

# A new synonymy for the Madagascan copal spider fauna (Araneae, Selenopidae)

David PENNEY, Hirotugu ONO & Paul A. SELDEN

## ABSTRACT

PENNEY, D., ONO, H. & SELDEN, P.A. 2005. A new synonymy for the Madagascan copal spider fauna (Araneae, Selenopidae). *J. Afrotrop. Zool.* 2: 41-44.

*Garcorops jadis* Bosselaers, 2004 is identified as a senior synonym of *Anyphops cortex* Wunderlich, 2004 based on the structure of the male pedipalp, particularly the form of the retrolateral tibial apophysis. The young age of Madagascan copal supports the idea that *G. jadis* may be a previously undiscovered extant species. The possibility that a copal inclusion may belong either to an extant or an extinct species highlights the importance of considering both neontological and palaeontological data when describing new taxa from copal-producing regions.

D. PENNEY & P.A. SELDEN, School of Earth, Atmospheric and Environmental Sciences, The University of Manchester, Oxford Road, Manchester, M13 9PL, UK (david.penney@manchester.ac.uk, paul.selden@manchester.ac.uk)

H. ONO, Department of Zoology, National Science Museum, 3-23-1 Hyakunin-cho, Shinjuku-ku, Tokyo, Japan (ono@kahaku.go.jp)

**Keywords:** amber, *Anyphops*, *Garcorops*, sub-fossil resin, taxonomy

## INTRODUCTION

Amber, fossilized tree resin, is a well-known Fossil-Lagerstätte (an exceptional occurrence of well-preserved fossil biota). Living animals become trapped in the sticky resin when it is exuded by the tree and subsequently engulfed by more resin (e.g. Penney 2002), which hardens in contact with the air. Reasons for trees to exude resin are not well known and may be related to wound repair, but many insects, and therefore their predators, are attracted to resin seeps. Following burial in sediment, diagenetic processes turn the resin into the fossilized amber. Resin which has been only weakly fossilized is softer and is referred to as copal. Poinar (1992) defined copal as recently deposited resin that can be distinguished from amber by its physical properties. If mouldable by hand, Poinar considered it still to be resin, if not it was classed as copal up until 3–4 Ma, by which time it should have acquired the unyielding properties of amber. Other authors have provided similarly ambiguous definitions and some authors restrict their usage of the term copal to refer only to resins from particular tree genera (see Langenheim 1995), including *Hymenaea verrucosa* Gaertner from which Madagascan copal is derived.

There is considerable confusion regarding the appropriate usage of the terms recent resin, ancient resin, copal, and sub-fossil resin, which define the various stages from resin secretion until amber formation. There is no definitive solution to the above problem because fresh resins and ambers are members of a

continuous series and no objective analysis capable of determining reliably the relative maturity of fossil resins is currently available (Anderson 1996). Anderson (1996) proposed a scale based on  $^{14}\text{C}$  dating to provide a consistent nomenclature for discussing immature resins: 0–250 yrs = modern resin, recent resin, or copal; 250–5,000 yrs = ancient resin; 5,000–40,000 yrs = sub-fossil resin; >40,000 yrs = amber or fossil resin. This may seem a rather young age for considering resins as fossilized, particularly in light of previous definitions. However, as Anderson (1996) remarked, there is no firm age definition for the term ‘fossil’ and mammoths and other extinct species of the order of a few tens of thousands of years old, are usually referred to as fossils. This issue is still open to debate, but the correct usage of these terms warrants consideration. Carbon dating results have demonstrated that copal from Madagascar can be as young as 50 years old (Poinar 1999).

Spiders are well known as fossils in amber deposits but have only recently been identified and described from copal. Wunderlich (2004: 34) suggested the specimen described by Holl (1829) as *Entomocephalus formicoides* n. gen. & sp. from Baltic amber was a fake in Madagascan copal. The present location of the holotype is unknown. The description consisted of a single sentence, and Holl’s figure [plate 8, fig. 68a] suggests it is almost certainly a salticid belonging to an ant-mimicking genus such as *Myrmarachne*, although the figure and description mention only six eyes (Penney 2003). It was placed erroneously in Archaeidae by Petrunkevitch (1958).

