

Ptinid beetles from the Cretaceous gymnosperm-dominated forests



David Peris^{a,*}, T. Keith Philips^b, Xavier Delclòs^a

^a *Departament d'Estratigrafia, Paleontologia i Geociències Marines, and Institut de Recerca de la Biodiversitat (IRBio), Facultat de Geologia, Universitat de Barcelona, Martí i Franquès s/n, 08028 Barcelona, Spain*

^b *Systematics and Evolution Laboratory, Department of Biology, Western Kentucky University, 1906 College Heights Blvd., Bowling Green, KY 42101, USA*

ARTICLE INFO

Article history:

Received 27 November 2013

Accepted in revised form 14 February 2014

Available online 25 March 2014

Keywords:

Amber
Coleoptera
Ptinidae
Anobiinae
Spain
New Jersey

ABSTRACT

The diversity of ptinid beetles (Coleoptera: Ptinidae) is described from Cretaceous amber that originated from the North Atlantic and Western Tethian resiniferous forests. All studied specimens belong to the subfamily Anobiinae. *Stegobium raritanensis* sp. nov. is described from Raritan amber (Turonian in age) of Sayreville (New Jersey, USA), whereas *Actenobius magneoculus* sp. nov. is described from San Just amber (early Albian in age) of Utrillas (Teruel Province, Spain). Both species have been examined using propagation phase-contrast X-ray synchrotron microtomography. An additional specimen from Peñacerrada I amber (Moraza, Burgos Province, Spain) is described without further taxonomic placement due to poor preservation. The Spanish specimens represent the most ancient adult record of the family Ptinidae to date. *Mesernobius anawrahtai* from Burmese amber (late Albian–early Cenomanian in age), the only previously described Cretaceous ptinid species, is transferred to Scirtidae based on a re-examination of the holotype. Hypotheses about ecological habits of fossil ptinids are also provided.

© 2014 Elsevier Ltd. All rights reserved.

1. Introduction

Beetles are abundantly found in amber deposits of both Cretaceous Period (Azar et al., 2010; Grimaldi and Nascimbene, 2010; Kirejtshuk and Azar, 2013; Peñalver and Delclòs, 2010) and Cenozoic Era (Dunlop, 2010; Kirejtshuk and Nel, 2013; Penney, 2010; Solórzano-Kraemer, 2010). In spite of their abundance, beetles have generally remained less studied than other orders of insects due to the difficulty of placing fossil forms in modern families or lower taxonomic categories. In contrast with the fossils preserved as impressions, amber inclusions can potentially be studied in more detail due to three-dimensional fossilization preserving minute characters (Martínez-Delclòs et al., 2004). But even so, the formal description of the coleopterans found in amber is, in some cases, virtually impossible due to the limitations in studying certain characters with optical microscopy. Recently, synchrotron X-ray

imaging has eased this task (Soriano et al., 2010), revealing details from arthropods preserved in amber not accessible by conventional methods (Hendrickx et al., 2006; Perreau and Tafforeau, 2011).

The family Ptinidae Latreille, 1802 (previously known as the Anobiidae Fleming, 1821) has a cosmopolitan distribution and currently contains more than 2200 described extant species in approximately 230 genera (Philips and Bell, 2010). The only previously described Cretaceous ptinid species was *Mesernobius anawrahtai* Engel, 2010, from Burmese amber (late Albian–early Cenomanian in age) (Engel, 2010). During the present study, the holotype was re-examined by the first author to confirm its correct familial placement. The oval and somewhat flattened shape, strongly deflexed head, short and broad prothorax, maxillary palpi with four awl-shaped palpomeres, and the fourth tarsomere bilobed, is strong evidence for this taxon not in the Ptinidae. These characters do fit perfectly with those of a scirtid, hence this species is transferred from Ptinidae (Anobiidae in Engel, 2010) to Scirtidae.

No other Cretaceous ptinid species have been described, although one specimen was observed in Lebanese amber (Kirejtshuk and Azar, 2013). Regardless, the family has been found in several Cenozoic amber-bearing deposits, including Baltic (Larsson, 1978; Weitschat and Wichard, 2002), Bitterfeld (Dunlop, 2010), Mexican (Poinar, 1992; Solórzano-Kraemer, 2010), Rovno (Ukraine) (Perkovsky et al., 2003, 2010), Dominican (e.g. Philips and Mynhardt, 2011), and Oise (Kirejtshuk and Nel, 2013) ambers. An update of the fossil ptinid record is provided by Kirejtshuk and Ponomarenko (2013).

