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Taxonomic revision of the monotypic genus *Acyphus* Heller (Coleoptera: Curculionidae) with comments on infraspecific variation

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Abstract

Acyphus Heller, 1921 is a monotypic genus of Entiminae, Naupactini, ranging in north-central Argentina, southern Brazil, Paraguay and Uruguay. Its single species is mainly associated to trees of the genus *Prosopis* (Leguminosae), with several species ranging throughout the xerophytic forests of the Chacoan subregion. The genus is easily recognized by the presence of 20 elytral striae and the robust antennae, with strongly dilated scape, compressed from near base onwards. *Acyphus renggeri* (Labram & Imhoff) -senior synonym of *Acyphus funicularis* Heller- shows variation in the distribution and density of the scaly vestiture of the elytra. There is a morphotype devoid of distinct scales and two squamose morphotypes with different irregular nebulose pattern. The paper includes descriptions of the genus and its only species, habitus photographs, line drawings of genitalia and mouth parts, and a map of distribution.

Keywords: Taxonomy, weevils, Naupactini, *Acyphus renggeri*

Introduction

Acyphus is a monotypic genus described by Heller (1921) based on the species *A. funicularis* Heller, a junior synonym of *A. renggeri* (Labram & Imhoff), according to Kuschel (in Wibmer & O'Brien 1986). It belongs to the subfamily Entiminae, tribe Naupactini, and is distributed in South America (Argentina, Brazil, Paraguay and Uruguay), throughout the Chacoan subregion of the Neotropics, mainly characterized by xerophyllous forests and savannas (Morrone 2002, 2006).

Heller (1921) included *Acyphus* in a dichotomous key of Naupactini from Argentina, where it keys out along with *Cyphus* Germar (current junior synonym of *Cyrtomon* Schoenherr) based on the presence of extra-numeral elytral striae. The genus was also

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included in keys by Emden (1944) and Hustache (1947), however, a complete generic description was never provided, nor was a detailed analysis of the infraspecific variation of its single species.

The main objectives of this contribution are to redescribe *Acyphus*, including characters of the genitalia and mouthparts, to provide a detailed description of its species variation, to bring new data on host plants and geographic distribution, and to discuss its possible relationships to other Naupactini genera.

Materials and methods

This study was based upon examination of 202 specimens borrowed from the following institutions (the collaborating curator's name is given after the location of the collection, and the abbreviation precedes the name):

AMNH American Museum of Natural History, New York, USA. Lee Herman.
BMNH The Natural History Museum, London, UK. Christopher Lyal.
CWOB Charles W. O'Brien Collection, Tallahassee, FL, USA. Charles W. O'Brien.
FIML Fundación e Instituto Miguel Lillo, San Miguel de Tucumán, Argentina. María V. Colomo de Correa.
MACN Museo Argentino de Ciencias Naturales Bernardino Rivadavia, Buenos Aires, Argentina. Arturo Roig Alsina.
MLPC Museo de La Plata, La Plata, Argentina. Norma B. Díaz.
MZSP Museu de Zoologia da Universidade de São Paulo, SP, Brazil. Sergio Vanin.
USNM National Museum Natural History, Smithsonian Institution, Washington D.C., USA. Richard Gordon.

Dissections were made according to standard entomological techniques. Photographs and drawings were done with a digital camera and a camera lucida attached to a stereoscopic microscope.

Measurements were taken with an ocular micrometer. The length of the body was obtained by measuring along the midline. Other measurements, with their abbreviations are as follows: LC, maximum length of club; WC, maximum width of club; LR, length of rostrum; WF, width of frons between anterior margin of eyes; WR, width of rostrum measured across apex (excluding scrobes); LP, maximum length of pronotum; WP-, width of pronotum at anterior margin; WP+, width of pronotum at posterior margin; LE, maximum length of elytra; WE, width of elytra near middle.

