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Paratimia succinicola sp. n. (Coleoptera: Cerambycidae) from Baltic amber, with palaeogeographical remarks on the tribe Atimiini LeConte, 1873

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A new fossil cerambycid, *Paratimia succinicola* sp. n. (Spondylidinae, Atimiini) is described based on one specimen preserved in Baltic amber. Morphological comparison is made with the extant Vancouverian *Paratimia conicola* Fisher, 1915. Phylogenetic, biological and palaeogeographical remarks on the tribe Atimiini are added. *Saphanites mirabilis* Vitali, 2011 is transferred from the tribe Saphanini to Atimiini.

Key words: Spondylidinae, fossil, succinite, systematics, palaeontology

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INTRODUCTION

The tribe Atimiini LeConte, 1873 currently has 4 genera and 18 species that are widespread in the Holarctic (Zicha 1999-2020).

Fifteen species belong to *Atimia* Haldeman, 1847, that is widespread in eastern Asia and Nearctic and all have larvae associated with Cupressaceae (Linsley 1962). The remaining genera, instead, have a reduced distribution and their larvae bore Pinaceae. *Oxypleurus* Mulsant, 1839 is localised in the Mediterranean and Canary Islands and is associated with *Pinus nigra salzmanni* (Dunal), *P. sylvestris* L., *P. pinea* L., *P. pinaster* Aiton, *P. halepensis* Miller and *P. canariensis* Smith (Villiers 1978, Sama 2002). *Proatimia pinivora* Gressitt, 1951 is localised in Yunnan (China) and is associated with *Pinus yunnanensis* Franchet (Gressitt 1951), while *Paratimia conicola* Fisher, 1915 is localised in the Pacific Coast Ranges (USA) and is associated with *P. attenuata* Lemmon and *P. contorta* Douglas (Linsley 1939).

Considering the distribution and the hosts of the extant species, the presence of one of more representatives of this tribe in Baltic amber was not surprising.

The first fossil species of *Paratimia* Fisher, 1915, and the only known Eurasian species of this genus, is described here.

MATERIALS AND METHODS

The beetle is preserved inside a rectangular piece of amber measuring 36 x 18 x 5 mm and including many "stellate hairs" (trichomes covering inflorescences of oaks).

Due to the cut of the amber, the beetle is missing part of the right antennae (except for the two basal and the last five antennomeres) and is missing most of the left antenna (except the basal part of the scape and the last three antennomeres). This position did not allow further modifications remodelling of the amber. Moreover, mouthparts and ventral side are covered by turbidity.

Observations on the fossil were made using a stereomicroscope Antares Geminar 3 with 20-40x eyepieces equipped with a micrometer system. However, the original cut of the amber, oblique and very close to the specimen, did not allow taking exact measurements and evaluating exact proportions. The reconstructions of the habitus of *Saphanites mirabilis* Vitali, 2011 (Fig. 1) and *Paratimia succinicola* sp. n. (Fig. 5) were_obtained with mixed traditional and computer graphic techniques. Figures 2 and 4 were furnished by Marius Veta (Palanga, Lithuania), seller of this amber; figure 3 was taken with a digital camera Nikon DX VR mounted on the stereomicroscope; figure 6 was furnished by Kyle Schnepp (Gainesville, FL USA).

Terminology of the female genitalia is according to Saito (1989).

SYSTEMATIC PART

Cerambycidae Latreille, 1802
Spondylidinae Audint-Serville, 1832
Atimiini LeConte, 1873 (new tribal placement)
***Saphanites* Vitali, 2011**
***Saphanites mirabilis* Vitali, 2011**
(Fig. 1)

This species was originally compared to several Spondylidinae (Vitali 2011), appearing more specialised than *Oxypleurus* but more primitive than *Paratimia* and *Drymochares* Mulsant, 1847. Thus, it was considered as the possible ancestor of both / either *Paratimia* and *Drymochares* and the natural link between Saphanini and Atimiini. Since *Oxypleurus* is no longer a member of Saphanini but to Atimiini (Švácha & Lawrence 2014), *S. mirabilis* should be transferred to this last tribe.

Cerambycidae Latreille, 1802
Spondylidinae Audint-Serville, 1832
Atimiini LeConte, 1873
***Paratimia* Fisher, 1915**
***Paratimia succinicola* sp. n.**
(Figs. 2-4)

Holotype. Baltic amber, ex coll. M. Veta, author's coll. FS57BS31.