Abbreviations: AMNH, American Museum of Natural History, New York, USA; CPT, Colección Paleontológica de Teruel-Dinópolis, Teruel, Spain; ESRF, European Synchrotron Radiation Facility, Grenoble-Cedex, France; Fm, formation; MCNA, Museo de Ciencias Naturales de Álava, Vitoria-Gasteiz, Spain; NJ, New Jersey amber collection; SJ, San Just amber collection; WKU, Western Kentucky University, Bowling Green, USA.

* Corresponding author. Tel.: +34 934020177.

E-mail addresses: david.peris@ub.edu, daperce@gmail.com (D. Peris), Keith.Philips@wku.edu (T.K. Philips), xdelclos@ub.edu (X. Delclòs).

<http://dx.doi.org/10.1016/j.cretres.2014.02.009>

0195-6671/© 2014 Elsevier Ltd. All rights reserved.

The present paper describes two new ptinid species within the subfamily Anobiinae from the Cretaceous. One is from New Jersey amber, USA (Turonian in age) classified within the genus *Stegobium* Motschulsky, 1860, and a second from San Just amber, Spain (early Albian in age) placed in the genus *Actenobius* Fall, 1905 (Fig. 1). An additional specimen from Peñacerrada I amber, Spain (early Albian in age) is described as an undetermined Anobiinae.

All three fossil taxa fit the set of hypothesized non-homoplastic synapomorphies outlined in the study of Philips (2000) that included the bostrichids and ptinids (including both the spider beetles and the anobiids, *sensu stricto*). These include open procoxal cavities, procoxae strongly projecting, trochanter attached to the femur relatively squarely, and what appears to be mandibular pseudomolae. It cannot be determined if three additional synapomorphic characters of wing venation are present as wings are not visible in any of the specimens studied.

2. Geological and palaeontological settings

2.1. New Jersey amber

Raritan amber occurs throughout Cretaceous outcrops of the Atlantic Coastal Plain of the northeastern United States, within strata of clay, sand and lignite (Grimaldi et al., 2000). Amber occurs in two geological units, mainly in the Raritan Formation but also in the Magothy Formation, extending from Martha's Vineyard, Massachusetts, into Long Island and Staten Island, New York, through central New Jersey and south of Maryland (Grimaldi and Nascimbene, 2010). These amber-bearing levels belong to several geological formations that are Cenomanian–Maastrichtian in age (99–65 Ma). Amber from central New Jersey (e.g., Sayreville: Crossman's pits) and Staten Island (e.g., Charleston: Androvetto pits) lies within the South Amboy Fire Clay Member and the Old Bridge Sand Member of the Raritan Fm., which are Turonian in age (93–89 Ma) (Christopher, 1979; Grimaldi and Nascimbene, 2010).

Beetles studied herein were found in the Old Crossman's Clay Pit in Sayreville (Middlesex County), included in the South Amboy Fire Clay Member (Grimaldi, pers. comm. 2013). This Member is 6–7 m

deep, and is interbedded with thinner sand layers and coal (lignitic) layers. Amber is more abundant when associated with coarse lignite. Lack of faulting and erosion in this region and the excellent preservation of the amber, indicates that coal deposits are preserved *in situ* as originally buried, and thus there has been no reworking or redistribution (Grimaldi and Nascimbene, 2010). Raritan amber is located within the sediments of an interdistributary system of shallow, brackish water channels in a tide-influenced delta. This occurs in modern coastal swamp forests, when freshwater streams arrive to a delta, where their flow energy is diminished, and brackish stagnant areas develop. In these palaeoenvironment, deposition of rich organic matter sediments under anoxic conditions occurred (Grimaldi et al., 2000).

