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A new species of *Charinus* Simon, 1892 (Amblypygi, Charinidae) from termite nests in French Guiana

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Abstract: The genus *Charinus* is represented by 51 species, distributed in all tropical regions. Their small size allows them to use a wide range of micro-habitats, from caves, litter to insect nests. The new species *C. sillami* sp. nov. was found into termite nests of three different species: *Neocapritermes taracua*, *Spinitermes* sp. and *Embiratermes neotenicus*. Only *Paracharon caecus* (Paleoamblypygi: Paracharontidae) was previously known to be associated with Isoptera. Eleven species of *Charinus* were previously known from Northern South America. *Charinus sillami* sp. nov. is the second species of the genus occurring in French Guiana. An updated key of Northern South-American species is provided.

Key words: taxonomy, whip spider, systematic, termites, *Charinus sillami*

Introduction

Whip spiders are secretive animals that feed on small animals they can capture with their spiny pedipalps. They live in dark habitats like caves, tree trunks or insect nests (termites or ants) (Weygoldt, 2000).

The genus *Charinus* is characterized by a small size (usually less than a centimeter) and the presence of pulvilli at the leg tip. It is the largest genus of Amblypygi (Weygoldt, 2000) with 51 species (Miranda & Giupponi, 2011; Jocque & Giupponi, 2012; Vasconcelos *et al.* 2013; Vasconcelos *et al.* 2014). Its small size allows it to use a wide range of micro habitat from caves (like *C. troglobius* Baptista and Giupponi, 2002) to litter (*C. seychellarum* Kraepelin, 1898) including man-modified environment (*C. vulgaris* Miranda & Giupponi, 2011). The eleven known species in Northern South America are *C. bordoni* (Ravelo, 1977) (Venezuela), *C. camachoi* (González-Sponga, 1998) (Venezuela), *C. gertschi* Goodnight & Goodnight, 1964 (British Guiana and Surinam), *C. insularis* Banks, 1902 (Ecuador, Galapagos Islands), *C. koepcke* Weygoldt, 1972 (Peru), *C. pardillalensis* (González-Sponga, 1998) (Venezuela), *C. platnicki* (Quintero, 1986) (Surinam), *C. quintero* Weygoldt, 2002 (Guyana), *C. tronchonii* (Ravelo, 1975), *C. vulgaris* Miranda & Giupponi, 2011 (Brazil), and the last one—the first species occurring in French Guiana—*Charinus bromeliaea* Jocque and Giupponi 2012. That last species was found in bromeliceae plants near inselbergs. Recent captures have shown that this species can be found also on the ground, foraging on the litter (Courtial & Pétilion, pers. comm.).

In Amblypygi, only *Paracharon caecus* (Paleoamblypygi: Paracharontidae) was previously known to be associated with Isoptera (Hansen, 1921), but recently four specimens (1 male and 3 females) of *Charinus sillami* sp. nov. were captured in several termite nests in the *Barrage de Petit Saut* [*Petit saut* Dam] (French Guiana) belonging to two different genera of termites: *Neocapritermes taracua* Krishna & Araujo, 1968 and *Spinitermes* sp. (Isoptera, Termitidae). Two other specimens (1 male and 1 female) were found in the same locality than the first ones, but in nests of *Embiratermes neotenicus* (Holmgren, 1906) (Isoptera, Termitidae). The specimens were caught alive and one of the authors tried to breed them. Due to the stress of the travel and the dryness, they died soon after the reception of the specimens.

Material and methods

The specimens were stored in 70% ethanol. The studies, drawings and measurements were realized with a *camera lucida* on a Leica Wild M8 binocular microscope. The alive depicted specimens were taken in picture with an Eos 450 D Canon DSLR and a 100 mm macro F/2.8 L IS UMS Canon lens, lightened with a 580 EXII Canon Cobra flash. The designation terms follow Weygoldt (2000), *i. e.* the tibial pedipalp spines are counted from distally to proximally, and proximally to distally for the femur. Ventral spines are noted in Roman numbers and dorsal spines in Arabic numbers. The first letter of the name of the segment is placed before the number of the spine. The surface sculpture follows the terms of Harris (1979). The terms used in the description of the male genitalia follows Giupponi & Kury (2013).