Similarly, Wunderlich (1998) described *Mysmena dominicana* (Mysmenidae) and *Grammonota deformans* (Linyphiidae, now placed in *Ceratinopsis* [Wunderlich 2004]) and Wunderlich (1999) reported the family Archaeidae as present in Dominican Republic amber. However, both these papers were based on specimens that are actually preserved in Madagascan copal (Wunderlich 2004). Lourenço (2000) described the new sub-fossil species *Archaea copalensis* (Archaeidae) in Madagascan copal. This species was synonymized with the extant *Archaea gracilicollis* Millot, 1948 by Wunderlich (2004). Wunderlich (2004) described sub-fossil spiders in copal from Colombia and Madagascar. Species from the following spider families are currently known as sub-fossils in Madagascan copal: ?Migidae, Mysmenidae, Araneidae, Archaeidae, Clubionidae, Corinnidae, Deinopidae, Dictynidae, Hahniidae, Hersiliidae, Linyphiidae, ?Miturgidae, Oonopidae, Philodromidae, Pholcidae, Salticidae, Scytodidae, Segestriidae, Selenopidae, Tetragnathidae, Theridiidae, Thomisidae, and Uloboridae (Wunderlich 2004: 1834).

The spider family Selenopidae consists of 177 extant species in four genera (Platnick 2004). They are free-living, agile spiders often found on rocks, walls, and tree trunks and hence have a high potential for becoming entombed in secreted tree resin. Fossil species have been described from Miocene Dominican Republic amber (see Schawaller 1984; Wunderlich 1988, 2004; Penney 2001). The family is well represented in the Afrotropical region (Dippenaar-Schoeman & Jocqué 1997), with extant species in four genera recorded from Madagascar: *Hovops* (Benoit 1968), *Anyphops* (Corronca 1998), *Garcorops* (Corronca 2003), and *Selenops* (Corronca 2003). The genus *Garcorops* was erected by Corronca (2003) for three new species from Madagascar and the Comoro Islands. Bosselaers (2004) described *G. jadis* Bosselaers, 2004 from Madagascan copal and Wunderlich (2004) described ?*Anyphops cortex* Wunderlich, 2004 also from Madagascan copal. A detailed examination of both holotypes revealed that the specimen described by Wunderlich (2004) was incorrectly placed in *Anyphops* (as suspected by Wunderlich) and that it is identical to *G. jadis*. The paper by Bosselaers was published in March 2004, whereas that by Wunderlich was published in September 2004 and the latter author did not cite the former. Thus, here we establish *G. jadis* as a senior synonym of ?*A. cortex*. This paper is a contribution to the African Arachnological Database (AFRAD 2005).

#### MATERIAL EXAMINED

*Garcorops jadis* Bosselaers, 2004 holotype (MRAC 216 106), held in the Musée Royal de l'Afrique

centrale, Belgium and ?*Anyphops cortex* Wunderlich, 2004 holotype currently held in the private collection of Jörg Wunderlich (F1114/CM/AR/SEL/CJW), eventually to be deposited in the Senckenberg Museum Frankfurt, Germany. The piece containing the holotype of *G. jadis* was accidentally broken into two pieces following publication of Bosselaers (2004) and before being deposited at the MRAC (Bosselaers pers. comm. 2005) but the spider inclusion is undamaged. No extant *Garcorops* specimens were available for study because the specimens have not yet been deposited in the MRAC and are still in the possession of Corronca (Jocqué pers. comm. 2005).

#### SYSTEMATICS

Order **Araneae** Clerck, 1757  
Suborder **Opisthothelae** Pocock, 1892  
Infraorder **Araneomorphae** Smith, 1902  
Family **Selenopidae** Simon, 1897  
Genus ***Garcorops*** Corronca, 2003

***Garcorops jadis*** Bosselaers, 2004

Figure 1

*Garcorops jadis* Bosselaers, 2004: 2–3, figs 1–7, Sambava region, NE Madagascar.

?*Anyphops cortex* Wunderlich, 2004: 1844, figs 24–25. Locality not given, N Madagascar. Syn.n.

**Diagnosis** As per Bosselaers (2004) except that retrolateral tibial apophysis is directed apically (see Remarks below).

