le, Length of the proximal epiphallus; Lfl, Length of the flagellum; Lpe,
17 Length of the penis + distal epiphallus; Lso, Length of the spermoviduct.

18



19

20 **Figure 3.** Fertilization pouch-spermathecal complex (FPSC), typical of the genus
21 *Jeanneretia* (A), *Polymita muscarum* (Lea, 1834) (B) and verge typical of the genus
22 *Jeanneretia* (D). Scale bars = 1 mm.

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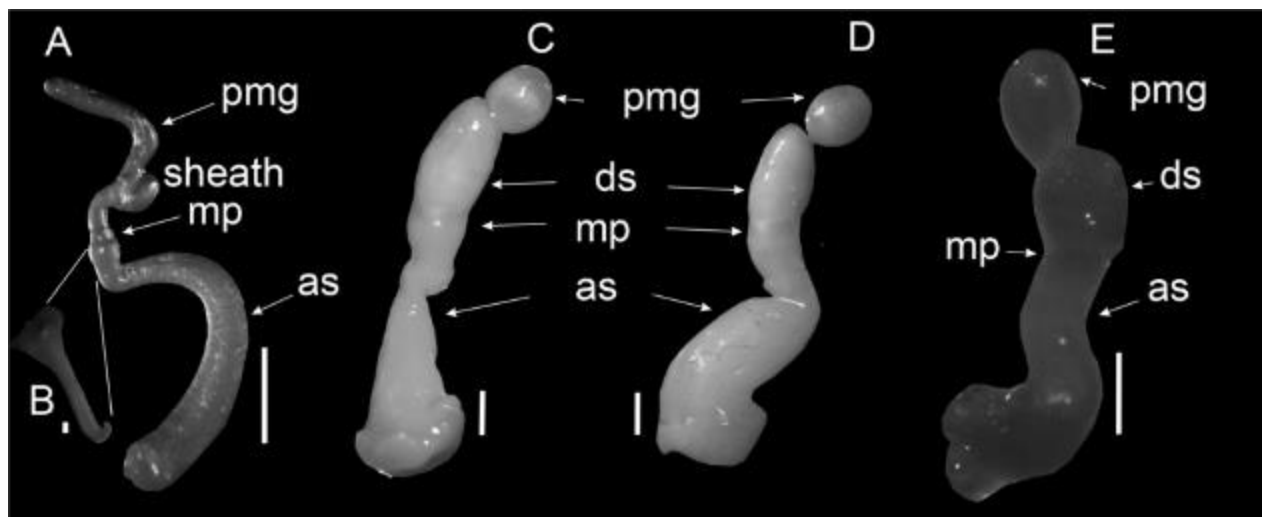