Depositories

BMNH	Natural History Museum, London, UK. (Janet Beccaloni).
AMNH	American Museum of Natural History, New York, USA (Lorenzo Prendini).
CFR	Personal Collection of Florian Réveillon; Dijon, France.
CPOM	Personal Collection of Pierre-Olivier Maquart, Sainte-Hermine, France.
CRU	Collections of Rennes 1 University, Rennes, France (Cyril Courtial).

Additional material. *Charinus bromeliaea*: 1 female, Guyane Française, Réserve Nationale de la Trinité, Crique Aya, 21-22/X/2009, pitfall trap, Courtial C., Pétilon J. [CRU].

Results

Taxonomic description

Charinidae Quintero, 1986

Charinus Simon, 1892

Identification key for the *Charinus* species from Northern South America (modified from Jocque and Giupponi, 2012)

1	Basitibia of the fourth leg divided into 4 articles (tibia with five) and carapace with or without median eye tubercle	2
-	Basitibia divided into 3 articles.	4
-	Basitibia divided into 2 articles (tibia with three)	7
2	Female gonopods with small vestigial claws	<i>C. koepcke</i>
-	Female gonopods without small vestigial claws.	3
3	3 and 5 spines on the upper side of the femur and tibia (respectively), 3 and 2 spines on the lower side of the femur and the tibia (respectively). Animal occurs in the Galapagos Islands	<i>C. insularis</i>
-	5 and 7 spines on the upper side of the femur and tibia (respectively), 5 and 4 spines on the lower side of the femur and the tibia (respectively). Animal occurs in the Guianas	<i>C. gertschi</i>
4	Total body length maximum 6.0 mm	5
-	Total body length exceeding 8.0 mm	6
5	Meso- and meta-sternum are flattened plates	<i>C. pardillalensis</i>
-	Meso- and meta-sternum in the shape of a small granule.	<i>C. camachoi</i>
6	Pedipalpal femur with 2 dorsal and 2 ventral spines and distitibia of leg IV with 16 trichobothria	<i>C. bordoni</i>
-	Pedipalpal femur with 3 dorsal and 3 ventral spines and distitibia of leg IV with 15 trichobothria	<i>C. tronchoni</i>
-	Pedipalpal femur with 3 dorsal and 2 ventral spines and distitibia of leg IV with 16 or 17 trichobothria	<i>C. vulgaris</i>
7	Carapace without median eye tubercle	<i>C. quinteroi</i>
-	Carapace with a small median eye tubercle	8
8	Color dark brown, distitibial spine of pedipalp about 1/4 the size of the medial spine basitibia, distitibia of leg IV with 2 + 16 trichobothria	<i>C. platnicki</i>
-	Color light brown, distitibial spine of pedipalp about 2/3 the size of the medial spine, basitibia of leg IV with just 1 trichobothria.	9
9	Pedipalp distitibia dorsally densely hairy; Pedipalp tibia with 4 spines in its dorsal side and a setiferous tubercle; First femoral	

- spine on pedipalp just 1.3 times longer than the second one. *C. sillami* sp. nov.
- Pedipalp distitibia dorsally sparsely hairy; Pedipalp tibia dorsally with 5 spines; First femoral spine on pedipalp 2 times longer than the second one. *C. bromeliaea*

***Charinus sillami* sp. nov. Réveillon & Maquart**

Diagnosis. Pedipalp: distitibia dorsally densely hairy; tibia bearing dorsally 4 spines and one proximal setae. Cephalothorax shrinking anteriorly, fovea deep and surrounded by high rounded bumps. *C. sillami* differs from *C. platniki* by of the presence of just one trichobotria in the basitibia of leg IV instead of two; from *C. quinteroi*, *C. troglobius* and *C. vulgaris* by the presence of a median eye tubercle; from *C. koepckeii*, *C. insularis* and *C. gertschi* by the presence of a basitibia IV divided into just 2 articles instead of 4 articles, and from *C. pardillalensis*, *C. camachoi*, *C. bordoni*, *C. tronchoni* and *C. vulgaris* which have 3 articles. The new species can be distinguished from the only other known species from French Guiana (*C. bromeliaea*) by shape of the cephalothorax, anteriorly shrinking in the new species, instead of wider in *C. bromeliaea*, the place of the angle formed by the fovea, which is located approximately at 2/3 of the length of the cephalothorax in *C. sillami*, instead of 4/5 in *C. bromeliaea* (Figure 1 c & f); the amount of setae on the distitibia of the pedipalp, which is dorsally densely hairy, instead of sparsely hairy; the number of spines on the pedipalp tibia, which bears 4 spines and a setiferous tubercle (present in juveniles and adults of both sexes), contrary to 5 spines on *C. bromeliaea* (Figures 1 a & e); the number of spines on the basitarsus, 1 spine on the ventral side in the new species and 2 on *C. bromeliaea*; and the size of the first dorsal femoral spine, 1.3 times bigger than the second in *C. sillami* instead of 2 times in *C. bromeliaea* (Figures 1b & 1e).