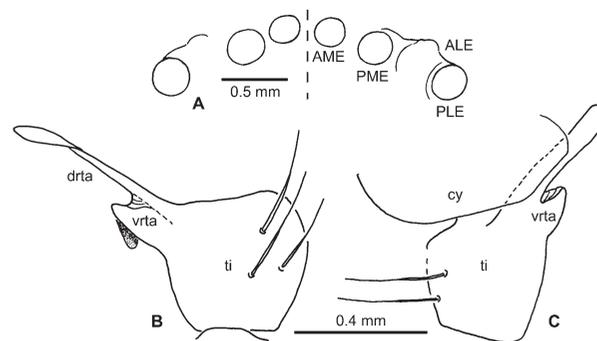


Fig. 1. *Garcorops jadis* Bosselaers, 2004. A. eye arrangement, left side = eyes of the holotype of *G. jadis*, right side = eyes of the holotype of ?*A. cortex*; B. left palpal tibia of holotype of ?*A. cortex*, dorsal view; C. right palpal tibia of same specimen, antero-dorsal view. Abbreviations: ALE, anterior lateral eyes; AME, anterior median eyes; cy, cymbium; drta, dorsal retrolateral tibial apophysis; PLE, posterior lateral eye; PME, posterior median eye; ti, tibia; vrta, ventral retrolateral tibial apophysis.

**Remarks** The specimen described by Wunderlich has an eye arrangement characteristic of *Garcorops* and identical to that of *G. jadis* (Fig. 1). The pedipalps of the specimen described by Bosselaers are displayed in ventral and ectal views (see Bosselaers 2004: figs 3–5, 7), whereas in that of Wunderlich they are visible in dorsal and subectal views (see Wunderlich 2004: 1852, fig. 25). The structural details of the conductor, median apophysis, and the base of the embolus appear identical, as do those of the retrolateral tibial apophysis. However, the dorsal retrolateral tibial apophysis branch is not directed ventrally as per the diagnosis of Bosselaers (2004), but apically (Fig. 1) as in *G. madagascar* Corronca, 2003. It differs from the latter in being extremely thin and slightly curved retrolaterally in dorsal view and by being spatula-shaped (almost like a shoehorn), with a smooth curved tip in medial view (particularly evident in the specimen described by Wunderlich) (Fig. 1); the tip in *G. madagascar* is distinctly pointed (see Corronca 2003: fig. 2C–D).

Bosselaers (2004) suggested that *G. jadis* may be a previously undiscovered extant species, as was the archaeid described by Lourenço (2000) and as is almost certainly the case with the hersiliid spider described by Wunderlich (2004) (S. Foord pers. comm. 2005). The young age of the Madagascan copal supports this idea. The possibility that a copal inclusion may belong either to an extant or an extinct species highlights the importance of considering both neontological and palaeontological data when describing new taxa from copal-producing regions.

#### ACKNOWLEDGEMENTS

We thank Rudy Jocqué (MRAC) and Jörg Wunderlich (Hirschberg-Leutershausen) for providing holotypes. Jan Bosselaers and José Corronca are thanked for providing reprints. David Grimaldi (American Museum of Natural History) and Stefan Foord (University of Venda, Thohoyandou) are thanked for discussion. DP acknowledges a Leverhulme grant, PAS acknowledges Leverhulme and NERC grants, and HO acknowledges Grant-in-aid No.16540431 for Scientific Research, from the Ministry of Education, Science, Sports and Culture, Japan. This work was completed during a short research visit by HO to the University of Manchester.

