

FIRST FOSSIL FILISTATIDAE: A NEW SPECIES OF *MISIONELLA* IN MIOCENE AMBER FROM THE DOMINICAN REPUBLIC

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ABSTRACT. *Misionella didicostae* new species is described from 15–20 Ma Miocene amber from the Dominican Republic as the first fossil record of the family Filistatidae. The biogeography of the extant (Brazil and Argentina) and the new fossil species supports the hypothesis that the developing northern Greater Antilles and northwestern South America were briefly (33–35 Ma) connected by a landspan centered on the emergent Aves Ridge. Undiscovered extant species of *Misionella* may exist on Hispaniola. The autospized first pair of legs suggest that the spider was engulfed in a flowing resin seep of relatively low viscosity, rather than having wandered onto a sticky exudate, becoming stuck and then covered by a subsequent resin flow.

Keywords: Hispaniola, Araneae, spider, biogeography, autospasy

The spider family Filistatidae has an almost worldwide distribution in tropical and warm temperate regions, and consists of 107 species and one subspecies in 16 genera (Platnick 2003). These small to medium-sized, cribellate spiders represent one of the most basal branches of the Haplogynae (Platnick et al. 1991). Filistatidae have not previously been described in the fossil record, although Eskov (1990) mentioned a fossil specimen from the Upper Jurassic of Kazakhstan. The current evolutionary tree (including the new fossil described in this paper) of the Haplogynae (Fig. 1) predicts the presence of Filistatidae in the fossil record back to the Upper Cretaceous. However, this is a youngest age prediction based on the presence of Oonopidae and Segestriidae in amber from New Jersey (Penney 2002a, 2004). Here, the first fossil Filistatidae is described in the genus *Misionella*, from Miocene (15–20 Ma; e.g. Iturralde-Vinent & MacPhee 1996) Dominican Republic amber.

METHODS

Preservation.—The spider is preserved close to the surface of a clear yellow, tear-shaped piece of Dominican Republic amber 4 cm long × 1.7 cm wide; for details of locality and stratigraphy see Iturralde-Vinent & MacPhee (1996). The spider is best observed in ventral view. There are two partial insect legs and the associated thoracic sternite in the

amber as a syninclusion. The holotype and only known specimen is held in the collection of the Museo del Ámbar Dominicano, Puerto Plata, Dominican Republic.