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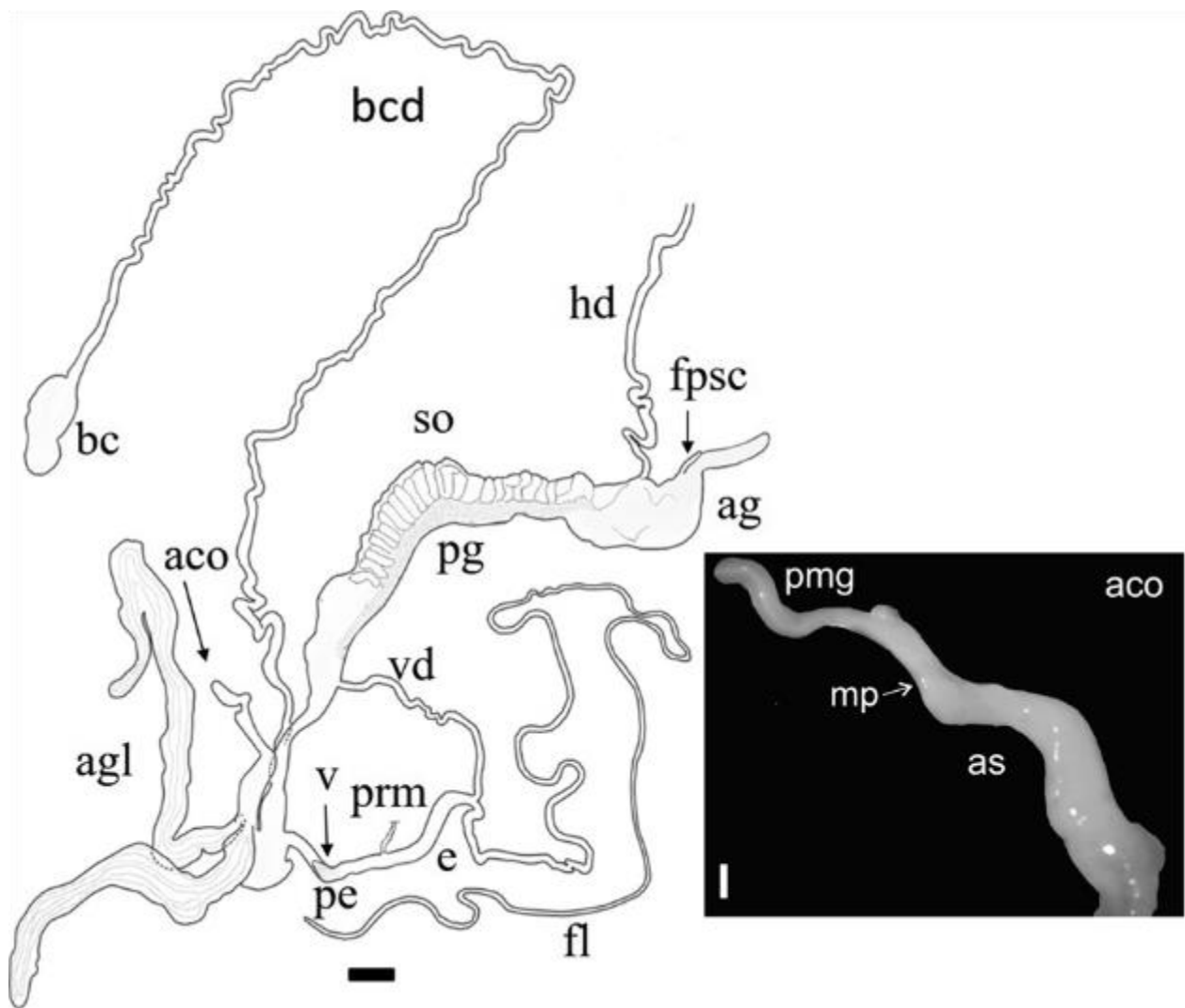
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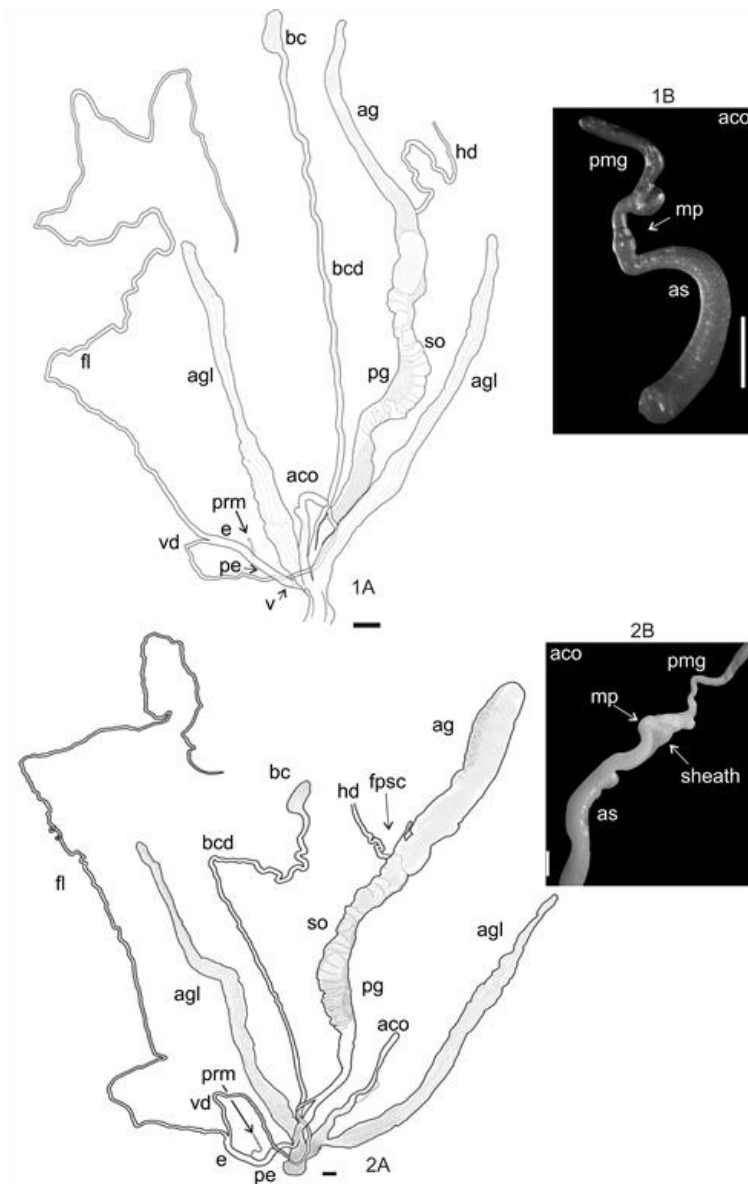
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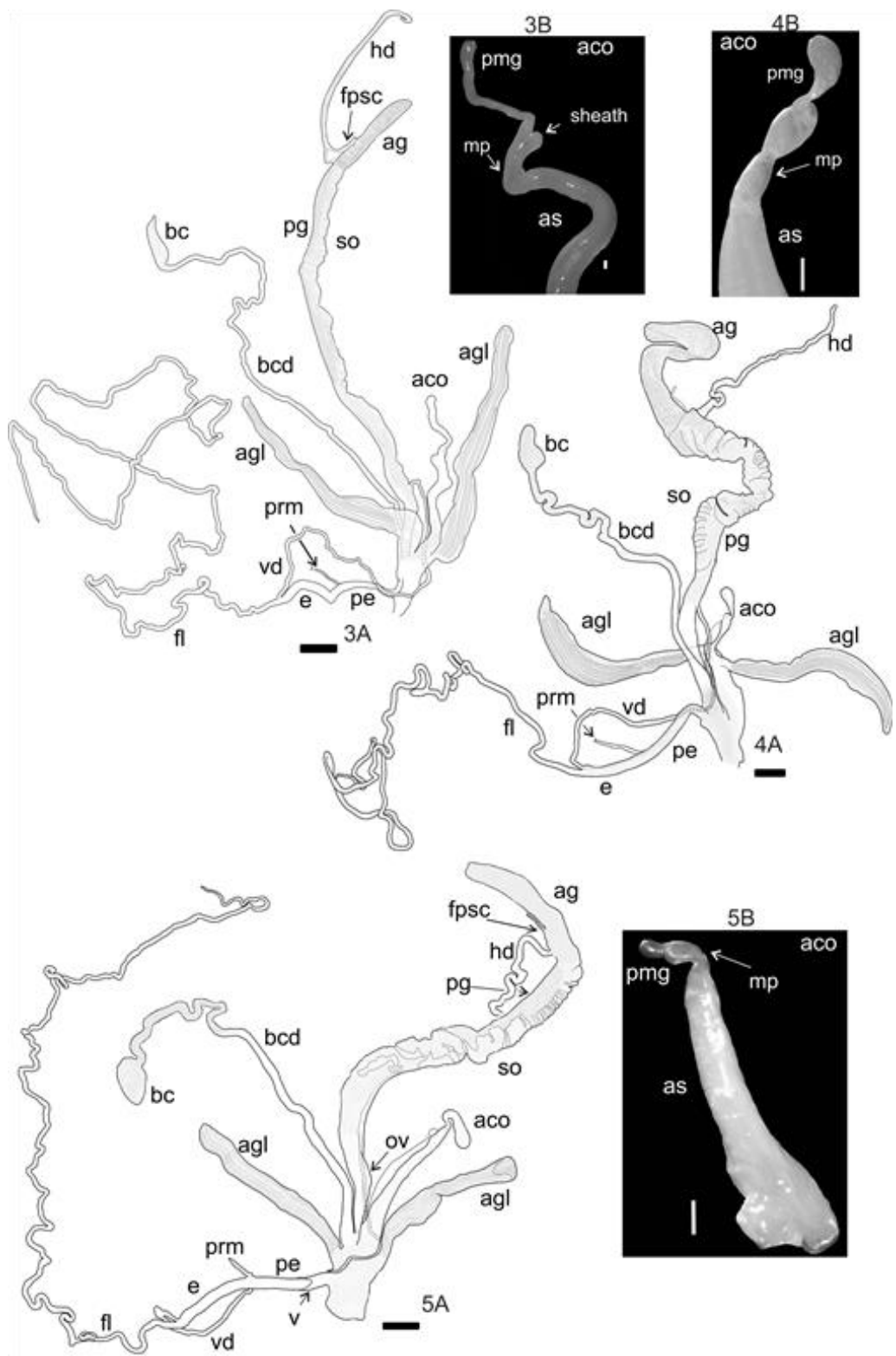
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 33 Figure 4. Auxiliary copulatory organ in Cepolidae: *Jeanneretia parraiana parraiana*, with