Results

Acyphus Heller
(Figures 1–12)

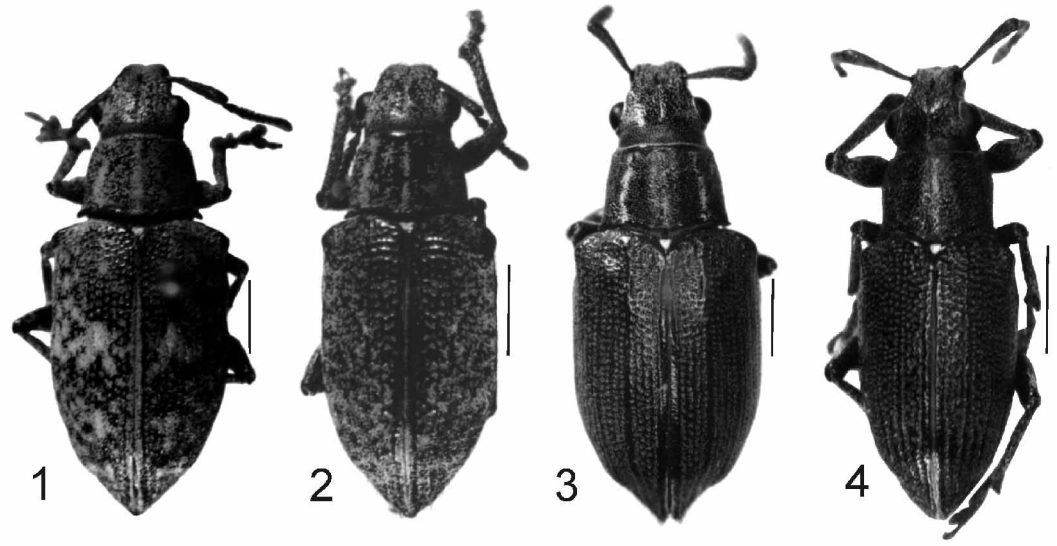
Acyphus Heller 1921:21; Dalla Torre *et al.* 1936:10 (catalogue); Emden 1944:513 (in key); Hustache 1947:8 (in key); Blackwelder 1947:792 (checklist); Wibmer & O'Brien 1986:52 (checklist); Alonso-Zarazaga & Lyal 1999:163 (catalogue).

Type species: *Acyphus funicularis* Heller 1921:27 (=*Megalostylus renggeri* Labram & Imhoff 1849), by original designation.

Diagnosis. Antenna robust, with scape strongly dilated and compressed from near base onwards; funicular article 2 as long as funicular article 1; remaining articles slightly longer than wide. Pronotum truncate-conical, thickened at base. Elytra somewhat depressed, with strongly bisinuate base, prominent humeri and 10 extra numeral striae (20 striae in total). Front tibiae with small denticles on inner face. Outer bevels broad, squamose. Spermatheca large, with long tubular nodulus and well developed ramus; spermathecal duct strongly sclerotized.

Redescription. Species medium sized (female 9.50–15.50 mm long; male 8.60–9.75 mm long). Integument either devoid of distinct scaly vestiture, or covered with recumbent short setae and cream, oval, apressed scales, forming an irregular nebulose pattern. *Rostrum* (Figs 1–4) short to moderately long (LR/WR:1.15–1.33), moderately truncate-conical (WF/WR:1.52–1.70), with elevate, sharp borders; dorsum flat, depressed on anterior third; median groove linear, deep, almost reaching anterior margin of pronotum; epistome narrow, covered with small oval scales; scrobes strongly curved, visible from dorsum, ending in front of eyes; gular angle about 90º. *Mouthparts.* Prementum (Fig. 5) subcordate, external surface slightly concave, areolate, without setae; internal surface with a moderately developed median keel; palpi forming an obtuse angle regarding prementum. Maxillae (Fig. 6) with subrectangular mala, almost parallel to axis of palpus, having three basal lacinial teeth and numerous setae; palpifer and articles 1–2 of palpi transverse, article 3 subconical. Eyes convex; preocular impression absent; postocular constriction slight. Frons and vertex slightly convex. *Antennae* (Fig. 7) very stout; scape strongly dilated and compressed from near base onwards, reaching hind margin of eyes, as long as funiculum excluding club; funicular article 2 as long as article 1, articles 3 to 7 slightly longer than wide; club acuminate oval (LC/WC:1.75–2.20). *Pronotum* (Figs 1–4) strongly transverse (WP/LP:1.37–1.57), truncate-conical (WP+/WP-:1.20–1.45); disc slightly convex, with median depression; front margin slightly curved onwards; flanks slightly arcuate; hind margin thickened, strongly bisinuate; posterior angles strongly projected. *Scutellum* distinct, small, covered with white scales. *Elytra* (Figs 1–4) moderately elongate (LE/WE :1.48–1.68) and somewhat depressed; base strongly bisinuate; humeri strongly prominent, without tooth; apex entire (not bifid), moderately acute; apical declivity slight; punctures