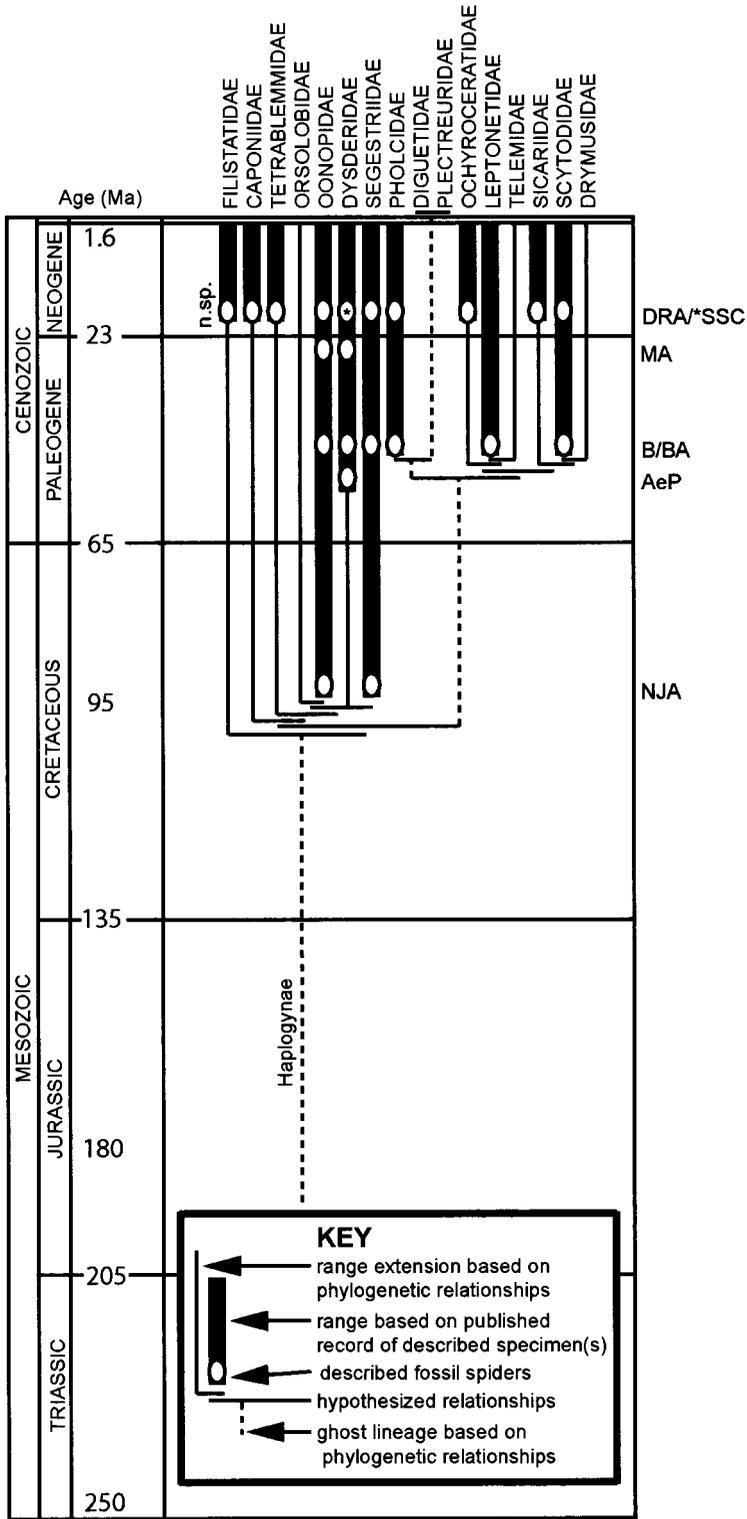
Measurements and drawings.—All measurements were made using an ocular graticule and are in mm. Drawings were done under incident light with a camera lucida attached to an Olympus SZH stereomicroscope and photographs were taken with a Nikon D1X digital camera attached to a Wild M8 stereomicroscope then manipulated in Adobe Photoshop.

Abbreviations used in the text and figures.—In the leg formula (e.g. 1423), the legs are ranked in order of length (longest first). Abbreviations are as follows: cx = coxa; cy = cymbium; e = embolus; fe = femur; h = haemolymph; la = labium; mt = metatarsus; op = opisthosoma; pa = patella; pl = paraembolic lamina; pnm = leg segment present but not measurable; pp = pedipalp; rex = retro-lateral excavation; s = long setae; sp = spine; spr = spinneret region; st = sternum; ta = tarsus; ti = tibia; 1–4 = walking legs 1–4.

SYSTEMATIC PALEONTOLOGY

Family Filistatidae Ausserer 1867
Subfamily Prithinae Gray 1995
Misionella Ramírez & Grismado 1997

Type species.—*Filistata mendensis* Mello-Leitão 1920 by original designation.



Distribution.—Recent species in Brazil and Argentina, fossil species in Dominican Republic amber.

Remarks.—*Misionella* was erected as a monotypic genus by Ramírez & Grismado (1997) for *Filistata mendensis* from Brazil and Argentina. Grismado & Ramírez (2000) described a second species from Brazil.

Misionella didicostae new species
Figs. 2–5

Material examined.—Holotype, adult male in Dominican Republic amber, held in the Museo del Ámbar Dominicano, Puerto Plata, Dominican Republic.

Diagnosis.—*Misionella didicostae* can be distinguished from the two known extant species by having a spiralled embolus distally extending well beyond the paraembolic lamina. In addition, it lacks small spinules in the retrolateral excavation of metatarsus 2.

Etymology.—The specific epithet is a matronym in honor of Mrs Ada (Didi) Benelli Costa who co-founded the Museo del Ámbar Dominicano, Puerto Plata, Dominican Republic in 1982, based on collections amassed over 33 years.

Description of holotype.—Body length 2.21; carapace 0.84 long, width not measurable; ocular region slightly raised, with eight closely grouped eyes. Clear views of the eye arrangement and carapace shape are not afforded by the specimen, but there are no obvious differences between the details visible and the figure of the type species provided by Ramírez & Grismado (1997: fig. 96). Only distal tips of chelicerae visible: weak, unmodified with a small fang. Labium longer than broad, with curved sides converging to form a pointed tip; fused to sternum. Maxillae longer than wide, convergent. Sternum subcircular, width 0.40, length of fused sternum and labium 0.77. Opisthosoma 1.21 long, 0.54

wide, fine detail of anal tubercle, spinnerets and cribellum not clear, situated ventrally, advanced from the posterior margin (Figs. 2, 3).

