A new species of the ant genus *Forelius* (Formicidae: Dolichoderinae) from the dry forest of Colombia

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Abstract

*Forelius damiani* sp. nov. is described from the dry forest of the Sierra Nevada de Santa Marta, Colombia, and additional collections from Costa Rica and Texas (USA). This new species is separated from the other rounded spiracles *Forelius* by the number of erect pronotal hairs, size and coloration. Comments and hypotheses about the biogeography of the genus are provided. *Forelius pruinosus* is recorded for the first time for Colombia.

**Key words:** Ants, *Forelius*, Neotropical region, taxonomy, Colombia

Resumen

Se describe a *Forelius damiani* sp. nov., del bosque seco de la Sierra Nevada de Santa Marta, Colombia; esta especie también se encuentra en Costa Rica y Texas (Estados Unidos de Norte América). Esta nueva especie puede separarse de las otras *Forelius* con espiráculo redondeado, por el número de pelos erectos en el pronoto, tamaño y la coloración. Además, se presentan comentarios e hipótesis sobre la biogeografía del género *Forelius*. La especie *Forelius pruinosus* es registrada por primera vez para Colombia.

**Palabras clave:** Hormigas, *Forelius*, región Neotropical, taxonomía, Colombia

Introduction

Ants of the genus *Forelius* Emery 1888 are a component of the arid and semiarid ant fauna of the New World (Cuezzo 2000). *Forelius* has an apparently amphitropical distribution in North and South America (Shattuck 1992), occurring from the southern part of the United States to Panama and from northeastern Brazil to southern Argentina (Cuezzo 2000). Most species occur in the southern part of the range, from coastal and southern Brazil to Patagonia, and relatively few species occur in the northern part of the range, in Mesoamerica and the southern United States (Shattuck 1992, Cuezzo 2000, Ward 2005). In general, all species of *Forelius* inhabit dry and open areas and are seldom found in forested or moist sites.

Cuezzo (2000) revised the genus delimiting 18 species, offering distribution maps and a key to species. Recently Ward (2005) proposed *F. analis* as a junior synonym of *F. pruinosus*. In this paper, we report the first record of the genus *Forelius* in Colombia, with the description of a new species, *Forelius damiani* Guerrero & Fernández sp. nov. and the first record of *F. pruinosus* in Colombia. A revised key to known species with rounded spiracles is also provided.
**Methods**

Observations of pinned specimens were made using a Nikon SMZ645 stereomicroscope at 80X magnification and an optic fiber ring lamp. Scanning Electron Microscope (SEM) photographs of *Forelius damiani* were obtained from two specimens at the MZSP in São Paulo, Brazil. The specimens were previously cleaned in acetone, critical point dried in a Balzer (Bal-TecH CPD 030), and sputter coated with gold (Bal-TecH SCD 050). Specimens were mounted on metallic triangles using silver glue and then affixed to stubs for the electron microscopy. The images were obtained under several magnifications (150 to 300x), according to the size of the specimens or structure observed. Finally, the images were edited (Corel Photo–Paint X3 version 13.0®) to enhance some brightness and contrast details.

Measurements follow Cuezzo (2000) using an ocular micrometer at 80x. All of the following measurements are expressed in millimeters:

- **TL** Total length. In lateral view, taken from anterior clypeal margin (excluding mandibles) to apex of last segment of metasoma.
- **HL** Head length. Maximum length, in full face view, from apex of clypeal plate to middle of posterior vertex margin.
- **HW** Head width. Maximum width in full face view excluding eyes.
- **EL** Eye length. Maximum length of eye in full face view.
- **EW** Eye width. Width of eye perpendicular to maximum length.
- **IOD** clypeus-ocular distance. Shortest distance between posterior margin of clypeus and anterior margin of eye.
- **COD** Scape length. Maximum length of first antennal segment, excluding neck and basal condyle.
- **PSL** Propodeal spiracle length. Maximum length of propodeal spiracle.
- **PSW** Maximum width of propodeal spiracle perpendicular to maximum length.
- **ISPD** Inter-spiracle distance, across propodeum. Taken with body in dorsal view.
- **PL** Petiolar length. Maximum length of petiole. Taken with body in lateral view.
- **PHM** Maximum petiolar height. Taken with body in lateral view.
- **MsL** Mesosoma length. Straight-line distance measured in lateral view from anterior margin of pronotum (excluding collar) to posterior extremity of metapleural lobe.

