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A new species of *Lacinius* in amber (Arachnida: Opiliones)

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Abstract. A new specimen of *Lacinius* Thorell, 1876; (Opiliones: Phalangiidae) from Eocene Baltic amber is described. We interpret it as conspecific with a slightly younger record from the German Bitterfeld amber, originally referred to as the extant species *L. erinaceus* Staręga, 1966. Our new specimen reveals pedipalpal apophyses on both the patella and the tibia, features which we can now confirm in the Bitterfeld fossil too. This unique character combination for the genus justifies a new, extinct species: *Lacinius bizleyi* sp. nov. The Baltic amber inclusion dates to ca. 44–49 Ma, and is thus the oldest putative example of *Lacinius* in the fossil record. It is a further example of an arachnid species shared between Baltic and Bitterfeld amber.

1 Introduction

Harvestmen in the genus *Lacinius* (Opiliones: Phalangiidae) Thorell, 1876 are typically characterized by a distinctive spiny ornament across the legs and body. *Lacinius* is currently represented by seven Recent species (Table 1), six of which are found in central Europe down into the Balkans and the Mediterranean, as well as in northern Africa, Turkey and the Caucasus (e.g. Kraus, 1961; Šilhavý, 1956, 1965; Staręga, 1966, 1976; Marcellino, 1975; Martens, 1978; Prieto, 2003, 2008; Novak, 2005; Çorak et al., 2008, 2014; Sánchez-Cuenca and Prieto, 2014). Additionally, one species is recognized from the USA (Banks, 1893), while a further putative American *Lacinius* was synonymized with a species in *Odiellus* Roewer, 1923 by Cokendolpher and Lee (1993). Note that the online species lists assembled by Hallan (2005) did not always include all published synonyms, compared with Crawford (1992). Over-reliance on such online data for harvestman taxonomy – and the resulting risk of errors being copied and multiplied into other publications or resources – was recently critiqued by Schönhofer (2013). Similarly, the *Lacinius* species from China listed in Hallan (2005), *Lacinius bidens* (Simon, 1880) (*Acantholophus bidens*; Simon, 1880), has long been referred to as *Bidentolophus* Roewer, 1912 (see Roewer, 1912, 1923; Wang, 1953; Li and Song, 1993), which is a junior subjective synonym of *Lacinius* Thorell, 1876 (see Crawford, 1992: p. 13). Note also that the Spanish species *L. carpetanus* (Rambla, 1959) was recently transferred to *Odiellus by* Sánchez-Cuenca and Prieto (2014). As shown in Table 1, three of the six Recent Palearctic species are fairly widely distributed across Europe (often through into Turkey). Others are more restricted and local in their ranges.

A few years ago, a remarkable fossil assignable to *Lacinius* was documented by Dunlop and Mitov (2009) from the Bitterfeld (or Saxon) amber of eastern Germany, a locality whose age has been disputed – reviewed by Dunlop (2010) – but which has recently been considered to be Oligocene (ca. 24–25 Ma) and thus younger than the better known Eocene (ca. 44–49 Ma) Baltic amber. In their original description, Dunlop and Mitov (2009) considered their *Lacinius* fossil to be anatomically indistinguishable from the Recent species *Lacinus erinaceus* (Staręga, 1966), and tentatively assigned the amber inclusion to this taxon. This extant harvestman was first described from Abkhazia in the Caucasus Staręga, 1966, and was later documented from the provinces of Bayburt and Gümüşhane in northeastern Turkey too (Kurt and Erman, 2012).

Recently, a second example of a spiny, *Lacinius*-like fossil in amber became available, this time from Baltic amber. This

Table 1. Summary of the seven living and one fossil (†) species belonging to the harvestman genus *Lacinius* (Phalangiidae; Thorell, 1876) currently recognized in the literature.