Leg formula 1423; leg 1 cx 0.33, fe 1.86, ti 2.13, mt 1.64, ta 1.00; leg 2 cx 0.30, fe 1.34, ti 1.47, mt 0.70, ta 0.60; leg 3 cx 0.30, fe 0.93, ti 0.93, mt 0.83, ta 0.43; leg 4 cx 0.33, fe 1.36, ti pnm, mt 1.00, ta not preserved; mt 2 with a retrolateral excavation in the distal half bearing a single prominent retrolateral spine (Figs. 2–4); mt 1 with a single long, ventral terminal spine; remaining leg segments without spines. All leg segments, opisthosoma and sternum with clearly visible, long setae. Pedipalp fe long, ti globose without projections, cymbium vestigial and partially fused to tegulum, embolus spirally twisted distally which extends well beyond the paraembolic lamina (Fig. 5).

Female.—Unknown.

Distribution and age.—Dominican Republic amber; Miocene (see Iturralde-Vinent & MacPhee [1996]).

Remarks.—This specimen conforms with the diagnostic characters of the genus given by Ramírez & Grismado (1997). Ramírez & Grismado (1997) performed a cladistic analysis of the filistatid genera, which are placed in two subfamilies, Filistatinae and Prithinae. Only males of the genera *Misionella* Ramírez & Grismado 1997 and *Pikelinia* Mello-Leitão 1946 have the metatarsus of the second leg modified, presumably to perform a clasping function during copulation. Extant species of both these genera are known only from South America and the Galapagos Islands (Grismado & Ramírez 2000; Ramírez & Grismado 1997; Müller 1987). These genera are distinguished from one another by the structure of the male palpal tibia. *Pikelinia* has a prominent dorsal retrolateral projection, whereas *Misionella* does not (Ramírez & Grismado 1997). The new fossil species differs from the two known extant species of *Misionella* in the structure of

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Figure 1.—Evolutionary tree of the Haplogynae. DRA = Dominican Republic amber (Wunderlich 1988; Penney 2001, this paper); SSC = Shanwang, Shandong, China (Dysderidae only; Zhang et al. 1994); MA = Mexican amber (Petrunkevitch 1971); B/BA = Baltic and Bitterfeld ambers (Menge 1854; Petrunkevitch 1950; Wunderlich 1981, 1991, 1993); AeP = Aix en Provence (Gouret 1888); NJA = New Jersey amber (Penney 2002a, 2004). Cladogram follows Coddington & Levi (1991); for details of evolutionary tree construction and terminology see Smith (1994). Not illustrated: Segestriidae described by Hickman (1957) and Oonopidae from Japan and Kenya (Nishikawa 1974 and Wunderlich 1981 respectively) may be extant species in Recent copal (e.g. Poinar 1992).



the pedipalp. In *M. mendensis* (Mello-Leitão 1920) the embolus is not spiralled but has only a slight kink and it does not extend beyond the paraembolic lamina; *M. jaminawa* Grismado & Ramírez 2000 has a hook-shaped embolus and lacks a paraembolic lamina. In addition, both extant species have small spinules in the retrolateral excavation of mt2; these are absent in the new fossil species. Based on the pedipalp morphology the new species is more closely related to *M. mendensis*.

DISCUSSION

The fossil and extant Hispaniolan spider faunas were reviewed by Penney & Pérez-Gelabert (2002). The only known filistatid from the island was the extant *Kukulcania hibernalis* (Hentz 1842), which is most certainly an introduced species (Penney 1999). Based on this observation, Penney (1999) hypothesized that Filistatidae may not have been present on Hispaniola during the Miocene when the amber was formed, and that the family had colonized the island more recently. The discovery of the new fossil falsifies this hypothesis and undiscovered extant species of *Misionella* may also exist on the island today. This new family record for the fossil fauna brings the number of families recorded from named species in Dominican Republic amber to 36 and the total number of families recorded to 45 (see Penney & Pérez-Gelabert 2002).

