

Abraracourcix curvivenatus n. gen. n. sp. from the Lowermost Eocene Oise amber (Hemiptera: Fulgoromorpha: Ricaniidae)

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Abstract. An extinct genus *Abraracourcix* n. gen. with *A. curvivenatus* n. sp. is described based on the specimen from the Lowermost Eocene Oise amber. The venation characters and possible host-plant relationships, as well as taxonomic position and biogeographical pattern of recent *Pochazoides* generic group are discussed.

Résumé. *Abraracourcix curvivenatus* n. gen. n. sp. de l'Eocène inférieur dans l'ambre de Oise (Hemiptera : Fulgoromorpha : Ricaniidae). Une genre éteint *Abraracourcix* n. gen. avec *A. curvivenatus* n. sp. est décrit sur la base des spécimens de l'ambre éocène basal de l'Oise. Les caractères de nervation des ailes et des relations plante-hôte possibles, ainsi que la position taxonomique et biogéographique du groupe générique récent *Pochazoides* sont discutés.

Keywords: *Abraracourcix*, *A. curvivenatus*, Ricaniidae, Oise amber, fossil, Eocene, France.

The planthopper family Ricaniidae is weakly represented in fossil materials. There is a single species known – *Scolypopites bryani* Tillyard 1923 from the Upper Miocene of Australia (Tillyard 1923, Jell 2004). There are also a few taxa from East African copal, placed in recent genera: *Osaka* Distant 1909, *Acroprivesa* Schmidt 1912, *Pocharica* Signoret 1860 and *Pochazoides* Signoret 1860 (Stroiński & Szwedo 2002, Stroiński 2007). The other genera used to be placed in Ricaniidae (Szwedo *et al.* 2004) were transferred by Shcherbakov (2006) to Nogodinidae *sensu lato*. The status of '*Ricania*' *equestris* Dalman 1825 and '*Ricania*' *multinervis* Giebel 1862 remains unclear (Szwedo *et al.* 2004).

The recent Ricaniidae comprises over 400 species, attributed to 51 genera, distributed mainly in tropical and subtropical areas of the world. The generic classification and relationships are still not well elaborated and the number of species is definitely much higher than the number actually described (Stroiński, unpublished). Recently, Gnezdilov (2009) established a subfamily Pharsalinae for a few taxa from South America. However, the status of this unit, as well as other South American Ricaniidae remains unclear and needs further studies.

