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Pulchellaranea pedunculata n. gen., n. sp. (Araneae: Araneidae), a new fossil genus of spiders with a review of araneid spiders in Dominican amber

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Abstract

Pulchellaranea pedunculata n. gen., n. sp. (Araneae: Araneidae), a new genus of orb web spiders, is described from Dominican amber. Diagnostic characters for the new taxon are: lateral eyes positioned on peduncles arising from the upper edge of the carapace, large, protruding anterior median eyes that are twice the diameter of the posterior median eyes, the opistosoma dorsally wider than long and attached one quarter distance from the anterior end, overhanging spinnerets with the posterior edge notched; opistosoma with 3 pairs of posteriorly directed humps and 3 pairs of sigilla, large palps with a wide cymbium and narrow paracymbium curved at the tip, a large median apophysis with a ventral tubercle and forked tip, and the terminal apothesis with a forked tip. A review of araneid spiders in Dominican amber is provided.

Keywords: Araneidae; Dominican amber; Tertiary spider
Introduction

Members of the spider family Araneidae are a globally distributed clade of orb web spiders ranging from 2-15 mm in size (Roberts, 1995). They are probably one of the most frequently observed spider groups since their symmetrical webs are quite noticeable with the spider usually positioned in the middle waiting for potential prey. Many araneids are festooned with colorful patterns of yellow, orange, green, black or white on their dorsum. Many tropical forms bear various types of projections or humps on their abdomens. Representatives of seven genera were previously described from Dominican amber (Penney 2008; Wunderlich 1988). The present study describes a new genus of Araneidae from this source.

Materials and methods

The specimen was obtained from mines in the Cordillera Septentrional of the Dominican Republic. Dating of Dominican amber is still controversial with the latest purposed age of 20-15 mya based on foraminifera (Iturralde-Vinent and MacPhee 1996) and the earliest as 45-30 mya based on coccoliths (Cêpek in Schlee 1990). In addition, Dominican amber is secondarily deposited in sedimentary rocks, which makes a definite age determination difficult (Poinar and Mastalerz 2000). A range of ages for Dominican
amber is possible since the amber is associated with turbiditic sandstones of the Upper Eocene to Lower Miocene Mamey Group (Draper et al. 1994). Dominican amber was produced by the leguminous tree, *Hymenaea protera* Poinar and a re-construction of the Dominican amber forest based on amber fossils indicated that the environment was similar to that of a present day tropical moist forest (Poinar and Poinar 1999). Observations and drawings were made with a Nikon SMZ-10 stereoscopic microscope. The specimen is complete and well preserved. The amber piece containing the fossil is sub-rectangular in outline, measuring 10 mm in greatest length, 9 mm in greatest width, and 6 mm in greatest thickness.

**Description**

**Araneae**

**Araniomorphae**

**Araneidae**

*Pulchellaranea* Poinar, n. gen.

Type species: *Pulchellaranea pedunculata* Poinar (Figs. 1-4)

Description: Lateral eyes approximate, positioned on peduncles arising from upper edge of carapace; anterior median eyes large, protruding, twice diameter of posterior median eyes; head portion of carapace not set off from thoracic portion; sides of carapace convex; opistosoma yellow, wider than long when viewed dorsally, attached one quarter distance from anterior end and overhanging spinnerets; anterior edge of opistosoma rounded, posterior edge notched, with 3 pairs of posteriorly directed humps,
first pair double; with 3 pairs of sigilla; palp large with wide cymbium and narrow paracymbium curved at tip; median apophysis large, with ventral tubercle and forked tip; terminal apothesis forked.

Comments: The new genus is distinguished from extant genera of araneids by the position of the pedunculate lateral eyes and structure of the carapace, opistosoma and palps. The fossil shows some similarities with the following extant genera. Members of Enacrosoma Mello-Leitão, 1932 are characterized by a wider than long opistosoma with pairs of lateral humps, but they have a rectangular opistosoma, the humps occur on the anterior, lateral and posterior surfaces, the opistosoma is marked with paired, indistinct darker patches and spots, and there is a sclerotized ring round the spinnerets (Levi, 2001). The males have a narrow cephalic region set off from the remainder of the prosoma and the palps are quite different from those of the fossil.