 34 part of the sheath indicated (A), soft, non-calcareous structure (B), *Hemitrochus*
 35 *rufoapicata* (Poey, 1858) (C), *Cysticopsis cubensis* (Pfeiffer, 1840) (D), and *Eurycampta*
 36 *bomplandi* (Lamarck, 1822) (E). Atrial sac (as), pedunculated mucous gland (pmg),
 37 muscular papilla (mp). Scale bar = 1 mm.



38
 39 **Figure 5.** Genital anatomy of *Jeanneretia bicincta bicincta*. Auxiliary copulatory organ
 40 (aco), albumen gland (ag), accessory glands (agl), atrial sac (as), bursa copulatrix (bc),
 41 bursa copulatrix duct (bcd), proximal epiphallus (e), flagellum (fl), fertilization pouch-
 42 spermathecal complex (fpsc), hemaphroditic duct (hd), muscular papilla (mp), penis +
 43 distal epiphallus (pe), pedunculated mucous gland (pmg), prostatic gland (pg), penial
 44 retractor muscle (prm), spermoviduct (so), verge (v), vas deferens (vd). Black bar = 2
 45 mm, white bar = 1 mm.



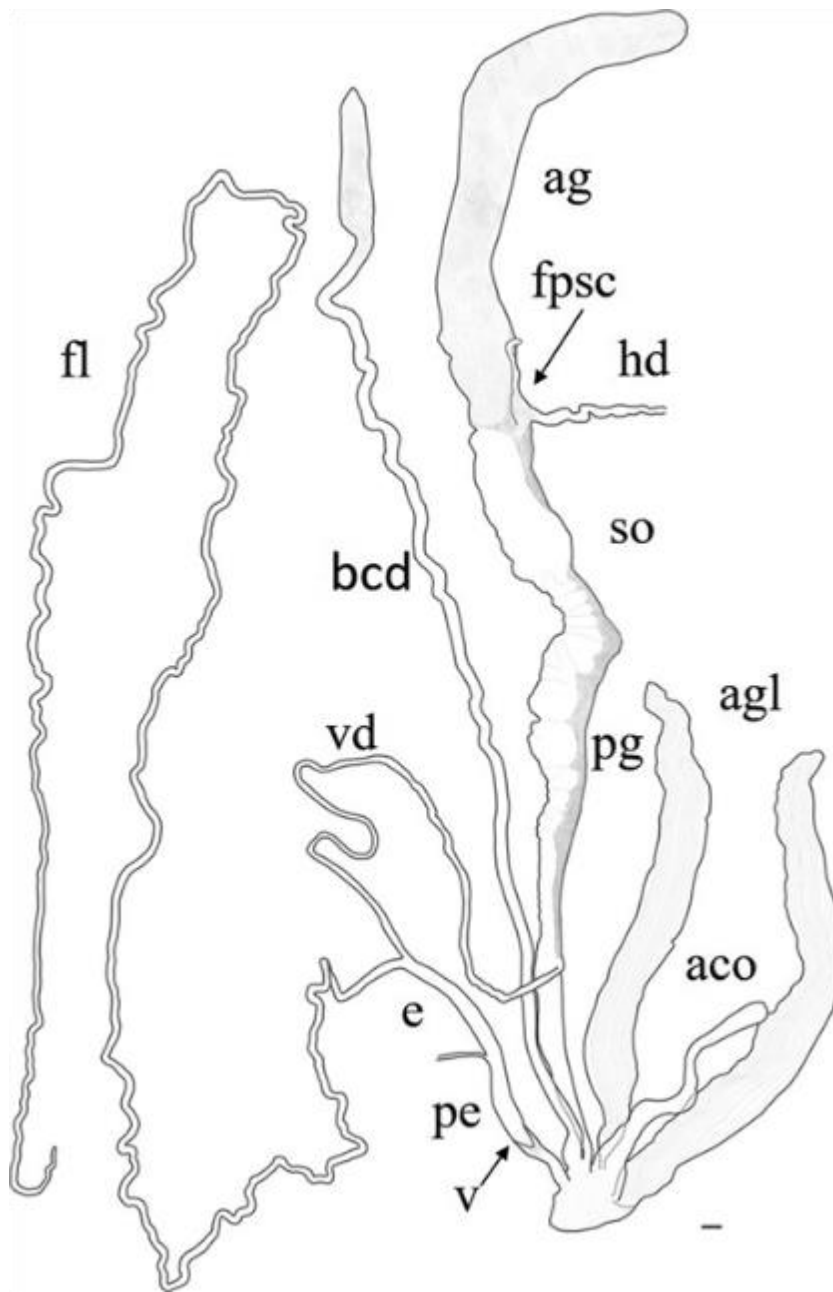
46