The Raritan amber forest was dominated by conifers. Previous studies based on infrared spectroscopy and pyrolysis gas chromatography (PyGC) note that the source of the amber resin was secreted by araucarian trees (Grimaldi et al., 1989; Langenheim, 1969). However, the wood anatomical structure is clearly not araucarian but indicative of pines; and isolated cone scales and assorted leafy shoots from the sediment associated with the amber suggests that Raritan amber had a taxodiacean origin (Grimaldi et al., 2000). The Raritan amber forest undergrowth was composed by ferns, horsetails, cycads, and sparse angiosperms. Fusainized remains of complete minute flowers, cones, and other plant and arthropod remains are also found within the amber-bearing sediment (Grimaldi, 1996). Angiosperm flowers found comprise mainly magnoliids, and lauraceans, among other groups. Inclusions of small, leafy shoots of several species of cupressaceans *sensu lato* (including taxodiaceans) and records of the Fagales (oaks, beeches, and relatives) are also present. Raritan amber preserves a high diversity of organisms, including fungi, plants, and animals (Grimaldi, 1996; Grimaldi et al., 2000; Grimaldi and Nascimbene, 2010). Arthropods (arachnids and hexapods) are the most abundant and diverse taxa. The most significant groups are Hemiptera, Neuroptera, Mantodea, Lepidoptera, Diptera, and Hymenoptera (Grimaldi and Nascimbene, 2010). Grimaldi et al. (2000) reviewed all the bioinclusions from New Jersey amber, and ptinids (anobiids in the text) comprised 10% of the 90 documented beetles, representing nine specimens found in different amber pieces (Grimaldi et al., 2000; Grimaldi, pers. comm. 2013).

2.2. Spanish amber

Cretaceous amber from Spain occurs throughout outcrops belonging to different continental-transitional to marine basins that are tectonic in origin. Spanish amber outcrops are distributed in a strip curve from the east to the north of Iberia, within strata of clay, sand, and lignite (Delclòs et al., 2007). Amber occurs in several geological levels that are Barremian–Maastrichtian in age (130–75 Ma), mainly in the Escucha Formation and Las Peñasas Formation, extending from Asturias and Basc Country (Basque-Cantabrian Basin) to Teruel and Castellón Provinces (Maestrat Basin) (Peñalver and Delclòs, 2010). The amber from San Just and Peñacerrada I, both early Albian in age (112–99 Ma), lie within the Escucha Fm.

Palynological assemblages are composed of spikemosses, clubmosses, and fern spores; and pollen grains from araucariaceans, cupressaceans/taxodiaceans, cheirolepidiaceans, cycadaceans, ginkgoaceans, bennettitaceans, pteridosperms, gnetalean, and angiosperms; also dinoflagellate cysts and phycomas of prasinophycean algae that imply a certain marine influence, mainly in Basque-Cantabrian Basin outcrops (Barrón et al., 2001; Villanueva-Amadoz et al., 2010). Palaeobotanical and palynological studies suggest that the forests that produced the resin that originated the amber were composed of cheirolepids, araucarias, and cypresses, while the undergrowth consisted of ferns, cycads, ginkgos,

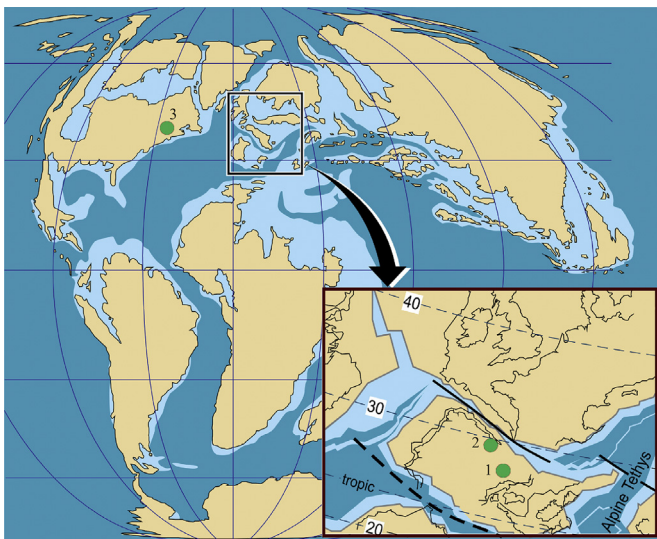


Fig. 1. Occurrences of the family Ptinidae in the Cretaceous amber record. Early Cretaceous (early Albian) 1) San Just (Spain), *Actenobius magneoculus* sp. nov.; 2) Peñacerrada I (Spain), Anobiinae indet. Late Cretaceous (Turonian); 3) Sayreville (New Jersey, USA), *Stegobium raritanensis* sp. nov. The palaeogeographical map corresponds to the middle Albian (105 Ma). Modified from Najarro et al. (2009), after Blakey (2008).

Download English Version:

<https://daneshyari.com/en/article/4747144>

Download Persian Version:

<https://daneshyari.com/article/4747144>

[Daneshyari.com](https://daneshyari.com)