#### REFERENCES

- AFRAD. 2005. www.arc-afrad.agric.za
- ANDERSON, K.B. 1996. The nature and fate of natural resins in the geosphere – VII. A radiocarbon ( $^{14}\text{C}$ ) age scale for the description of immature natural resins: an invitation to scientific debate. *Organic Geochemistry* 25: 251-3.
- BENOIT, P.L.G. 1968. Les Selenopidae africains au Nord du 17e parallèle Sud et reclassement des espèces africaines de la famille (Araneae). *Revue de Zoologie et de Botanique Africaines* 77: 113-41.
- BOSSELAERS, J. 2004. A new *Garcorops* Species from Madagascar copal (Araneae: Selenopidae). *Zootaxa* 445: 1-7.
- CLERCK, C. 1757. *Svenska spindlar, uti sina hufvud-slågter indelte samt under några och sextio särskildte arter beskrefne och med illuminerade figurer uplyste*. Stockholm: L. Salvii, 154 pp.
- CORRONCA, J.A. 1998. Sobre la distribución geográfica de *Anyphops* Benoit (Araneae, Selenopidae): primer registro y nueva especie para Madagascar. *Biogeographica* 74: 23-6.
- CORRONCA, J.A. 2003. New genus and species of Selenopidae (Arachnida, Araneae) from Madagascar and neighbouring islands. *African Zoology* 38: 387-92.
- DIPPENAAR-SCHOEMAN, A.S. & JOCQUÉ, R. 1997. *African Spiders. An Identification Manual*. Pretoria: Agricultural Research Council, 392 pp.
- HOLL, F. 1829. *Handbuch der Petrefactenkunde*. Dresden: Hilscher.
- LANGENHEIM, J.H. 1995. Biology of amber producing trees: focus on case studies of *Hymenaea* and *Agathis*. In Anderson, K.B. & Crelling, J.C. (eds), *Amber, Resinite and Fossil Resins*. ACS Symposium Series, Vol. 617, pp. 1-31.
- LOURENÇO, W.R. 2000. Premier cas d'un sub-fossile d'araingée appartenant au genre *Archaea* Koch & Berendt (Archaeidae) dans le copal de Madagascar. *Comptes Rendus. Académie des Sciences, Paris, Sciences de la Terre et des Planètes* 330: 509-12.
- MILLOT, J. 1948. Faits nouveaux concernant les *Archaea* (Aranéides). *Mémoires de l'Institut Scientifique de Madagascar* 1(A1): 3-14.
- PENNEY, D. 2001. Advances in the taxonomy of spiders in Miocene amber from the Dominican Republic (Arthropoda, Araneae). *Palaeontology* 44: 987-1009.
- PENNEY, D. 2002. Paleoecology of Dominican amber preservation – spider (Araneae) inclusions demonstrate a bias for active, trunk-dwelling faunas. *Paleobiology* 28: 389-98.
- PENNEY, D. 2003. *Afrarchaea grimaldii*, A new species of Archaeidae (Araneae) in Cretaceous Burmese amber. *Journal of Arachnology* 31: 122-30.
- PENNEY, D. In press. The oldest fossil pholcid and selenopid spiders (Araneae), in lowermost Eocene amber from the Paris Basin, France. *Journal of Arachnology*.
- PETRUNKEVITCH, A. 1958. Amber spiders in European collections. *Transactions of the Connecticut Academy of Arts and Sciences* 41: 97-400.
- PLATNICK, N.I. 2004. *The World Spider Catalog, Version 5.0*. American Museum of Natural History, <http://research.amnh.org/entomology/spiders/catalog> 81- 87/index.html.
- POCOCK, R.I. 1892. *Liphistius* and its bearing upon the classification of spiders. *Annals and Magazine of Natural History, Series 6* 10: 306-14.
- POINAR, G.O. JR. 1992. *Life in Amber*. Stanford: Stanford University Press.
- POINAR, G.O. JR. 1999. Cenozoic fauna and flora in amber. *Estudios del Museo Ciencias Naturales de Álava* 14 (Número Especial 2): 151-4.
- SCHAWALLER, W. 1984. The family Selenopidae in Dominican qmber (Arachnida: Araneae). *Stuttgarter Beiträge*

- zur Naturkunde Serie B (Geologie und Paläontologie) 103: 1-8.
- SIMON, E. 1897. *Histoire naturelle des araignées*. Paris, 2: 1-192.
- SMITH, F.P. 1902. The spiders of Epping Forest. *Essex Naturalist* 12: 181-201.
- WUNDERLICH, J. 1988. Die Fossilen Spinnen im Dominikanischem Bernstein. *Beiträge zur Araneologie* 2: 1-378.
- WUNDERLICH, J. 1998. Beschreibung der ersten fossilen Spinnen der Unterfamilien Mysmeninae (Anapidae) und Erigoninae (Linyphiidae) im Dominikanischen Bernstein (Arachnida, Araneae). *Entomologische Zeitschrift* 108: 363-7.
- WUNDERLICH, J. 1999. Two subfamilies of spiders (Araneae, Linyphiidae: Erigoninae and Anapidae: Mysmeninae) new to Dominican amber – or falsificated amber? *Estudios del Museo Ciencias Naturales de Alava* 14 (Número Especial 2): 167-72.
- WUNDERLICH, J. 2004. Fossil spiders in amber and copal. Conclusions, revisions, new taxa and family diagnoses of fossil and extant taxa. *Beiträge zur Araneologie* 3AB: 1-1908.