of striae moderate to broad; intervals slightly convex, having extra-numeral striae (whole number of striae= 20). Metathoracic wings present. *Legs* short; fore coxae contiguous, slightly closer to anterior margin than to posterior margin of prosternum; fore tibiae with row of 5 small denticles on inner face (crenulate) and strong mucro; tarsites 2 and 3 laterally expanded; outer bevels broad, squamose; dorsal comb slightly longer than apical comb. *Abdomen*. Intercoxal portion as long as cavities of hind coxae; ventrite 2 slightly longer than ventrites 3+4.

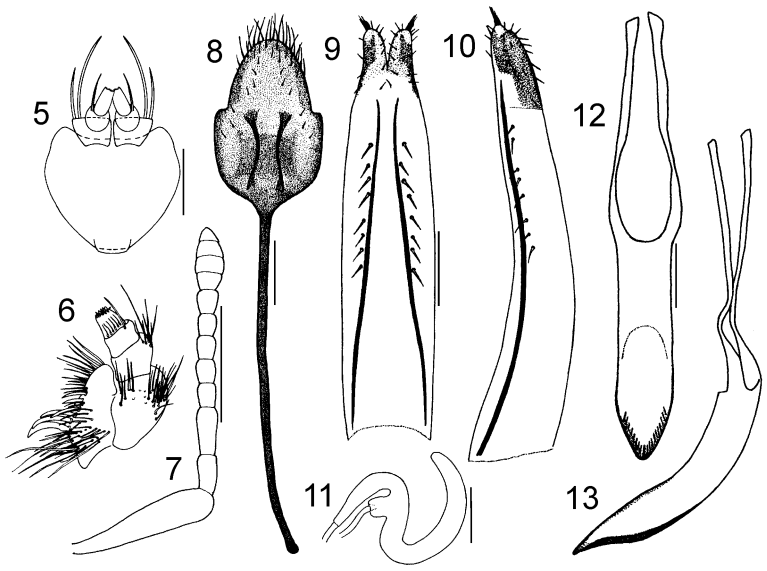


FIGURES 1–4. Dorsal habitus of *Acyphus renggeri*. **1–3,** females; **4**, male. Scale: 2 mm.

Female genitalia. Sternite VIII (Fig. 8) subrhomboidal, 3x as long as apodeme, with pair of longitudinal strongly sclerotized stripes, apex curved bearing long setae. Ovipositor (Figs 9–10) slender, long (about 0,6x as long as abdomen), slightly curved on lateral view, with 8–19 pairs of broad setae on external sides of distal half of baculi; hemisternites slightly sclerotized with short setae; baculi divergent toward proximal end; styli well developed, slightly divergent. Spermathecae (Fig. 11) large (about 1mm), subcylindrical, with long tubular nodulus (as long as spermathecal body), well developed ramus, and long cornu with rounded apex; spermathecal duct strongly sclerotized.

Male genitalia. Aedeagus (Figs 12–13) slightly shorter than abdomen; tube slightly longer than apodemes, slightly curved in lateral view, with subacute apex and large ostium.

Sexual dimorphism. Males more slender and smaller than females; antennal club more elongate and slender than in females (LC/WC:2.15–2.38); pronotum less transversal and larger in relation to elytral disc (values of LE/LP:2.97–3.20, smaller than in females), sides more arcuate on anterior third and less divergent towards posterior margin (WP/LP:1.31–1.37, WP+/WP-:1.30–1.35); elytra more elongate than in females (LE/WE :1.67–1.84).



FIGURES 5–13. Mouth-parts, antennae and genitalia of *Acyphus renggeri*. **5,** prementum, external surface; **6**, maxilla; **7**, antennae; **8**, sternite VIII; **9**–**10**, ovipositor, ventral and lateral; **11**, spermathecae; **12**–**13**, aedeagi, ventral and lateral. Scales: 1 mm (antennae); 0.5 mm (sternite VIII, ovipositors and aedeagi); 0.25 mm (mouth-parts, spermathecae).