Taxon	Distribution	Reference(s)
Lacinius angulifer (Simon, 1878)	Northern Africa (Algeria, Morocco), France (Corsica), ?Spain	Simon (1878), Roewer (1912, 1923, 1957), Kraus (1959, 1961), Prieto (2003), Delfosse (2014)
† *Lacinius bizleyi* sp. nov.	Europe: Bitterfeld and Baltic amber	Dunlop and Mitov (2009), this study
Lacinius dentiger (Koch, 1848)	Europe (excluding the northernmost part)	Staręga (1976), Martens (1978), Rozwałka et al. (2010)
Lacinius ephippiatus (Koch, 1835)	Europe, Turkey	Staręga (1976), Martens (1978), Çorak et al. (2008, 2014)
Lacinius erinaceus Starega, 1966	Caucasus, Turkey	Staręga (1966), Kurt and Erman (2012)
Lacinius horridus (Panzer, 1794)	Europe (excluding the northernmost part), Turkey, Iran	Roewer (1959), Staręga (1976), Martens (1978)
Lacinius insularis Roewer, 1923	Crete	Roewer (1923), Martens (1966), Chatzaki et al. (2009)
Lacinius texanus Banks, 1893	USA: eastern Texas, Georgia	Banks (1893, 1901), Roewer (1912, 1923), Crosby and Bishop (1924)

small specimen (Figs. 1–2), a little over a millimetre long, is probably immature, but immediately caught our attention for possessing distinct apophyses on the pedipalp, different from the morphology of any of the living *Lacinius* species described to date. Baltic and Bitterfeld amber are known to host a number of arachnid species in common – including some harvestmen (Dunlop and Mitov, 2009) – a fact which led some authors to consider the two ambers to be of the same stratigraphic age. Here, we demonstrate that the new specimen does belong to *Lacinius* and that the Baltic and Bitterfeld examples are probably conspecific. However, their pedipalp morphology differs from *Lacinus erinaceus* (and other extant species); thus, we suggest that both amber specimens should be referred to as a new taxon.

2 Material and methods

The new specimen from Baltic amber was acquired by one of us (D. Penney) via Jonas Damzen (Vilnius). It has now been deposited in the amber collection of the Museum für Naturkunde (MfN) Berlin under repository number MB.A. 2815 for "Museum Berlin, Arthropoda". It was drawn under a Leica MZ12.5 stereomicroscope with a *camera lucida* attachment and photographed immersed in water on a Leica Z16 microscope running the Leica Application Suite software package for generating stacks of images in different focal planes. These were combined into final pictures using Helicon Focus and edited in Adobe Photoshop. All measurements in the descriptions are in millimetres.

The new fossil was compared to the previous amber *Lacinius* specimen, again in the MfN under repository number MB.A 1661. We also examined alcohol-preserved specimens (adults and juveniles) of recent *Lacinius* species and other phalangiid harvestmen in the zoological collections of the MfN, as well as material from the private collection of P. G. Mitov. These were compared with published descriptions from the literature (e.g. Roewer, 1923). We also consulted images of living species kindly provided by Christian Komposch (Graz) – see also Fig. 3 – and Nataly Snegovaya (Baku).

3 Systematic palaeontology

Order **Opiliones** Sundevall, 1833

Family **Phalangiidae** Latreille, 1802

Genus ***Lacinius*** Thorell, 1876

***Lacinius bizleyi* sp. nov.**

Figs. 1–2

2009 ?*Lacinius erinaceus* (Staręga, 1966; Dunlop and Mitov, 368–369; Figs. 27, 31–32 – misidentification)

Type material. Holotype, Museum für Naturkunde Berlin, MB.A. 1661.