Differential diagnosis

Proatimia and *Paratimia* are closely related genera, evidently differing in elytral pattern (*Paratimia* shows a contrasting white suture) and several relative characters (body more or less flattened, pronotum more or less expanded anteriorly, elytra more or less broad with more or less straight margins, procoxae more or less angulated, antennae more or less long, etc.). Such features are not exactly detectable in this fossil; nonetheless, *Paratimia* also differs from *Proatimia* in the body covered by some erect setae and the female pygidium elongate, longer than previous segment and evidently surpassing the elytral apex. These characters are evident in the fossil species.

On the basis of what it is possible to identify from the preserved condition of this fossil, *Paratimia succinicola* sp. n. differs from *P. conicola* (Fig. 6) in the fine punctures of head and pronotum (coarse *P. conicola*) and in the glabrous pronotal disc, which permits observation of the pronotal structure. Additionally, the fossil species shows pitch brown (instead of reddish brown) integument, but this character might be subject to variability.

Description

Female, body length 7 mm. Body elongated, pitch-black; pronotal sides and elytra covered with dense recumbent pubescence; elytra with some

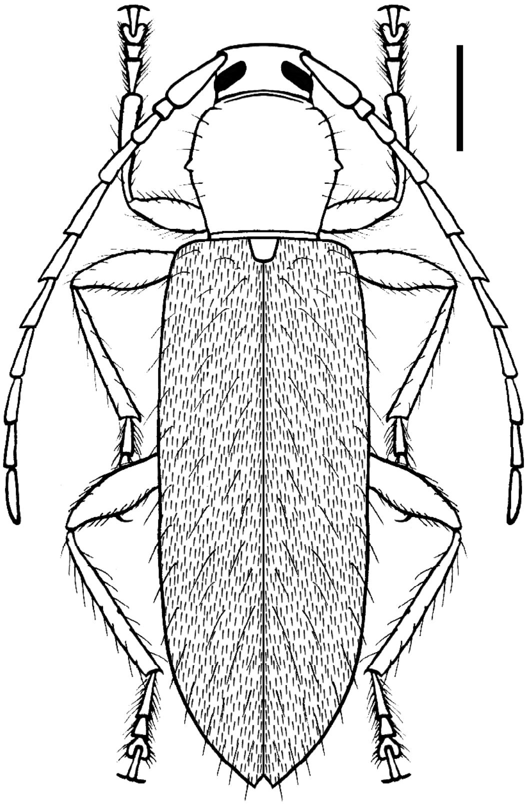

Fig. 1. *Saphanites mirabilis* Vitali, 2011, reconstruction.

Fig. 2. *Paratimia succinicola* sp. n., lateral view

sparse long erect setae.

Head large; forehead oblique, short; antennal tubercles separated and not elevated; without inter-antennal furrow; eyes small, coarsely faceted, strongly reniform, scarcely prominent laterally, largely separated above; surface covered with dense fine punctures, seemingly glabrous except for some long erect setae. Mouthparts not visible. Antennae (eleven-segmented), much shorter than body (possibly reaching the elytra half), covered with fine recumbent pubescence; scape subconical, with some erect setae on the frontal margin; antennomeres II-VI not present; antennomeres VII-X flattened, sub-equal, a bit shorter than scape, antennomere IX as long as scape (antennomere proportions according to the formula: 1.1: ?: ?: ?: ?: ?: 0.9: 0.9: 0.9: 0.9: 1.1).

Pronotum as long as broad, cordate, expanded on the apical third and straightly convergent backward; broader at apex than at base; apex and base straight; disc flattened, covered with dense fine punctures, a dense pubescence at the sides and at base and some sparse long erect setae at the sides. Scutellum parallel-sided, largely rounded apically and densely covered with recumbent pubescence

Elytra elongate, thin, 3.3 times as long as wide at humeri; base anteriorly feebly concave; humeri squared; sides sinuate in the middle, then apically acutely convergent; apex rounded; disc flat, covered with dense fine punctures, a dense pubescence and some sparse long erect setae.

Ventral side scarcely observable due to turbidity in the amber, however, abdomen with recumbent pubescence and some very long sparse erect setae; pygidium elongated, largely surpassing the elytral apex.

Genitalia (Fig. 4) exposed: paraproct very long with straight baculi; valvifer not distinguishable; coxites feebly restricted at the apical part and externally arcuate at apex; coxite lobes with short apical hairs; stylus apical, rather long and sclerotised.

Legs relatively short, covered with recumbent pubescence and some long erect setae on the tibiae; femora club-shaped; tibiae straight, evidently shorter than femora; tarsi relatively long; metatarsi one-fifth shorter than metatibiae; metatarsomeres I-II sub-equal, metatarsomere III much shorter.