 47 **Figure 6.** Genital anatomy of the *Jeanneretia parraiana* subspecies, with part of the
 48 sheath indicated. 1A, B: *J. p. parraiana*; 2A, B: *J. p. parallela*; 3 A-C: *J. p. arangoi*; 4A,
 49 B: *J. p. depressa*; 5A, B: *J. p. carinata*. Auxiliary copulatory organ (aco), albumen gland
 50 (ag), accessory glands (agl), atrial sac (as), bursa copulatrix (bc) bursa copulatrix duct
 51 (bcd), proximal epiphallus (e), flagellum (fl), fertilization pouch-spermathecal complex
 52 (fpsc), hemaphroditic duct (hd), muscular papilla (mp), penis + distal epiphallus (pe),
 53 pedunculated mucous gland (pmg), prostatic gland (pg), penial retractor muscle (prm),
 54 spermoviduct (so), vas deferens (vd). Black bar = 2 mm, white bar = 1 mm.



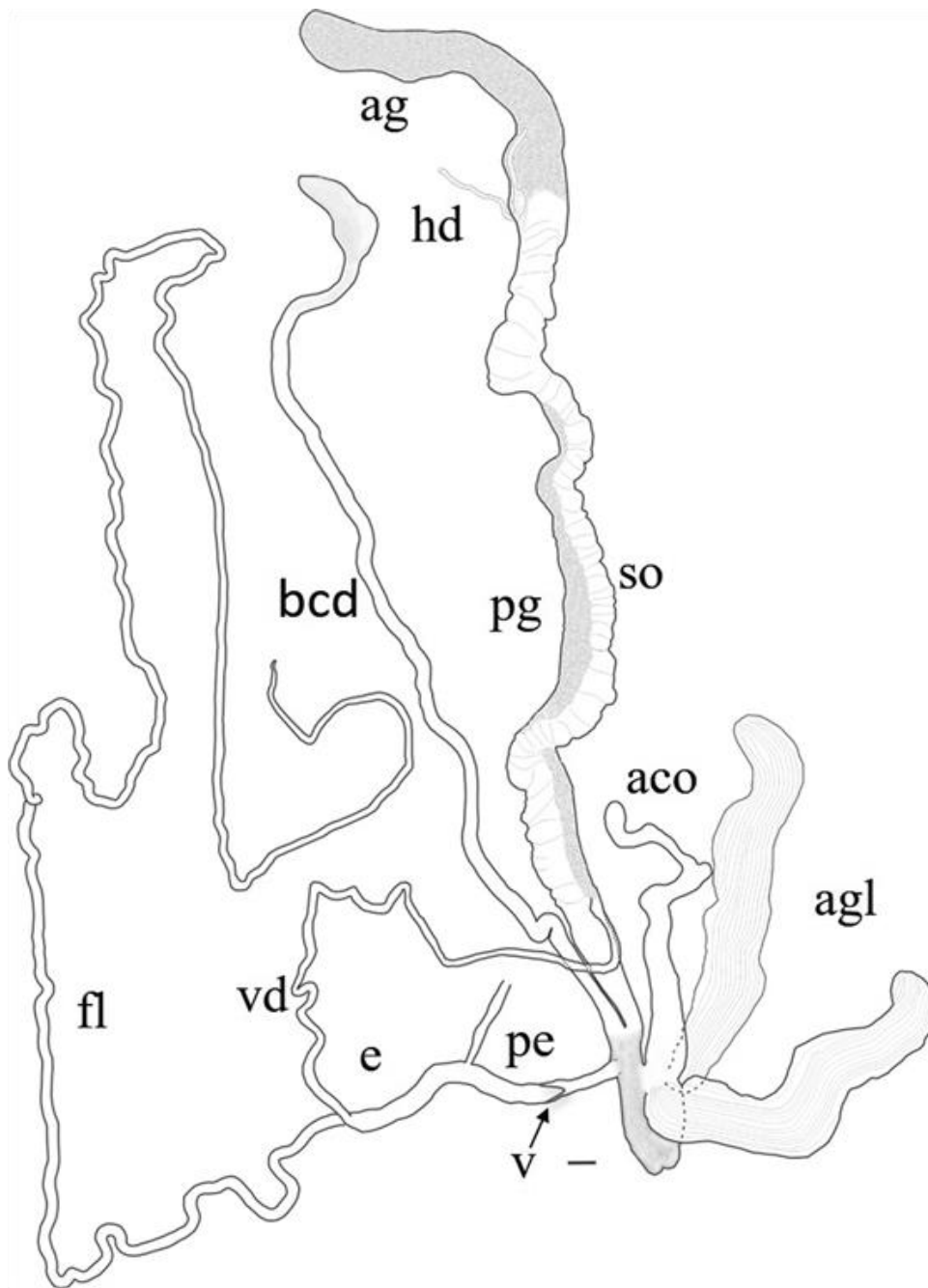
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56 **Figure 6.** Continuation.

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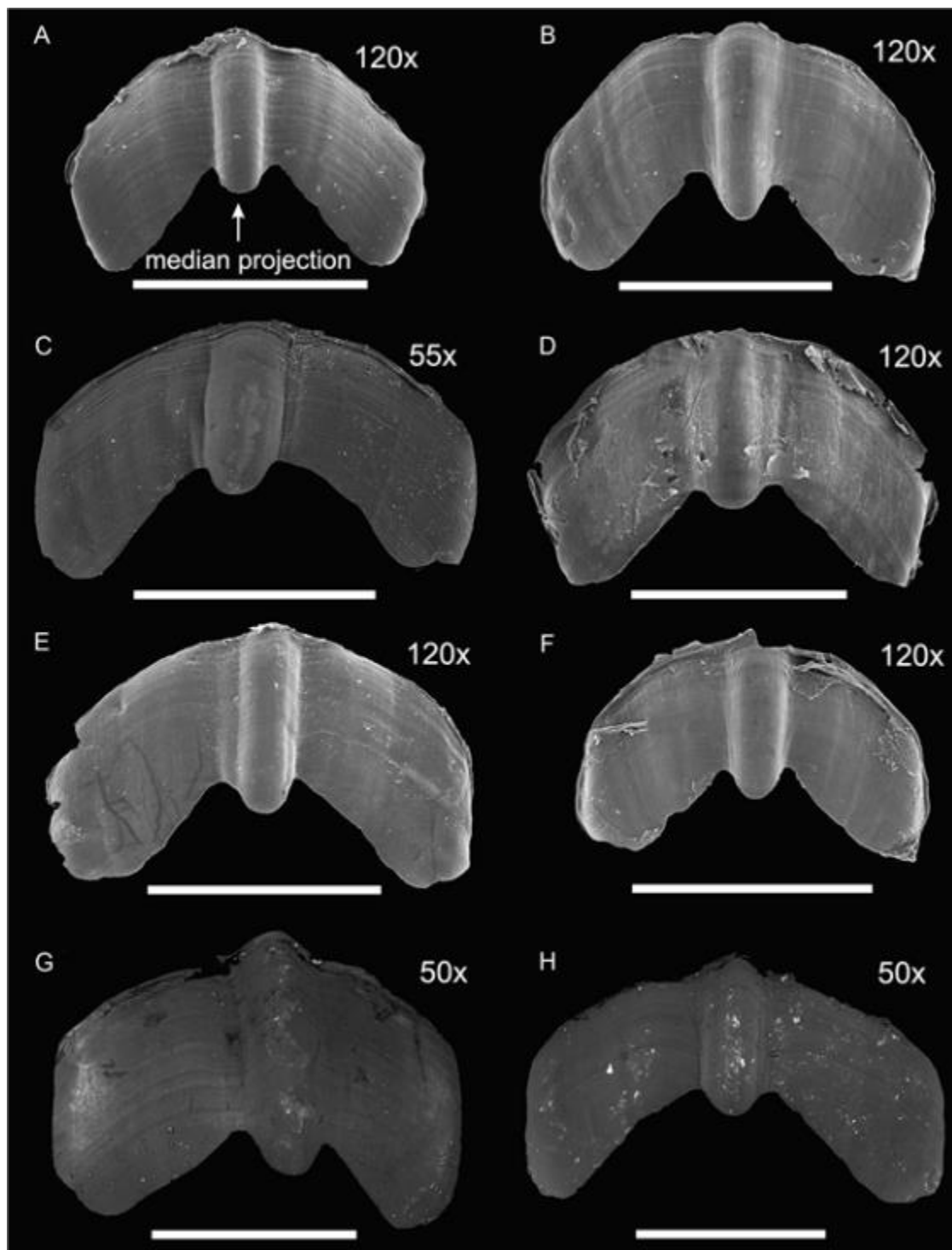


58
 59 **Figure 7.** Genital anatomy of *Jeanneretia sagraiana*. Auxiliary copulatory organ (aco),
 60 albumen gland (ag), accessory gland (agl), bursa copulatrix (bc), bursa copulatrix duct
 61 (bcd), proximal epiphallus (e), flagellum (fl), fertilization pouch-spermathecal complex
 62 (fp), hemaphroditic duct (hd), penis + distal epiphallus (pe), prostatic gland (pg), penial
 63 retractor muscle (prm), spermoviduct (so), verge (v), vas deferens (vd). Scale bar = 1
 64 mm.