Etymology. The species name is dedicated to David Sillam-Dussès, who caught and kindly gave us the specimens.

Description. female holotype **Pedipalp: Femur:** bearing dorsally 3 spines (F1>F2>F3), median spine (F2) almost 3/4 of proximal (F1) and the distal (F3) 3/4 of median spine (Figure 2c); ventrally with 3 spines on primary series (FI>FII>FIII), basal ventral spine (FI) curved inwards, bearing a setae, second spine (FII) almost 2/3 of basal spine, distal spine (FIII) as long as 2/3 of median spine; one paratype female, and the male bears a small fourth one; **Tibia:** bearing dorsally 4 spines and a well defined setiferous tubercle, T1<T2>T3>T4; T1=1/4 T2, T3=3/4 T2, T4=1/2 T3; bearing ventrally two large spines decreasing in size, TII=2/3 TI, and followed by a setiferous tubercle; **Basitibia:** bearing dorsally 2 large spines with the basal spine about 2/3 length of distal spine, bearing also one spine ventrally; **Distitibia:** long; Dorsally: densely hairy, bearing two spines, basal spines about half of distal spine; Ventral side inermous; **Cephalothorax** (Figures 1c, d & h): Anteriorly shrinking; anterior border of the prosoma with dented aspect, peripheric groove well defined, wider from the posterior margin to the lateral eyes, then continues thinner anteriorly; anteriorly with smooth impressions, but posteriorly with a deeply impressed fovea which is surrounded by rounded bumps. The base of the bumps are separated in two by a thin groove, the posterior part dies into the peripheric groove. The fovea is located at 1/3 of the cephalothorax length. **Sternum:** consisting of 3 sclerotized parts: tritosternum with a round base and projecting anteriorly between pedipalp coxa in an elongated, forked tubercle, a little over 3 times longer than wide, with 2 apical (1 on each prong of the fork), 2 middle and 2 basal setae; middle piece about 2/3 length of tritosternum, rounded, convex, anteriorly with 2 strong setae, and 2 setulae laterally and 1 posteriorly; third sclerite rounded and convex, about the same size as second sclerite, with 2 large setae positioned centrally.

Abdomen: oblong with delicate almost indistinguishable punctuations.

Chelicera: bearing four internal teeth. Proximal one very big (about 2 times longer than wider), 2 median teeth-spines like- about half size of proximal one; distal teeth about 2/3 of proximal teeth, bifid, with distal cusp larger (Figure 1g). Claw with 5 teeth.

Legs with many setae; length of I>III>IV>II, tibia I with 23 articles, tarsus I with 37 articles. **Leg IV, basitibia:** divided into 2 pseudo-articles, one trichobothria on the first pseudo-article, and one at the last one; **distitibia:** 3 basal trichobothria and 13 distal (*sf* with 5 trichobothria, *sc* with 5, and the 3 terminal (*tf*, *tm* and *tc*) (Figure 2). **Basitibia-distitibia length:** BT1>DT>BT2; distitarsus tetramerous. **Genitalia:** Posterior margin of the genital operculum rounded with few setae. Female gonopods rounded, sucker-like and small. Without finger like appendage and with few setae along its posterior edge.