**Indices**

- CI Cephalic index: (HW/HL)*100
- OI Ocular index: (EL/EW)*100
- SI Scape index: (SL/HW)*100

**Collections.** Specimens used in this study have been deposited in the following collections:

- **CASC** California Academy of Sciences, San Francisco, California, USA
- **CEUM** Insect Collection of University of Magdalena, Santa Marta, Colombia.
- **CPDC** Coleção de Formigas do Centro de Pesquisas do Cacau, Comissão do Plano de Lavoura Cacueira, Itabuna, Bahia, Brazil.
- **CWEM** William and E. Mackay Insect collection, University of Texas, El Paso Texas, USA.
- **IAvH** Insect Collection, Instituto Humboldt, Claustro San Agustín, Villa de Leyva, Boyacá, Colombia.
Coordinates of localities were obtained from the information on the specimen labels and in some cases from the field notes of P. S. Ward (for all specimens not seen). The geographic coordinates were plotted on a distribution map generated by the software ArcView 3.2®.

Results

*Forelius damiani* Guerrero & Fernández sp. nov.
(Fig. 1, 2 & 3)

**Worker measurements.** Holotype. TL 1.56, HL 0.48, HW 0.38, EL 0.10, EW 0.08, IOD 0.24, COD 0.10, SL 0.40, PSW 0.01, PSL 0.01, ISP 0.10, PL 0.10, PHM 0.08, MsL 0.44, CI 79, OI 125, SI 105.

Paratypes and non types (n= 38): TL 1.40 – 1.68, HL 0.42 – 0.50, HW 0.36 – 0.42, EL 0.10 – 0.12, EW 0.08 – 0.10, IOD 0.22 – 0.32, COD 0.04 – 0.10, SL 0.36 – 0.44, PSW 0.01 – 0.02, PSL 0.01 – 0.02, ISP 0.10 – 0.16, PL 0.08 – 0.14, PHM 0.06 – 0.10, MsL 0.44 – 0.58, CI 79 – 90, OI 120 – 150, SI 95 – 132.

**Worker diagnosis.** Mandible with four teeth and two denticles. Pronotum in profile relatively low and flat, with 2 erect setae. Dorsum of mesonotum and propodeum with very fine punctuation. Mesopleural and metapleural regions shining, with sparse pubescence. Propodeal spiracle circular ≤ 0.02 mm diameter.

**Worker description.** Head flattened dorsoventrally, longer than wide (full face view). Vertex of head weakly concave. Palpal formula 6:4. Anteromedial clypeal plate with shallow concavity and long, ventrally curved setae about same length as closed mandibles. Clypeal margin with a long median seta and two long lateral setae projecting forward. Long erect seta on middle inner margin of each torulus; long seta behind each torulus. Scape short, reaching posterior margin of head. Mandible with apical tooth elongate, twice as long as subapical tooth; subapical tooth followed by a denticle, a tooth, another denticle, and a basal tooth separating masticatory margin from basal margin. Mesosoma (lateral-view) straight with slight mesonotal groove. Mesonotum and propodeum with decumbent scattered pubescence; very fine punctuation on dorsum of mesonotum and dorsum of propodeum. Mesopleuron and metapleuron shining, with sparse pubescence. Propodeal spiracle circular. Posterior face and dorsal face of propodeum convex; dorsal face longer than posterior face. Outer face of anterior coxa with two setae; proximal seta longer than distal seta; inner face of middle and posterior coxae with distal setae; femora and tibiae with dense pilosity. Scale present and strongly inclined anteriorly; petiolar spiracle at base of scale. Dorsum of gaster with abundant pubescence; first gastric (third abdominal) tergite without setae, second gastric tergite bearing 2 setae, third gastric tergite bearing 4 setae and fourth tergite bearing 6 setae. Head and mesosoma dark brown; gaster, petiole, legs, scape and mandible light brown; teeth of mandibles slightly darker than mandible; funicular segments darker than scape.