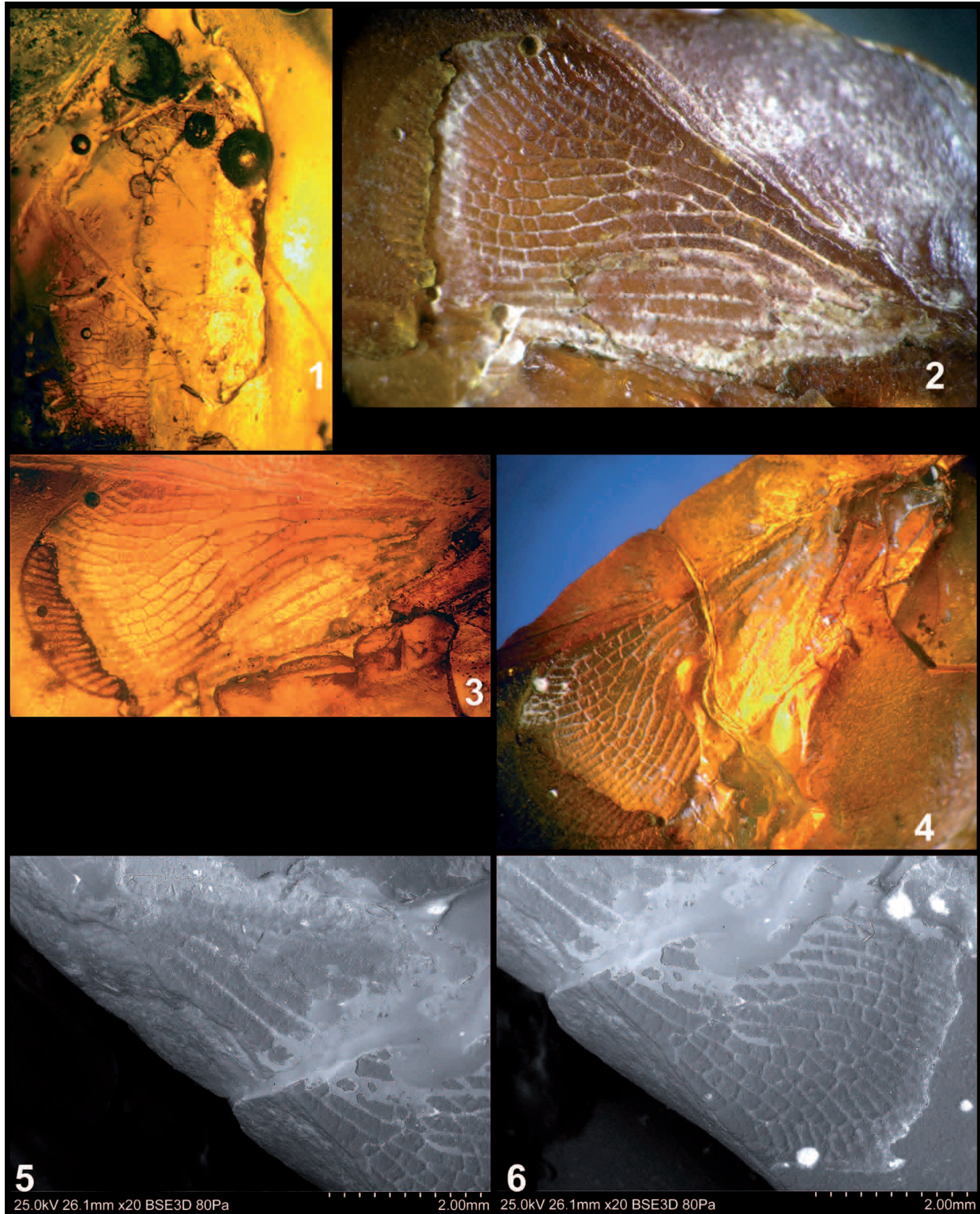
Amber is known from several sites of the Paris Basin since the beginning of the 19th century. All the listed sites date back from the early Eocene and are related to the Sparnacian continental facies (De Franceschi & De

Ploëg 2003), i.e. Ypressian of the ICS. A new deposit was discovered in 1997, at the Quesnoy locality in the Oise River area of the Paris basin (Oise department, France). This deposit is rich in flora and fauna diversity. It provided a great amount of this fossil resin (De Ploëg *et al.* 1998, Nel *et al.* 1999, 2004). Amber fossils present a good state of preservation, and amber pieces contained more than 300 recognised arthropod morphospecies (Nel *et al.* 1999, 2004), which are of great importance for insect evolution study. The resin contains angiosperm-like pollens and woody remains mainly belonging to dicotyledones (Nel *et al.* 1999, De Franceschi *et al.* 2000, De Franceschi & De Ploëg 2003). The deposit is aged Lowermost Eocene, i.e. 55–53 Mya. It was assessed by stratigraphy and confirmed by the presence of fossil remains of Condylarthra, Perissodactyla, and *Teilhardina* (minuscule primate) as the mammalian layer reference.

The amber was produced by an angiosperm, unlike the Baltic amber of gymnosperm affinities (Feugueur 1963; Nel *et al.* 1999, 2004, Jossang *et al.* 2008). The tree supposed to produce this amber was *Aulacoxylon sparnacense* Combes 1907 of the order Fabales and family Caesalpiniaceae, tribe Detariae, believed to be a key species of the forests of Paris Basin in Lowermost Eocene (De Franceschi & De Ploëg 2003). However, the microscopic analysis suggested that the tree fossil might correspond to the modern genus *Daniellia* Bennett 1854, (Caesalpiniaceae), while chemical molecular work indicated rather the Caesalpiniaceae genus *Hymenaea* L. 1753 (Jossang *et al.* 2008).