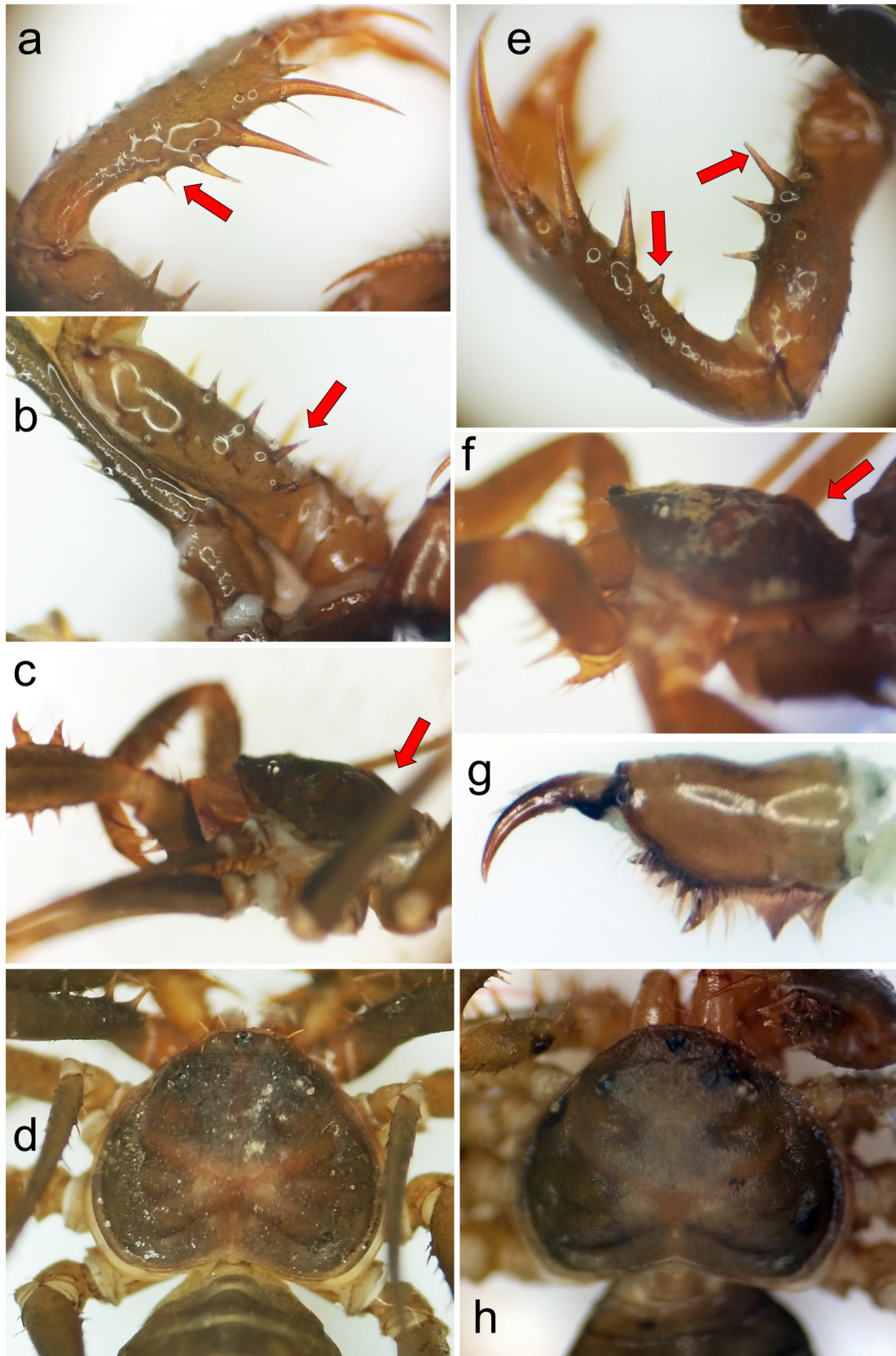


FIGURE 1. Differences between *C. sillami* and *C. bromeliaea*; a–d and g–h, holotype of *C. sillami*: **a:** *C. sillami*, left pedipalp tibia; **b:** *C. sillami*, left pedipalp femur; **c:** *C. sillami*, cephalothorax; **d:** *C. sillami* (male paratype), cephalothorax; **e:** *C. bromeliaea*, pedipalp tibia and femur; **f:** *C. bromeliaea*, cephalothorax; **g:** *C. sillami*, chelicerae; **h:** *C. sillami* (female paratype), cephalothorax; the arrows point the differences between *C. sillami* and *C. bromeliaea*.