Etymology

From Latin *succinum* (amber) and the suffix *-colus* (from the verb *colere*, inhabit), i.e. “inhabiting in amber”. Actually, it is a pun with reference to *Pinus succinifera* and *Paratimia conicola*, to be understood as “inhabiting in *Pinus succinifera*”.

Assumed biology

Paratimia conicola and *Xylotrechus schaefferi* Schott, 1925 are the only American cerambycids

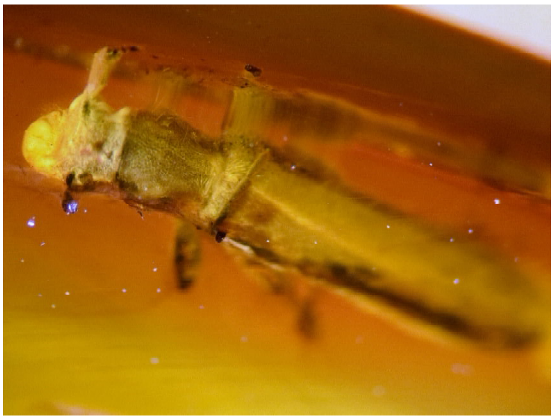

Fig. 3. *Paratimia succinicola* sp. n., dorsal view.

Fig. 4. *Paratimia succinicola* sp. n., genitalia.

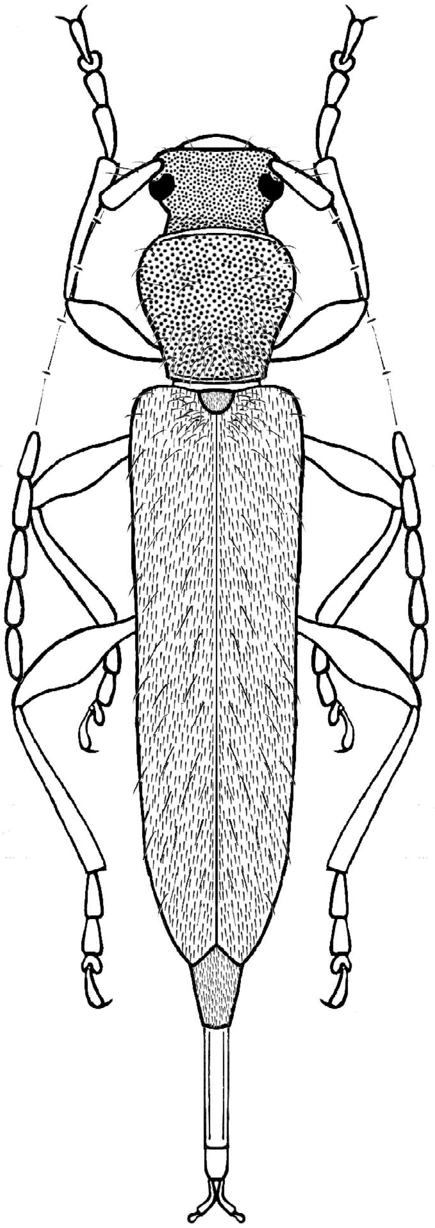

Fig. 5. *Paratimia succinicola* sp. n., reconstruction

showing the peculiar behaviour of feeding in dry pinecones (Linsley 1939, Hoebeke & Huether 1990).

P. conicola emerge in early spring (March and April) after overwintering as adults (Keen 1958). The presence of "stellate hairs" inside the amber suggests, nonetheless, that adults of *P. succinicola* sp. n. emerged in a month corresponding to the end of the blossom period of oaks, probably May, like the extant congener. This possible later phenology might mean that the climate of Baltic forests was fresher than that of extant Pacific Coast Ranges.

The rarity of *P. succinicola* sp. n. compared to that of the well-know pine-borer *Nothorhina granulipennis* Zang, 1905 (Zang 1905, Klebs 1910, Hieke & Pietrzeniuk 1984, Vitali 2006, 2009) supports the hypothesis that the larvae of *P. succinicola* sp. n. did not feed under bark of trees but in cones, like its extant congener. There is no reason to suspect a coniferous genus other than *Pinus*; thus, *P. succinifera* (Göppert) Conwentz, the well-known resin producer of Baltic amber (Conwentz 1890, Schubert 1961, Larsson 1978), was in all likelihood the host of this fossil species.

Fig. 6. *Paratimia conicola* Fisher, 1915 emerged on 21.II.1962 from cones of *Pinus attenuata* collected by G.H. Nelson at Aetna Springs, Napa Co., California, USA (© K. Schnepp).