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Figures 1–6

Abraracourcix curvivenatus n. gen., n. sp. Holotype MNHN PA-5155. 1, pronotum and mesonotum, dorsolateral view in amber. 2, left tegmen, exposed portion of imprint, dorsal view. 3, left tegmen, translucent view of exposed and included in amber portions. 4, specimen in amber. 5, SEM image of basal portion of tegmen. 6, SEM image of apical portion of tegmen.

Until now, within the Fulgoroidea of the Oise amber, only two genera of the family Cixiidae with three species (Hemiptera: Fulgoromorpha) were described (Szwedo *et al.* 2006).

Material and methods

The specimen was examined using direct and transmitted light under Olympus SZH10 stereoscopic microscope. The photographs were taken using attached Olympus C-5060 digital camera under QuickPHOTO 2.0 software and readjusted using Adobe Photoshop Elements 4.0 software. SEM examination was taken with use of Hitachi S-3400N Scanning Electron Microscope in Low Vacuum mode. The underside of the specimen was polished and broken during polishing then glued. Tegmen venation pattern follows scheme proposed by Szwedo & Żyła (2009).

Systematics

Ordo Hemiptera L. 1758

Subordo Fulgoromorpha Evans 1946

Superfamilia Fulgoroidea Latreille 1807

Familia Ricaniidae Amyot & Serville 1843

Abraracourcix n. gen.

(Figs 1–7)

Type species. *Abraracourcix curvivenatus* n. sp.; here designated.

Diagnosis. The genus is characterized by the following combination, among the taxa of the recent *Pochazoides* generic group: mesonotum without anterolateral carinae (Fig. 1); longitudinal veins wavy (Figs 2–7); Stem Sc+R with a short common stalk; branch RP strongly developed, complex of terminals Sc+R covering $\frac{3}{4}$ of apical margin of tegmen (unique character); branch M_{1+2} not forked to the apex (unique character);

clavus without transverse veinlets (unique character).

Description. Pronotum distinctly shorter in mid line than mesonotum; anterior margin arcuate, posterior margin in median portion concave; median carina distinct, lateral impressions weakly visible. Mesonotum distinctly elongate, with lateral angles placed before half of length; median carina reaching to scutellum, lateral carinae connected with median one at base, reaching almost to posterior margin, from the level of lateral angles almost parallel to median carina; anterolateral carinae absent; disc of mesonotum in median portion between lateral carinae flattened.

Tegmen (Figs 2–7) elongate, about 2.35 times as long as wide, apical and claval angles broadly rounded, apical margin arcuate. Longitudinal veins of tegmen numerous and wavy.

Costal area (only apical portion) weakly visible (in most part not preserved); tip of costal area exceeding half of tegmen length, ending at level of claval apex.

Costal cell with dense, single and straight transverse veinlets, forming cells more or less regularly subquadrate.

Basal cell longer than wide.

Stem Sc+R leaving basal cell with short common stem, vein Sc+RA forked distinctly apicad of first forking of RP (Fig. 7), slightly apicad of half of tegmen length; branch Sc+RA forked slightly basad of apical line; costad branch forked slightly before apex, with 2 terminals; mediad branch forked twice in preapical portion, first forking distinctly basad of costad branch of Sc+RA forking, second forking distinctly basad of apical line, 5 terminals of mediad branch of RA. Stem RP well developed with numerous branches, its terminals covering almost half of apical margin of tegmen. First forking of RP apicad of first forking of stem M, then multiforked, reaching apical margin with 15 terminals. Terminals of stems Sc+R occupying nearly $\frac{3}{4}$ of tegmen's apical margin. Stem M forked apicad of stem CuA forking; branch M_{1+2} single to the apex, branch M_{3+4} with more branching than branch Sc+RA, first forking of M_{3+4} slightly basad of first forking of branch RP; branches M_3 and M_4 forked slightly basad of apical line. Stem CuA forked distinctly basad of stem M and stem Sc+R forkings; branches forked basad of apical line, reaching postclaval margin with 4 terminals.