Geographic distribution and host plants. *Acyphus* ranges in north-central Argentina, southern Brazil, Paraguay and Uruguay. This area corresponds to the Chaco and Pampa provinces of the Chacoan subregion of the Neotropics, according to the biogeographic scheme of Morrone (2002, 2006). The Chaco (southern Bolivia, western Paraguay, southern Brazil and north-central Argentina) is a xerophyllous caducifolious forest; the Pampa (eastern Argentina, between 30º and 39º south latitude, Uruguay and southern part of the Brazilian state of Río Grande do Sul) is a savanna with Poaceae (Morrone 2000).

The only species of *Acyphus* seems to be associated to native trees of the Leguminosae family typical of the Chacoan subregion, especially *Prosopis* (Mimosoideae), a genus that probably evolved within this xeric biogeographic unit (Roig 1993), playing an important role in the plant-herviborous interactions (Solbring 1977). The known hosts are *Prosopis affinis* Sprengel (=*Prosopis algarrobilla*, *Prosopis nandubay*), *Prosopis torquata* and *Thalia* sp. *Prosopis affinis* is a late deciduous tree, up to 8 m high, distributed in northeastern Argentina (Buenos Aires, Chaco, Córdoba, Corrientes, Entre Ríos, Formosa, Santa Fe and Santiago del Estero provinces), southern Bolivia, southwestern Brazil, Paraguay, Peru and Uruguay (Burkart 1978). This area approximately corresponds to the geographic distribution of *Acyphus*.

Remarks and comparative notes. Nothing is known about the possible relationships of *Acyphus* with other genera of Naupactini. In the keys of Heller (1921), Emden (1944)

and Hustache (1947) it goes out in the same couplet as *Cyrtomon* Schoenherr (senior synonym of *Cyphus* Germar and *Neocyphus* Bedel) (see Lanteri 1990 a), based on the presence of supernumerary striae, however, in *Cyrtomon* these striae are not present in every interval (14 striae in total) and they are not continuous from base to apex. On the contrary, *Acyphus* has 20 complete striae being impossible to distinguish regular to supernumerary ones. Other external features such as those of the vestiture, the proportion of the antennal articles, and the shape of the body (especially pronotum and elytra) are clearly different in both genera.

We propose that *Acyphus* is more closely related to *Cyphopsis* Roelofs, also ranging in the Chacoan subregion. Both genera are similar in the characters of the antenna, body shape and vestiture (color, shape and arrangement of scales and setae). The type species of *Cyphopsis*, *C. clathrata* Roelofs, shows an elytral nebulose pattern similar to that seen in *Acyphus* (see Lanteri & del Río 2006). The main external differences between *Acyphus* and *Cyphopsis* are the presence of 20 elytral striae (instead of 10 normal striae), the absence of tubercles on pronotal flanks and the lack of denticles on the inner margin of all tibiae.

Based on male genitalia, *Acyphus* is also more closely related to *Cyphopsis* than to *Cyrtomon*, because in the latter genus the aedeagal apex has a particular arrow pointed shape similar to that of *Priocyphus* Hustache and *Mendozella* Hustache (see Lanteri 1989, 1990 b; Lanteri & Morrone 1991), whereas in *Acyphus* and *Cyphopsis* is subacute. Regarding to the female genitalia, all these genera are characterized by a strongly sclerotized spermathecal duct and a large spermathecae, with well developed ramus and long tubular nodulus. The curvature of the nodulus, the shape of the sternite VIII (subrhomboidal and with a long apodeme) and most characters of the ovipositor approximates *Acyphus* to *Cyrtomon*, more than to *Cyphopsis*. However, in *Acyphus* there is a very distinct feature of the ovipositor not seen in the other genera, the presence of two rows of coarse setae on each side of the baculi, the latter being recorded for some *Naupactus* Dejean. For an accurate phylogenetic placement of *Acyphus* it will be necessary to undertake a complete phylogenetic analysis of all the Naupactini genera, which is the main goal of our research.