Misionella was formerly only recorded from extant species in Brazil and Argentina (Ramírez & Grismado 1997) although it probably has a wider distribution in South America. It is not included in species lists for Panama (Nentwig 1993), Costa Rica (Vega 1980), Cuba (Alayón-García 2000) and is not recorded from North America (Platnick 2003). Petrunkevitch (1928) considered the Greater Antillean spider fauna to represent an eastern outgrowth of the Central American fauna by way of a presumed earlier land connection and subsequent continent–island vicariance. However, such a land connection appears never to have existed (Ross & Scotese 1988; Iturralde-Vinent & MacPhee 1999). Iturralde-Vinent &

MacPhee (1999) proposed that during the Eocene–Oligocene transition, the developing northern Greater Antilles and northwestern South America were briefly (33–35 Ma) connected by a landspan (a subaerial connection between a continent and one or more off-shelf islands) centered on the emergent Aves Ridge. This landspan consisted of a series of large, closely spaced islands or possibly a continuous peninsula stretching from northern South America to the Puerto Rico/Virgin Islands Block (Iturralde-Vinent & MacPhee 1999). The massive uplift that apparently permitted these connections was finished by 32 Ma (Iturralde-Vinent & MacPhee 1999). The Greater Antilles in their current guise are relatively young geographical features, probably no older than the middle Miocene. Therefore, all on-island lineages forming the Recent fauna must be younger than Middle Eocene (Iturralde-Vinent & MacPhee 1999). The known distribution of Recent and fossil species of *Misionella* supports the Greater Antillean–South America landspan hypothesis of Iturralde-Vinent & MacPhee (1999), rather than the Greater Antillean–Central American land connection hypothesis of Petrunkevitch (1928).

Roth & Roth (1984) defined autospasy as the separation of appendages, segments or parts thereof at a predetermined locus of weakness when the appendages or segments are restrained by any external (not self-induced) source. Entrapment in amber would constitute such a source. Autospasy occurs rarely in haplogynes but is known to occur in Filistatidae at the patellar–tibia joint. In the fossil, right legs 1 and 4 and left legs 1 and 3 have autospasized at this point and there are what I interpret as haemolymph exudations from the patella of right leg 1 and possibly also left leg 1 preserved in the amber (Figs. 2, 3), which indicates it had happened shortly after becoming entrapped in the resin. Indeed, the first pair of legs are preserved in the same piece of amber close to the spider, however they have rotated around approximately 180 degrees (Figs. 2, 3). This observation suggests

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Figure 2.—*Misionella didicostae* new species. Holotype male, Dominican Republic amber. Ventral view of whole specimen. Scale line 1.0 mm.