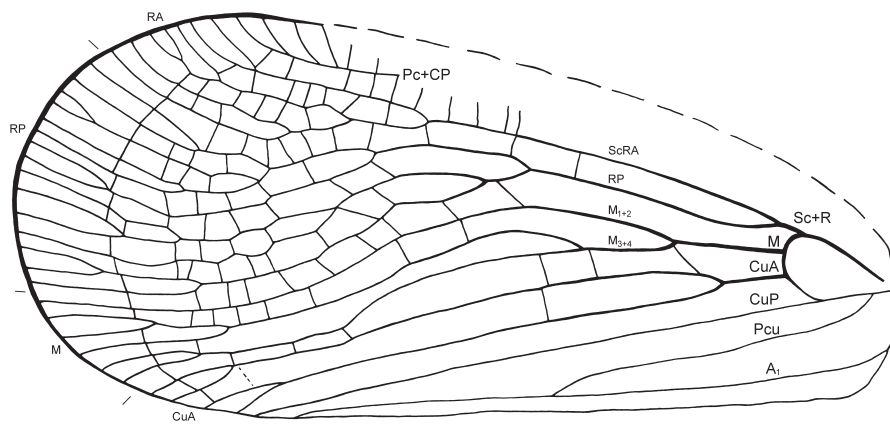


Figure 7
Abraracourcix curvivenatus n. gen., n. sp. tegmen venation pattern, partly reconstructed. Scale bar 1 mm.

Apex of clavus distinctly exceeding $\frac{3}{4}$ of tegmen length. Claval veins P_{cu} and A_1 forked at about half of clavus length.

Membrane with net of veinlets. Nodal line absent, subapical line of veinlets weakly developed, not very regular; apical line of veinlets well developed, regular. Apical cells distinctly longer than preapical ones. Prenodal portion of tegmen with a few transverse, straight veinlets. Oblique veinlet *m-cua* in basal portion of tegmen, merely apical of stem CuA forking.

Etymology. The genus name is derived after chief Abraracourcix of the Gaulish village in Asterix series of comic-books; Abraracourcix (from French “à bras raccourcis” - “with arms up ready to fight”). Gender: masculine.

***Abraracourcix curvivenatus* n. sp.**
(Figs 1–7)

Diagnosis. As for genus, as it is the only included species.

Description. Total length c. 9.2 mm, width c. 3.9 mm. Stem $Sc+R$ with 7 + 15 terminals, stem M with 6 terminals, stem CuA with 4 terminals. Cell $C3$ distinctly shorter than cell $C3a$, slightly longer than cell $C5$.

Etymology. Specific epithet refers to numerous and wavy, curved veins of the tegmen.

Age and occurrence. Lowermost Eocene, c. 55–53 Ma, Ypresian (Sparnacian), level MP7 of the mammal fauna of Dormaal (Feugueur 1963; De Ploëg *et al.* 1998; Nel *et al.* 1999, Cavagnetto 2000, De Franceschi & De Ploëg 2003, Nel *et al.* 2004).