Acyphus renggeri (Labram & Imhoff)

Megalostylus renggeri Labram & Imhoff 1849: Nº 61; Dalla Torre *et al*. 1936:10 (catalogue); Blackwelder 1947:792 (checklist).
Acyphus renggeri: Kuschel in Wibmer & O'Brien 1986:52 (checklist).
Acyphus funicularis Heller 1921:27 (syn. by Kuschel in Wibmer & O'Brien 1986:52)

Redescription. Species medium sized (female 9.50–15.50 mm long; male 8.60–9.75 mm long). Integument black to dark-brown, shiny, either devoid of distinct scaly vestiture, or

covered with cream, oval, apressed scales. Antennae clothed with fine white setae and dark-brown stiff, verticillate setae at distal end of each funicular article. Pronotum with three longitudinal stripes (one slender, along midline, and two wide, on sides). Scutellum squamose, white. Elytra with three different types of vestiture: A) with distinct oval scales, forming a nebulose pattern on whole disc and two pairs of more dense irregular maculae on each side of suture, one near middle and other on posterior declivity (Fig. 1); with distinct oval scales forming a nebulose pattern but lacking pairs of more dense irregular maculae (Fig. 2); and lacking distinct scaly vestiture (except on apical border), but with minute round pale-blue scales, only visible with high magnification (Figs. 3–4). Metepisterna completely covered with white scales. Legs and venter covered with seta-like scales and scatter suberect setae. *Rostrum* (LR/WR:1.15–1.33; WF/WR:1.52–1.70). *Pronotum* (WP/LP:1.37–1.57; WP+/WP-:1.20–1.45). *Elytra* (LE/WE:1.48–1.68). Other morphological features of females and males as those described for the genus (Figs 1–13).

Type material studied. 1 female probable syntype of *Acyphus funicularis*, at the Bruch collection (MACN): [Rca. Argentina/ Prov. Santa Fe 1913/ C. Bruch] [Rosario Hubrig Leg.]

Type of *Megalostylus renggeri* not seen. According to Kuschel (1955) the Imhoff´s collection of types should be at the Museum of Bassel, Switzerland, but the type of *Megalostylus renggeri* was not found there.

Other material studied. ARGENTINA. **Buenos Aires:** no loc., Viana col. (2 AMNH); Isla Martín García, Viana col., 26–29-I-1938 (97 MLPC), IV-1938 (1 CWOC, 3 MACN); Tigre, XII-1950 (1 MLPC). **Chaco:** Las Delicias, 15-III-1936, Denier col. (1 MLPC); Fontana, 8-XI-1935, Denier Col. (3 MLPC), XII-1935 (2 MLPC); Dep. Resistencia, 23-II-1939 (1 MLPC), X-XII-1935, Daguerre col. (1 CWOB, 2 MACN). **Córdoba:** Dto. Calamuchita, El Sauce, 1939-1942, Viana col. (2 MLPC), I-1953 (1 MLPC); Dto. Punilla, Valle Hermoso, XII-1942 (6 MLPC). **Entre Ríos:** no loc., I-1970, Vera Bezzi col. (2 MLPC); Concordia (1 MACN); Puerto Liebig, I-1963 (1 USNM); Ruta 12, 35mi S. Gualeguaychú, 16-XII-1976, on *Prosopis algarrobilla* (1 USNM). **Formosa**: Isla Oca, 1-II-1938 (2MLPC), 8-I-1939 (2 MLPC), 1-II-1939 (9 MLPC); Clorinda, 14-II-40 (1 MLPC), 15-X-1937, col. Denier (2 MLPC); Formosa, II-1949, Martinez leg. (9 MZSP); Ruta 81, 1mi N.W. Formosa, 10-XII-1976, on *Prosopis algarrobilla* (1 USNM). **Misiones:** Dto. Concepción, Santa María, X-1944-48 (8 MLPC). **Salta:** Metán, 13-I-1948 (3 FIML); Pocitos, 24-26-XI-1954 (1 MLPC). **Santa Fe:** no loc. (3 MLPC, 2 MACN); Arroyo Pindo V. Ocampo, 2-II-1948 (1 FIML); Laguna Quebracho, II-1962 (1 MLPC); Villa Ana, 1-18-II-1946 (3 FIML); Villa Guillermina, 15-26-II-1948 (1 FIML). **Santiago del Estero:** Fortín Inca, 20-XII-1937 (9 MLPC). **Tucumán:** no loc. (7 BMNH, 1 MACN); Tapia, XI-1912 (1 MACN). BRAZIL. **Rio de Janeiro:** Guaratiba, VIII-1941, Aristoteles Silva (1 MLPC). PARAGUAY. San Lorenzo, 13-I-1939, Denier col. (1 MLPC). URUGUAY. **Artigas:** Rio Puareim, Picada del Negro Muerto, Sepulturas, 15-I-1952, C. S. Carbonel (1 CWOB). **Río Negro:** San Javier (1 CWOB, 1 MLPC), I-1938 (2 MLPC).