Remarks on the tribe Atimiini

The systematic position of the trans-Beringian *Atimia* has long been confusing. Initially, Haldeman (1847) classified it as Lamiinae, due to its close resemblance with Saperdini. Afterwards Lacordaire (1869) placed it near Cerambycinae Smodicini and finally, Webb (1912) recognised its relation to *Asemum* Eschscholtz, 1830 (Spondylidinae Asemini) on the basis of larval characters.

Gressitt (1951) described *Proatimia* noticing its close resemblance with *Tetropium* Kirby, 1937 (Spondylidinae Asemini). He also suggested that this genus "may represent an ancestral stock and a link nearer the Asemini" appearing "to be more generalised than *Paratimia* and *Atimia*".

These last two genera may represent specialised branches of Atimiini. In fact, in contrast to other members of the tribe, *Atimia* is associated with Cupressaceae (*Cupressus*, *Calocedrus*, *Juniperus*, *Thuya* and *Sequoia*). Moreover, the analysis of feminine genitalia (Saito 1990) revealed that *Atimia* is rather far from other Spondylidinae, due to its unusual short paraproct. *Paratimia succinicola* sp. n. does not show this character (Fig. 4), but the larval biology of this genus in pinecones is really unusual.

Švácha & Lawrence (2014) noticed several morphological and biological characters common to Atimiini and *Oxypleurus*, a former Spondylidinae Saphanini, which they moved to Atimiini, underlining the link between Atimiini and European Saphanini.

Definitely, it appears rather clear that Atimiini are a branch of Spondylidinae with common ancestors or even somehow derived from Saphanini through *Oxypleurus* > *Proatimia* > *Paratimia* & *Atimia*.

Saphanites seems to be an extinct lateral branch derived from *Oxypleurus*.

The hosts of the more primitive genera (*Oxypleurus* and *Proatimia*) suggest that in origin, Atimiini were exclusively associated with pines and only afterwards, they adapted to Cupressaceae. Both fossil species in Baltic amber seem to support this hypothesis, which also retraces the phylogeny of the Pinophyta (Farjon 2003, Quinn & Price 2003).

The Mediterranean-Macaronesian distribution of *Oxypleurus* evidences that Atimiini were originally a thermophilic Arcto-Tertiary group that evolved in Europe at least during the Eocene.

Nonetheless, more evolved taxa show evidently mountain preferences: *Proatimia* was collected at 1850 m and *Paratimia* inhabits the Coast Ranges from Oregon to California. This corresponds to the same climatic preferences of those extant taxa whose ancestors have been found in Baltic amber, *e.g.* some *Bembidion* (Schmidt & Michalik 2017), *Nothorhina*, *Japonopsimus*, *Dicentrus*, *Procleomenes* (Vitali 2006, 2014, 2018, Vitali & Damgaard 2016) and probably, *Eurapatophysis*, *Obrium* and *Acanthoglyptus* (Alekseev & Vitali 2020, Vitali 2015, 2016). Again, this should suggest a more recent dating of Baltic amber.

The Baltic-Vancouverian distribution of the genus *Paratimia* exactly retraces that of *Dicentrus* LeConte, 1880 (Cerambycinae Opsimini), raising the same questions about its origin: Laurentian or trans-Beringian?

However, differently from this genus, for which a primitive exclusive association to *Calocedrus* was hypothesised (Vitali & Damgaard 2016), pines are still present in all temperate Eurasia. Thus, this does not allow correlating the current absence of this beetle in Eurasia to the extinction of its host.

Nonetheless, the dependence of *Paratimia* on pinecones is a peculiar biology common to few other Nearctic beetles, such as *Xylotrechus schaefferi* and Anobiidae of the genus *Ernobius* Thomson, 1858 (Keen 1958, Hoebeke & Huether 1990). Similarly to *Paratimia*, *Ernobius* was recorded from Baltic Amber (Alekseev 2014); thus, this kind of larval biology should have already been present in Laurasia during the Tertiary.

Its absence in extant European beetles (Resh & Cardé 2009), despite the seeming abundance of the hosts, might be researched in the physiology of extant European pines.

In fact, extant cone borers attack taxa, such as *Pinus lambertiana* Douglas, *Pinus* section *Trifolius*, *Pinus* section *Parrya* (Keen 1958), all absent or extinct in Europe for a long time (Farjon 2010).

The only link with European pines is *P. lambertiana* since it belongs to a group – *Pinus* section *Quinquefolius* subsection *Strobus* – currently still present in Europe. Maybe it is not a case that the resin of *P. lambertiana* contains labdane as the extinct *P. succinifera* (Larsson 1978), while the extant European *P. strobus* L. does not contain it (Higuchi 1985). Hence, the extinction of *Paratimia* in Europe might be actually related to the local extinction of some particular types of pines, whose resin contained labdane.

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