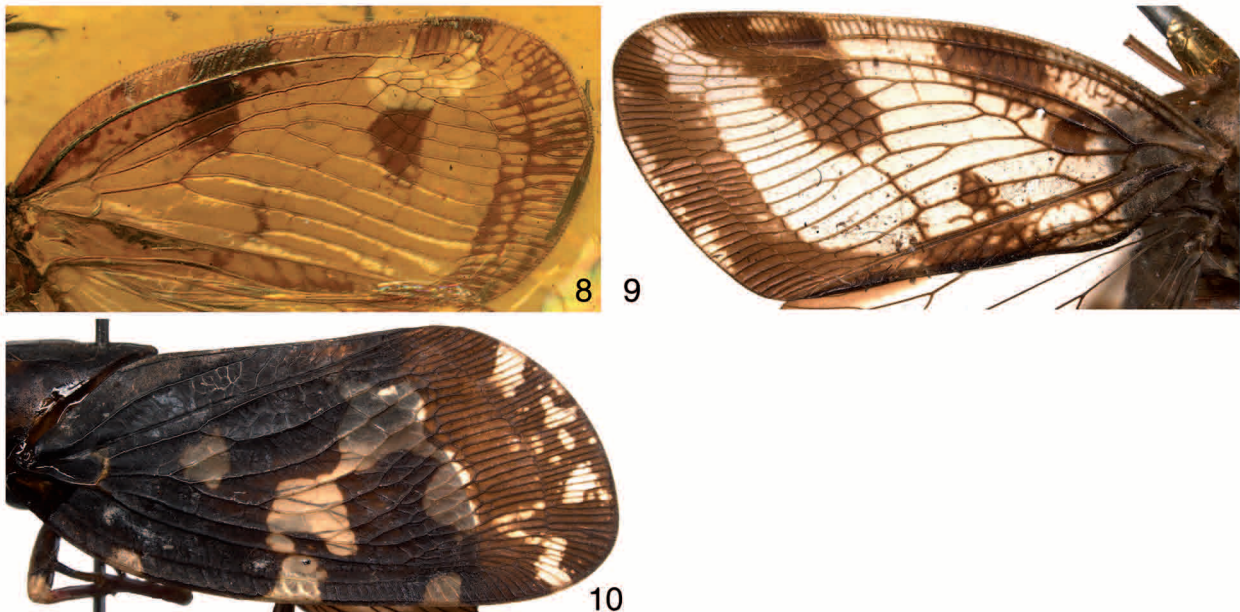
Type material. Specimen preserved in most part as impression on the surface of piece of Oise amber, anterior part and tip of tegmen embedded in amber. Specimen no. MNHN PA

5155. Deposited in the Département d'Entomologie, Muséum national d'Histoire naturelle, Paris.

Discussion

The fossil resins give the unique opportunity to have the insects living millions years ago preserved in perfect tomb. The Oise amber bears a lot of conserved specimens, including a number of representatives of the hemipteran suborder Fulgoroidea. Up to present only representatives of the family Cixiidae: Mnemosynini were described from this source of fossils (Szwedo *et al.* 2006). The representatives of Mnemosynini, recently only a genus *Mnemosyne* Stål 1866, are distributed in tropical and subtropical regions of the world. Extinct genera are known from the Middle Eocene Baltic amber - *Autrimpus* Szwedo 2004, Lowermost Eocene Oise amber - *Stalisyne* Szwedo, Bourgoïn & Lefebvre 2006 and *Mnaomaia* Szwedo, Bourgoïn & Lefebvre 2006 and, Palaeogene deposits of Menat (Auvergne, France) - *Mnasthaia* Szwedo, Bourgoïn & Lefebvre 2006.

The genus described above represents so called ‘higher Fulgoroidea’ family Ricaniidae (beside the latter comprising Tropiciduchidae, Lophopidae, Issidae, Acanaloniidae, Caliscelidae, Nogodinidae, Flatidae, Gengidae, Hypochthonellidae and Eurybrachidae). There are only a few other fossils placed in this family now (see Shcherbakov 2006), i.e. *Scolyopites bryani*



Figures 8–10

Tegmina of *Pochazoides* generic group representatives (types). 8, *Pochazoides szwedoi* Stroński 2007, East African copal. 9, *Pochazoides maculatus* Signoret 1860. 10, *Keiseriana maxima* Synave 1966.