Males of the genus Hypognatha Guérin-Méneville 1840 have lateral eyes on the tips of projections but the projections are positioned on the front of the head region beneath the median eyes. This genus is also characterized by a pattern of scutes on the dorsum of the opistosoma and a posterior notch in the sternum, neither of which occurs in the present fossil.

The posterior border of the sternum of the fossil is pointed and extends between the fourth coxae, similar to the condition found in Encyosaccus Simon, 1895. However, in Encyosaccus, the carapace is as wide in the eye region as it is in the thoracic region and the dorsum of the abdomen is covered with sclerotized discs.
Members of the genus *Xylethrus* Simon 1895 have a wide sternum as occurs in the fossil but also have the opistosoma covered with sclerotized disks and the paramedian process on the male palp is drawn out into a thread (Levi 1996). Species of *Gasteracantha* Sundwall, 1833 also have a wide sternum, but males have the median eyes set off from the rest of the carapace, and the latter is narrowed anteriorly with straight sides. In addition, the dorsum of the opistosoma has dark markings and the palp has a circular paramedian apophysis, which is not the case in the present fossil (Levi 1996).

The fossil shares some characters with *Cyclosa* Menge, 1866 but members of this genus have adjacent posterior median eyes, non-pedunculated lateral eyes and the thoracic region is raised and often set off from the cephalic portion. The opistosoma can be spherical but is usually longer than wide, pointed and often bearing tubercles (Levi 2002).

The fossil shows some resemblance to the Dominican amber *Enacrosoma verrucosa* (Wunderlich 1988) that was originally tentatively assigned to the genus *Cyclosa* (Wunderlich 1988) but then transferred to the genus *Enacrosoma* by Penney (2008). However the lateral eyes of *E. verrucosa* are juxtaposed on a slight raise on the carapace while those of the fossil are on a distinct peduncle. Also the opistosoma of *E. verrucosa* has only one pair of sigilla while the fossil has 3 pairs. In addition, the base of the prosoma is narrowed in *E. verrucosa* but truncate in the fossil. The long, slender, club-shaped paracymbium of *E. verrucosa* clearly differs from the short paracymbium with a curved tip as occurs in the fossil.
*Pulchellaranea pedunculata* Poinar, n. sp. (Figs. 1-4)

With characters listed in the generic diagnosis. a posterior notch in the sternum.

Holotype male. Body length, 2.9 mm, legs, palps and prosoma reddish brown, opistosoma yellow with 3 pairs of tan sigilla and numerous tan tubercles, each bearing a tan to white seta.

**Prosome:** Length (dorsal), 1.5 mm, length (lateral), 2.1 mm; width, 1.3 mm; lateral eyes adjacent but positioned at tips of projections (peduncles) arising from lateral margin of carapace; anterior median eyes large, protruding anteriorly, twice diameter of posterior median eyes; posterior median eyes facing dorsad, twice diameter of lateral eyes; labium triangular, wider than long; all coxae bearing from 2-4 tubercles; all femora spined; tibia without spurs, femur I longer than femur IV; tibia IV with 1/1/1 bristles; sternum as wide as long, posterior border pointed and extends between fourth coxae.

**Palps:** Palpal lengths, 950 µm and 800 µm; palpal widths, 280 and 300 µm; setae not observed on palpal patella; palpal tibia wider than long; palp large with distinct shell-like cymbium, paracymbium slender with hook-shaped tip; embolus short, barely extending beyond forked tip of median apophysis; terminal apophysis, also slightly forked at tip, longer than median apophysis. See Table 1 for lengths of leg segments.

**Opistosoma:** Length (dorsal), 1.5 mm, length (lateral), 1.8 mm; width, 1.6 mm, yellow, wider than long, attached to carapace at anterior fourth, rounded anteriorly, overhanging spinnerets, with 3 pairs of lateral posterior humps, first pair with associated lobe; with posterior notch and 3 pairs of sigilla; covered with tan tubercles, each bearing short tan or white seta; sclerotized ring around spinnerets absent.
Material examined. - Holotype (accession # A-10-267) from the northern mountain range in the Dominican Republic deposited in the Poinar amber collection maintained at Oregon State University. Female unknown.