**Queen and male.** Unknown

**Holotype worker. Colombia:** Magdalena; Santa Marta; Vda. Mosquito; 11°10'23.6" N 74°10'45" W 96 m; pitfall; 24-26.Feb.2007; D. Ramírez, coll. Deposited in ICN Insect Collection, Instituto de Ciencias Naturales, Universidad Nacional de Colombia, (Bogotá D.C., Colombia). Paratypes: 22 workers, all from the same locality and date as the Holotype, deposited in BMNH (1w), CASC (4w), CEUM (2w), CWEM (1w), CPDC
Additional material examined: Colombia: (10w), Bolívar; Zambrano; Hda. Monterrey; 9°45’ N 74°49’ W 70 m; pitfall; 01.Aug.1993 F. Fernández & G. Ulloa, coll. Costa Rica: (3w), Guanacaste; 10°48’N 85°41’W; 100 m; at tuna bait; 14Jun.1985; xeric scrub on rocky ridge; J. Longino, coll. [LACM EN1 141815]. (1w), Guanacaste; Santa Elena Peninsula; 10° 53’N 85° 45’W; 08.May.2002; J. M. Jacobs, coll. [JTLC000009256]. (1w), Guanacaste; 8km S Santa Cecilia; 10°59’N 85°26’W; 650 m; 24Jan.1991; Wet forest. Strays; J. Longino, coll. [INBIOCRI001282672]. (1w), Heredia; La Selva Biological Station; 10°26’N 84°01’W; 01.May.1994; J. Longino, coll. [INBIOCRI001260978]. (1w), Puntarenas; Pita; 10°10’N 84°55’W; 200 m; Sweep sample of roadside vegetation; 13Jul.1984; J. Longino, coll. [LACM EN1 141813].

Specimen records provided by P. S. Ward (pers. comm.): Costa Rica: Guanacaste; 1km E Playa Nancite; PN Santa Rosa; 10°48’N 85°41’W; 100 m; 5.Apr.2000; Low, open tropical dry forest, in gully, on serpentine; On trail between Playa Naranjo and Playa Nancite, within the watershed of Quebrada Nancite. P. Ward, coll. USA: Texas. Cameron Co. Resaca de la Palma State Park. 25°59’N 97°34’W; 10m; 16.Apr.2006; Subtropical thorn woodland; P. Ward, coll.

FIGURE 3. Distribution of Forelius damiani n. sp. Guerrero & Fernández.

**Geographic distribution:** Colombia (Magdalena, Bolívar), Costa Rica (Guanacaste, Heredia and Puntarenas), USA (Texas).

**Etymology:** The species name honors our colleague and friend Damian Ramírez, who collected and loaned the ants from his thesis research.

**Natural History:** *Forelius damiani* n. sp. was collected in lowland dry forest of the Sierra Nevada de Santa Marta, a tropical forest with an open canopy dominated by *Bursera simaruba* (L.) Sarg. (Burseraceae), *Bursera glabra* (Jacq.) Triana & Planch and *Pereskia colombiana* Britton & Rose (Cactaceae). The habitat is subjected to occasional human disturbance resulting from the extraction of timber. It was also collected in the dry forest of Zambrano (Bolívar, Colombia), but we have no specific information about floristic composition from this site. However, this locality is a transition zone between gallery forest and tropical dry forest. This species is restricted to lowland forest and scrub vegetation, from sea level to 650 m elevation.

The specimens from Costa Rica were collected in open tropical dry forest, xeric scrub, and synanthropic habitats in wet forest areas. Although the genus is generally adapted to dry climates, this species can extend into wet climate areas in the presence of frequent human disturbance.

Although no complete nest of *F. damiani* has been collected, the large number of specimens collected from the type locality with only one pitfall trap (150 workers) indicates that its colonies could be composed of more than one hundred workers, foraging in large numbers.

*Forelius pruinosus* (Roger 1863)
(Fig. 6)

**Material examined:** Colombia. (3w), Magdalena; Santa Marta; Vda. Mosquito. 11°10’23.6”N 74°10’45”W 96 m; Manual collection; 03.Jan.2008; D. Olivero & M. Escárraga, coll. Deposited in Insect Collection of University of Magdalena (CEUM), Santa Marta, Colombia.

**Geographic distribution:** Bahamas, Colombia (Magdalena), Costa Rica (Guanacaste), Cuba, Guatemala, Mexico, Panama, The West Indies, USA [Arizona, California, Florida, Georgia, Missouri, North Dakota (Wheeler & Wheeler 1963), Texas].

Cuezzo (2000) provided a taxonomic key for all species of *Forelius* known. Due to the new synonymy between *F. analis* and *F. pruinosus* (Ward 2005) and the description of *F. damiani*, we provide a new key for the species with circular propodeal spiracle, with the exception of *F. keiferi*. The descriptions of *F. keiferi* and *F. pruinosus* given in Cuezzo (2000) overlap in many characters and the status of *F. keiferi* as a species distinct from *F. pruinosus* is not certain.
Key to species of *Forelius* Emery with spiracles rounded [based on workers; modified from Cuezzo (2000)]