Geographic distribution. *Acyphus renggeri* was originally cited only for Santa Fe province, Argentina. Based on the material studied we add several new locality records and confirm its occurrence in ten Argentinian provinces, Paraguay and Uruguay. Regarding to Brazil, we suspect that the species is distributed in the southern states (Paraná, Santa Catarina and Rio Grande de Sul) but we were not able to confirm it presence in this country. The only specimen studied from Brazil came from Guaratiba (Río de Janeiro state), a locality far out of the range of *Acyphus* and its host plants within the genus *Prosopis*. For this reason we consider that the locality label of that specimen housed at the MLPC must be wrong and we cited it under the material studied with doubts.

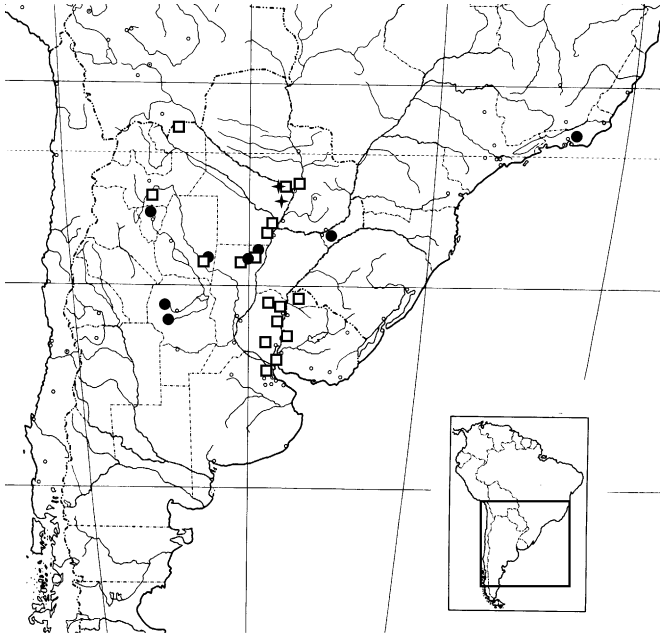


FIGURE 14. Geographical distribution of *Acyphus renggeri*. Morphotype A, only females (black circles); morphotype B, only females (white squares); morphotype C, females and males (black stars).

Infraspecific variation. The variation of *A. renggeri* is mainly related to the presence and distribution of the elytral scales. According to it, there are three main patterns or morphotypes: A) nebulose scaly pattern with two pairs of dense irregular maculae (Fig. 1); B) similar to the former but lacking pairs of dense irregular maculae (Fig. 2); and C) lacking distinct scaly vestiture (Figs. 3–4). The first morphotype was seen in females from Córdoba, Misiones, Santa Fe, Santiago del Estero and Tucumán (Argentina); the second corresponds to females from Argentina (Buenos Aires, Chaco, Entre Ríos, Formosa, Salta, Santa Fe and Santiago del Estero) Paraguay and Uruguay; and the third morphotype was recorded for males and females from Formosa (Argentina) (see figure 14). Morphotypes A and B coexist in Santa Fe and Santiago del Estero (Argentina), whereas B and C occur in

Formosa (Argentina). It seems that the scaly vestiture becomes looser in northern direction, and in some instances (e.g. samples from Chaco) there are specimens with intermediate patterns (e.g. between B and C). It is also remarkable that males are only known from Formosa and they are all devoid of scales.

The presence of several populations composed only by females and a single population from Formosa (Argentina) with the presence of both sexes, would suggest a phenomenon of geographical parthenogenesis (Lanteri & Normark 1995). This kind of reproduction is also recorded for other species of Naupactini with similar distribution and it should be confirmed by further biological studies and/or molecular analyses (Normark & Lanteri 1998; Scataglini *et al.* 2005).

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