Tillyard 1923 from the Upper Miocene of Australia and a few forms reported from copal. These are: '*Ricania equestris* Dalman 1825 from copal; no information about origin of this resin with inclusion is given in the original paper (Dalman 1825). According to Schlüter & von Gnielinski (1987) the copal mentioned by Dalman originates from India. '*Ricania multinervis* Giebel 1862 is described from copal of unclear origin. Hennig (1966: 4) mentioning Giebel's specimen observed that "... according to Mr. Fr. Heller, Stuttgart it could represent recent genus *Pochazoides* from Madagascar and East Africa". Stroiński & Szwedo (2002) described *Acroprivesa msandarusi* Stroiński et Szwedo 2002 from East African copal from Tanzania, and the genera *Osaka* Distant 1917, *Pocharica* Signoret 1860 and *Pochazoides* Signoret 1860 were recorded in East African copal. Later, Stroiński (2007) described another species – *Pochazoides szwedoi* Stroiński 2007 (Fig. 8) from the same resin. The age of copal is still discussed (Burleigh & Whalley 1983, Schlüter & von Gnielinski 1987, Grimaldi & Engel 2005).

The generic group *Pochazoides* comprises genera *Pochazoides* Signoret 1860 (Fig. 9) and *Keiseriana* Synave 1966 (Fig. 10) as well as numerous not yet described genera and species (Stroiński, unpublished). In respect of tegminal characters this group is characterised by the costal area slightly to extremely narrower than costal cell, costal cell with transverse veinlets, longitudinal venation wavy and absence of nodal line. All these characters are present in the newly described genus *Abraracourcix* **n. gen.**

Abraracourcix **n. gen.** is characteristic by the lack of anterolateral carinae of mesonotum. The recent taxa present this feature in various degree: distinct, weakly developed or absent. *Pochazoides* group taxa are characteristic of costal area narrower in various degree, to very narrow, than costal cell; in all cases the apical portion remain more or less widened. It seems that this character is also present in *Abraracourcix*, however the tegmen is partly destroyed or weakly preserved in costal portion. Costal cell is always provided with transverse veinlets, simple, straight, or less regular, forming net of veinlets. Stem Sc+R leaving basal cell as short common stem or branches Sc+RA and RP leaving basal cell separately. The recent taxa are characteristic of well developed complex of terminals of Sc+R stem, covering 1/3 to half of apical margin of tegmen apex. The unique character of *Abraracourcix* is stronger than in the known recent representatives of *Pochazoides* group development of this complex, with terminals occupying 3/4 of apical portion of tegmen apical margin. Therefore the terminals of M are reduced, especially to the single M_{1+2} . However all these longitudinal veins remain

distinctly wavy, particularly in their apical portions. Two more characters are important for the discussions. The oblique vein *m-cua* at the base of tegmen, close to the forking of CuA is present in *Abraracourcix* and some recent taxa of *Pochazoides* generic group. *Abraracourcix* **n. gen.** presents both subapical and apical lines of veinlets, as most of recent taxa of *Pochazoides* group. Absence of transverse veinlets on clavus remains unique character of *Abraracourcix*. It seems that the combination of venation pattern characters could be used in the future phylogenetic analyses of Ricanidae and *Pochazoides* generic group (Stroiński, work in progress).

The taxa ascribed to *Pochazoides* generic group are mainly distributed in Madagascar and East Africa. Representatives of this group were recognised among East African copal inclusions (Stroiński & Szwedo 2002, Stroiński 2007). The genus described above is the first and the oldest record of this group outside of Afrotropical Region. Very little is known about the trophic relationships of recent Ricanidae and their host plants (Wilson *et al.* 1994, Attié *et al.* 2008). Most known species are polyphagous of oligophagous, feeding on various angiosperms, dicots: Asparagaceae, Asteraceae, Cannabidaceae, Fabaceae, Flacourtiaceae, Malvaceae, Moraceae, Myrtaceae, Oleaceae, Pandanaceae, Pittosporaceae, Rosaceae, Rubiaceae, Santanalaceae, Sapotaceae, Smilacaceae, Theaceae, Urticaceae and monocots: Araliaceae, Areacaceae, Cyperaceae, and Poaceae (Wilson *et al.* 1994, Attié *et al.* 2008).