 65

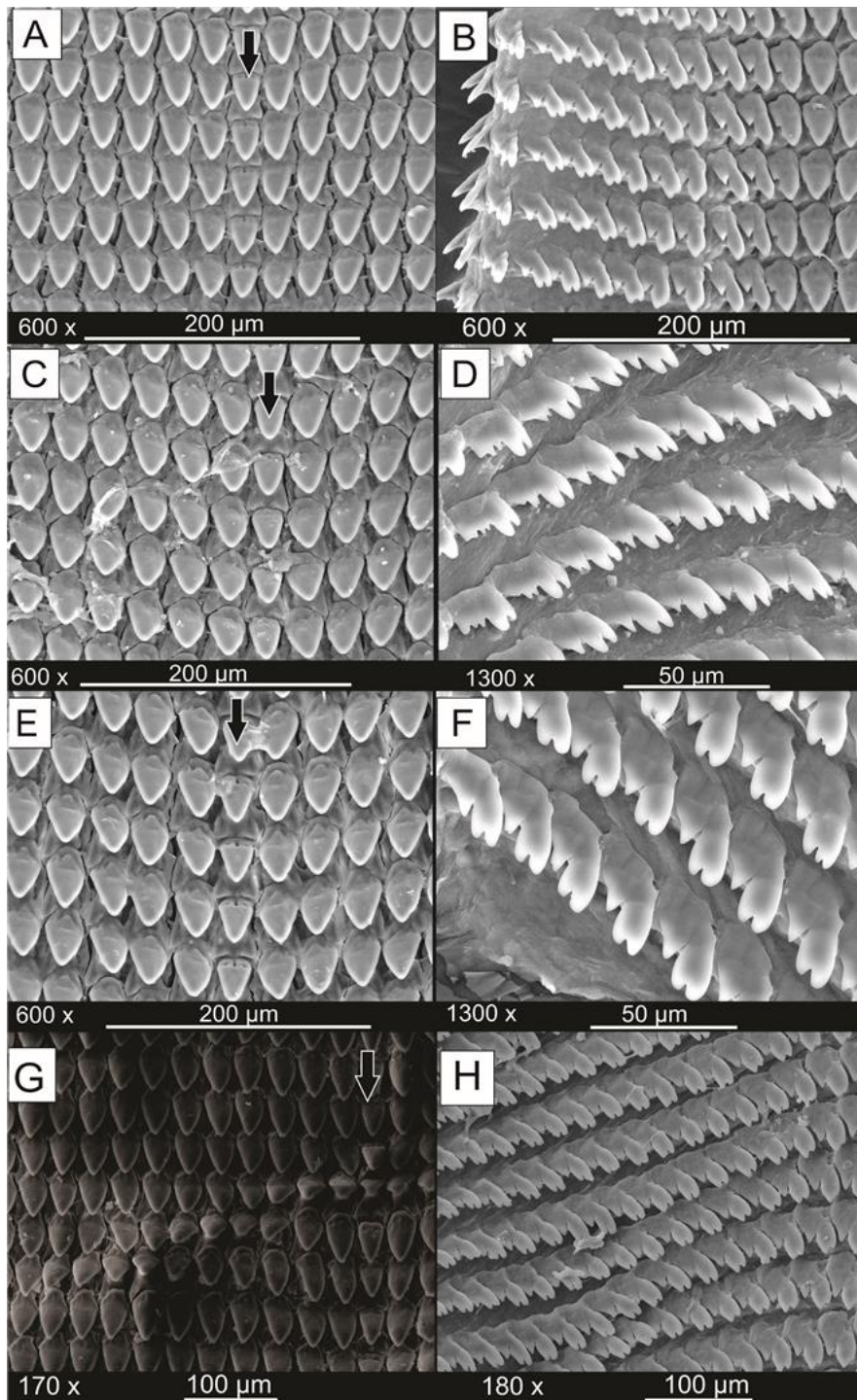


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67 **Figure 8.** Genital anatomy of *Jeanneretia jaumei*. Auxiliary copulatory organ (aco),
 68 albumen gland (ag), accessory gland (agl), bursa copulatrix (bc), bursa copulatrix duct
 69 (bcd), proximal epiphallus (e), flagellum (fl), hemaphroditic duct (hd), penis + distal
 70 epiphallus (pe), prostatic gland (pg), penial retractor muscle (prm), spermoviduct (so),
 71 verge (v), vas deferens (vd). Scale bar = 1 mm.



72
 73 **Figure 9.** SEM photographs of the jaw of *Jeanneretia p. parraiana* (A), *J. p. arangoi* (B),
 74 *J. p. paralella* (C), *J. p. carinata* (D), *J. p. depressa* (E), *J. bicincta* (F), *J. sagraiana* (G),
 75 *J. jaumei* (H). Scale bar = 1 mm.



76

77 **Figure 10.** SEM photographs of the radula of *Jeanneretia bicincta*, A: central and lateral
 78 teeth, B: lateral teeth and transitional teeth. *J. parraiana carinata*, C: central and lateral
 79 teeth, D: marginal teeth. *J. p. arangoi*, E: central and lateral teeth, F: marginal teeth. *J.*
 80 *sagraiana*, G: central and lateral teeth, H: transitional and marginal teeth. Central teeth
 81 marked with a black arrow.