1. Small workers (TL 1.6 – 1.7 mm). Scapes barely reaching vertex margin (SI < 90). Mesosomal outline always continuous in lateral view. (Argentina, Brazil, Paraguay)................. *pusillus* (Santschi) (Fig. 4)
   - Worker size variable (TL 1.4 – 2.5 mm). Scapes reaching or surpassing vertex margin by at least 1/6 of their length (SI > 90). Mesosomal outline variable ............................................................................. ........2

2. Pronotum bearing only two erect setae. Dorsal face of propodeum lacking erect setae. (Colombia, Costa Rica, USA)..........................................................damiani sp. nov. (Fig. 1 & 2)
   - Pronotum bearing more than two erect setae. Dorsal face of propodeum bearing erect setae. Note: Some evidence of intergradation between *F. pruinosus* and *F. mccoiki* (Ward 2005) suggests that *F. pruinosus* may contain a number of cryptic species, and may also hybridize with the very similar *F. mccoiki* .......3

3. Mandibles with four teeth and three to four denticles. Pronotum usually with six erect setae. Dorsal face of mesosoma bearing more than 10 erect setae. (Jamaica, Mexico, USA) ......*mccoiki* (McCook) (Fig. 5)
   - Mandibles with five teeth and one or two denticles. Pronotum usually with four erect setae. Dorsal face of

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mesosoma bearing 2 to 6 erect setae. (Bahamas, Colombia, Costa Rica, Cuba, Guatemala, Jamaica, Mexico, Nicaragua, Panama, USA) .................................................. pruinosus (Roger) (Fig. 6)

Discussion

Forelius damiani and F. pruinosus are the first species of the genus Forelius known from Colombia. Both species have been collected in the lowland dry forest of the Sierra Nevada de Santa Marta while F. damiani has also been collected in Zambrano (Bolívar), northern Colombia. The Zambrano specimens do not differ from those of the type locality. The workers of F. damiani from Costa Rica differ somewhat in size (TL 1.50 – 1.68 mm in Costa Rica vs. TL 1.40 – 1.58 mm in Colombia) and the length of the scapes (exceeding the vertexal margin by 0.04 mm in Costa Rica, not exceeding the vertexal margin in Colombia). While the TL of the workers showed differences between the populations of Costa Rica and Colombia, the length of mesosoma is less variable and the measurements for the two countries broadly overlap (MsL 0.46 – 0.56 mm in Costa Rica vs. MsL 0.44 – 0.58 mm in Colombia). Specimens from Costa Rica are darker brown than those from Colombia.

Forelius damiani is relatively similar to F. pruinosus (Roger), but F. damiani has only two erect pronotal hairs while F. pruinosus can have two to four erect pronotal hairs; the promesonotum of F. damiani is lower compared with F. pruinosus; the dorsal face of the propodeum is longer than the declivitous face in F. damiani, moreover it lacks propodeal hairs; and F. damiani is smaller than F. pruinosus in some measurements such as TL, HL, HW and SL (see measurements above and Cuezzo (2000) for comparison). Forelius damiani is similar to F. pusillus, however several characters show differences: the mandibles of F. damiani have four teeth while those of F. pusillus have five; the propodeum of F. pusillus has four conspicuous setae but F. damiani has none; the workers in F. pusillus are a little larger (TL 1.6 – 1.8 mm in F. pusillus vs. 1.40 – 1.68 mm in F. damiani). Characters that distinguish Forelius damiani from most other Forelius species are the circular propodeal spiracle and the absence of erect hairs on the dorsal face of the propodeum.

The occurrence of round spiracles on the new species F. damiani reinforces a pattern in which the few species found north of the Amazon basin all have round spiracles, while south of the Amazon many species have elongate, slit-like spiracles and only one species has round spiracles. Several hypotheses can explain this pattern, based on whether round spiracles are plesiomorphic, apomorphic, or homoplasious in the genus. If round spiracles are plesiomorphic, the genus could have originated north or south of the Amazon and then dispersed across the Amazon (perhaps during a period of drier climate). Subsequently, elongate spiracles evolved in the south (as one adaptation to arid conditions, reducing water loss through the spiracle) and perhaps allowed a greater diversification there. In the south, forms with elongate spiracles may have displaced previously more abundant and diverse forms with round spiracles. Alternatively, round spiracles could be apomorphic. An initial radiation of forms with elongate spiracles may have occurred in southern South America. Subsequently, a form with round spiracles evolved which was better suited to humid conditions and better able to cross the Amazon Basin. Once on the other side it diversified into the present species found north of the Amazon. Finally, round spiracles could be homoplasious, evolving independently north and south of the Amazon. Further phylogenetic work on the genus is needed to differentiate among these hypotheses.

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