The Oise amber was produced by the plant from the family Fabaceae, subfamily Caesalpinioideae and tribe Detariae. *Aulacoxylon sparnacense* Combes 1907, believed to be a key species of the forests of Paris Basin in Lowermost Eocene was proposed (De Franceschi & De Ploëg 2003). The tree fossil might correspond also to the modern genus *Daniellia* Bennett 1854, while chemical molecular work indicated rather the relationships with genus *Hymenaea* L. 1753 (Jossang *et al.* 2008). Most of East African copal is produced by the plant *Hymenaea verrucosa* (Gaertner 1791) also belonging to Detariae.

The plant tribe Detariae *sensu lato* is pantropical in distribution and consists of 82 genera and c. 750 species, with the majority of genera confined to Africa and Madagascar (Mackinder 2005). It includes many tropical trees, some of which are used for timber or have ecological importance. This group is known for its remarkable range and complex patterns of floral modifications. Detariae *sensu lato* (*sensu* Polhill 1994) includes the tribes Detariae DC. and Amherstieae Benth. The range and complexity of morphological

variation, especially floral modifications, exhibited in the tribe have proven problematic to the establishment of clearly circumscribed and accepted generic groupings (Mackinder 2005). Species in Detarieae demonstrate co-adaptation with animals for defensive and reproductive purposes. They have adapted flower shape and coloration to attract bees for pollination, and some have leaves that attract ants. Other distinguishing characteristics include the production of tannins and terpenoids (Cowan & Polhill 1981, Fougère-Danezan *et al.* 2007). Detarieae also includes a number of resin-producing genera (Fougère-Danezan *et al.* 2003, 2007).

The relationships between Ricaniidae genus *Acroprivesa* Schmidt 1912 and plants of Caesalpinioideae subfamily (Fabales: Fabaceae) were discussed by Stroiński (2010). Also copal entombed Ricaniidae very probably were captured on their host plant(s). The taxa of *Pochazoides*-group seems to be related to East African and Malgascan ecoregions. The finding of the new genus, probably related to the same host-plants group outside of this area, in the Lowermost Eocene of Europe could bring new questions and new answers about relationships and biogeographical migration tracts of the plants and insects as well. The presence of the tropical, resin exuding tree(s) in the Paris basin implies a hot climate in this region during the early Eocene in agreement with previously described climatic optimum (Zachos *et al.* 2008, Sluijs *et al.* 2007). The family Fabaceae is believed to have evolved during the Late Cretaceous based on the well defined subfamilies Caesalpinioideae, Mimosoideae and Papilionoideae that were in the existence by the Cretaceous (Taylor T.N. *et al.* 2009). The reconstruction of the habitats of the Oise area, c. 53 million years ago (Nel *et al.* 1999, 2004) show the local importance of the aquatic environment: a fluvial network with multiple arms and standing waters, in a flat landscape, and apparently without marine influence, inferred from the sedimentology, vegetation and the abundance of vertebrates and insects linked to freshwater. Nel *et al.* (1999, 2004) stated that the presence of Mastotermitidae (Isoptera), many reptiles, plant remains of families Arecaceae, Fabaceae: Caesalpinioideae, Combretaceae, Icacinaceae and Menispermaceae, etc. suggests a warm and wet seasonal climate in the area. The palaeoflora presents several phytocoenoses: swampy forest as the terrestrial palynomorphs indicate, semi-deciduous forest as indicated by the apparent dominance of an arborescent amber-producing species. The ligneous remains reflect seasonal alternations and the presence of dry periods (Nel *et al.* 1999). These data interpolated, indicate the existence of fluvio-lacustrine palaeoenvironment, i.e. a wet river forest, surrounded by semi-deciduous

or deciduous woodland, which was more affected by dry periods, under the warm and wet seasonal climate (Nel *et al.* 1999, 2004, Jossang *et al.* 2008). Presence of such habitat in France support the Boreotropical hypothesis of the diversification of Fabales (Doyle & Luckow 2003). It is also supported by the presence of the insects which seems to have trophic relations with some ancient groups of Fabales found in the Oise area and in much more recent East African copal.

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