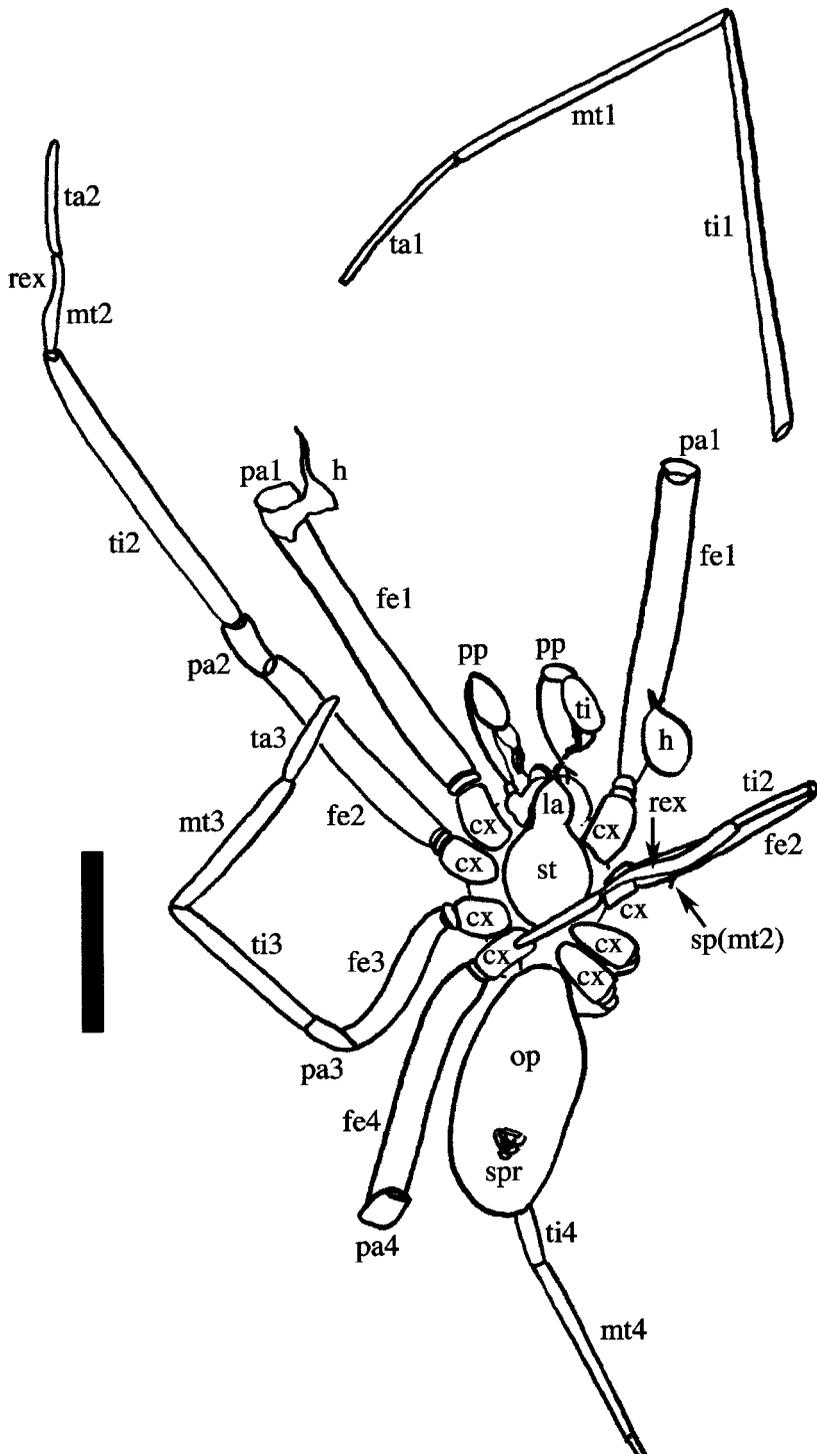
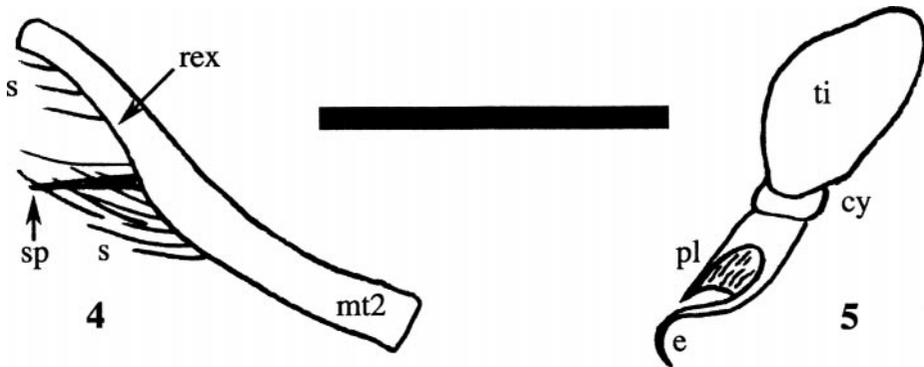


Figure 3.—*Misionella didicostae* new species. Holotype male, Dominican Republic amber. Camera lucida drawing of whole specimen. Scale line 1.0 mm. Refer to text for abbreviations.



Figures 4–5.—*Misionella didicostae* new species. Holotype male, Dominican Republic amber. 4, metatarsus 2. 5, pedipalp. Scale line 0.5 mm. Refer to text for abbreviations.

that the spider was engulfed in a flowing resin seep of relatively low viscosity, rather than having wandered onto a sticky exudate, becoming stuck and then covered by a subsequent resin flow, as is known to have occurred in many cases of invertebrate amber preservation (Penney 2002b). Although Recent species of *Misionella* are primarily synanthropic, some have been collected from tree trunks (Ramírez & Grismado 1997). The discovery of this genus in amber is consistent with ecological observations of its Recent relatives.

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