Etymology.- The generic name is from the Latin “pulcher” for beautiful and the Latin “aranea” for spider. The specific epithet is from the Latin “pedunculus” for foot in reference to the pedunculated lateral eyes.

Discussion

Male spiders of various groups may have one or more pairs of eyes on projections, presumably related to finding, mating with and then escaping from females. The length of the projections can vary considerable. The lateral eyes on males of *Hypognatha* can extend out to half the head width (Levi 1996). The Mexican amber *Mirometa valdespinosa* Petrunkevitch, 1963 has all eight eyes on separate projections (turrets) oriented in different positions (Petrunkevitch, 1963).

Presently, there are some 325 species of extant spiders in 182 genera and 45 families in Hispaniola and already some 170 fossil spider species in 99 genera and 45 families from Dominican amber (Penney 2008; Wunderlich 1988). All of the amber species and 26 % of the genera are extinct (Penney 2008; Wunderlich 1988).

Fossil representatives of the Araneidae are uncommon even though the family dates back to the Early Cretaceous (Penney 2008) and is widely distributed today. While 58 species of extant araneids in 27 genera occur in Hispaniola today, only representatives

The following key separates the males (corresponding females remain unknown) of the araneids thus far described from Dominican amber.

1- Cephalic portion of carapace raised (expanded) in area of posterior median eyes-

*Araneometa* Wunderlich, 1988- 2

- Cephalic portion of carapace not raised- 4

2- Both pairs of lateral eyes directed downwards; with 5 pairs of sigilla- *Araneometa excelsia* Wunderlich, 1988

– Lateral eyes not directed downwards; with 4 pairs of sigilla- 7

3 – Both pairs of lateral eyes directed laterally; opistosoma with long bristles; second pair of sigilla more or less spherical ---- *Araneometa herrlingi* Wunderlich 1988

- Only posterior pair of lateral eyes directed laterally: anterior pair of lateral eyes directed downward; opistosoma with short bristles; second pair of sigilla elongate, transverse---- *Araneometa spirembolus* Wunderlich 1988

4- Each pair of lateral eyes on erect peduncle protruding outward from carapace--

*Pulchellaranea pedunculata* n. gen., n. sp.

- Each pair of lateral eyes not on erect peduncle protruding outward from carapace- 5

5- Femora lacking spines -------------------------- *Pycnosinga fossilis* Wunderlich, 1988

- Femora with spines-------- 6
6- Opistosoma with humps and at least one pair of sigilla -------------------------------------

----- Enacrosoma verrucosa (Wunderlich, 1988)

- Opistosoma lacking humps and sigilla--------7

7 – Tibia IV ventral with 1/1 bristles, paracymbium short ---------------------- Araneus

nanus Wunderlich 1988

- Tibia IV ventral lacking bristles, paracymbium long ---------------------- Fossilaraneus

incertus Wunderlich 1988

The ant (Fig. 1) adjacent to P. pedunculata in the amber may indicate the habits of the spider in the amber forest. Members of Pseudomyrmex (Hymenoptera: Formicidae) are arboreal ants that move quickly over tree surfaces. This suggests that P. pedunculata was also an arboreal species that possibly encountered the ant, with the result that both fell into some fresh resin on the truck of the Algarroba tree.

Acknowledgements

I thank Joerg Wunderlich, Herbert Levi and Pat Craig for discussions regarding morphological characters on the fossil, Cesare Baroni Urbani for identifying the amber ant and Art Boucot and Roberta Poinar for comments on earlier drafts of the manuscript.
References


Figures

1. Dorsal view of *Pulchellaranea pedunculata* n. sp. adjacent to an ant of the genus *Pseudomyrmex* (Hymenoptera: Formicidae) in Dominican amber. Scale bar = 1.3 mm.

2. Dorsal view of head of *Pulchellaranea pedunculata* showing enlarged anterior median eyes, smaller posterior median eyes, pedunculate lateral eyes (arrows) and right palp. Scale bar = 270 µm.

3. Dorsal view of palps of *Pulchellaranea pedunculata*. Arrow shows paracymbium with curved tip. Scale bar = 270 µm.

4. Dorsal view of opistosoma of *Pulchellaranea pedunculata*. Note humps and sigilla. Scale bar = 300 µm.
Table 1. Lengths of leg segments of *Pulchellaranea pedunculata*

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