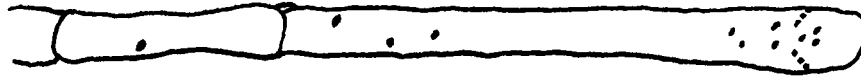


FIGURE 2. *C. sillami*: details of the tibia IV with location of trichobotria.

Color: alive: Cephalothorax and pedipalps: brownish with chelicerae and the tip of the pedipalp spines reddish. Legs: brownish with lighter articulations. Abdomen: dark-brown, with apical black stripe. Ethanol: same colors than alive but fader (Figure 3).

Measurements (in mm). Holotype: Cephalothorax: length: 2.62, width: 3.71; Pedipalp: femur: 2.57, tibia: 2.17, basitarsus: 0.88, distitarsus: 0.48, tarsal claw: 0.39.



FIGURE 3. *C. sillami*: living male and female specimens.

Description of the male. Same as female, except that it possesses elongated pedipalps, which bear on the tibia, ventrally two spines and a fade setiferous tubercle, and a fourth spine (half the size of the third one) on the ventral side of the pedipalp femur (like one of the female paratypes).

Male gonopods: soft structure V shaped with sclerotized regions in its base. LoL1 larger than LoD and LoD larger than LoL2. LoL1 and LoL2 with sclerotised region on their inner surface. Pi and LaM almost of the same size.

Measurements (in mm). Paratype male: Cephalothorax: length: 2.42, width: 3.20; Pedipalp: femur: 3.95, tibia: 4.45, basitarsus: 0.95, distitarsus and tarsal claw: 1.20.

Distribution records. North of French Guiana.

Type material. **HOLOTYPE** ♀: Guyane Française, 97315, Barrage de Petit Saut, III/2013, into a nest of *Neocapritermes taracua*. D. Sillam-Dussès leg. [BMNH]. **PARATYPES:** 1♀1♂ same data as the holotype. [Female in AMNH, Male in BMNH]. 1♀ same data as the holotype, but in *Spinitermes* sp. nests. [CPOM]. 1♀1♂ Guyane Française, 97315, Barrage de Petit Saut, III/2014, in *Embriatermes neotenicus* nests. [CFR].

Discussion

Like most of Charinidae, *Charinus sillami* does not support dryness (Weygoldt 2000). We were unable to breed them in order to understand their ethology. The only known case of association with Isoptera was made by Hansen (1921) with *Paracharon caecus* Hansen, 1921, which lives into termite nest in Guinea Bissau. *P. caecus* is extremely rare, very few observations were made, but due to the blindness of the species, its stout and hairy pedipalps, several authors (Hansen, 1921; Delle-Cave 1986; Weygoldt 1996) inferred that it is strongly associated with termites, and might use their nest, not only for resting, but also as a place to live in. Because *C. sillami* does not show any of the above cited features (blindness, stout and/or hairy pedipalps), their relationship with termites remains unclear. In addition, the fact that they were found in the nests of three different species—which limits the possibility of a chemical mimicry—tilts the balance for a facultative presence. The catch was made during the day and the catcher did not observe any agonistic sign against amblypygi by the termites. A recent observation, made in Guinea (Seringbara), have shown that *Damon medius* (Herbst, 1797; Phrynichidae) can be found inside cathedral termite nest, and was observed by night going out and hunting on the construction (Vanderbergh, per. com.). Similar observations were made in Formicidae nests. LeClerc *et al.* (1987) have shown that *Phrynus gervaisii* (Pocock, 1894), can rest during the day at the entrance of the nests of the giant tropical ant *Paraponera clavata* Smith, 1858 (Hymenoptera, Formicidae) which is known to inflict a very painful sting. Pérez *et al.* (1999) have even shown that the presence of *Phrynus gervaisii* (Pocock, 1894) decrease the mortality rate of the nests of *Paraponera clavata* (Fabricius, 1775).

Peter Weygoldt (2000; 2002) reported the case of *Charinus platnicki* (Quintero 1986) which was found in nests of *Atta cephalotes* (Linnaeus, 1758) and *Atta sexdens* (Linnaeus, 1758).

It would be very interesting to study how whip spiders deal with their hosts to be able to live among them without having them initiating any agonistic behaviour.

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