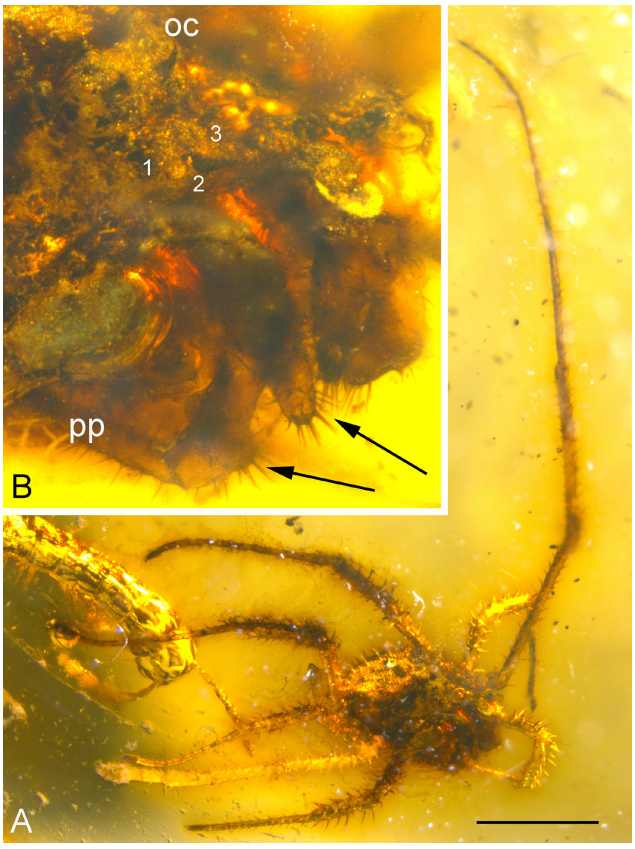

Figure 1. *Lacinius bizleyi* sp. nov. MB.A. 2815 from Eocene (Lutetian) Baltic amber. At ca. 44–49 Ma, this is the oldest putative record of the genus. **(a)** Overview. **(b)** Detail of the anterior prosoma showing the ocularium (oc), the three spines in front of this and the distinct apophyses on the patella and tibia (arrowed) of the pedipalp (pp). Scale bar equals 1.0 mm.

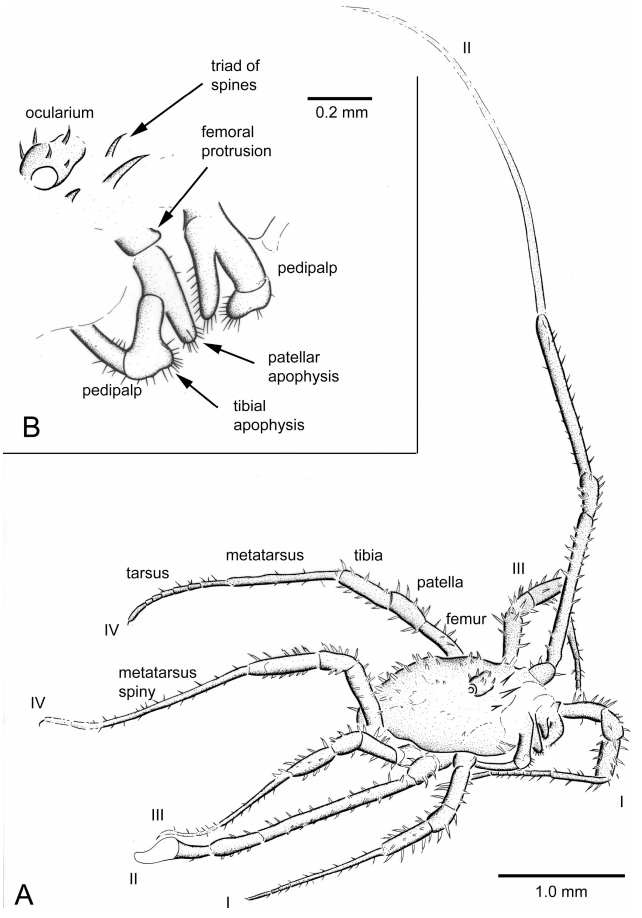

Figure 2. *Camera lucida* drawings of the specimen shown in Fig. 1. **(a)** Overview. **(b)** Detail of the anterior prosoma. Legs numbered from I to IV.

Type locality and horizon. From Bitterfeld amber, Saxony-Anhalt, Germany. Palaeogene (?Oligocene). Described in detail by Dunlop and Mitov (2009).

Additional material. MB.A. 2815 (*ex* D. Penney coll., via J. Damzen). Baltic amber; precise locality not recorded, but most of the recently acquired material stems from the Kaliningrad region of the Russian Baltic coast. Palaeogene (Eocene: Lutetian).

Derivation of name. In honour of the British palaeoartist Richard Bizley (Lyme Regis) for his assistance to D. Penney with various palaeontology-related projects.

Diagnosis. Species of *Lacinius* with a combination of ornamented body and leg articles (except tarsi) with numerous long sharp-pointed/tipped thorns, and distinct apophyses on both the patella and tibia of the pedipalp; patellar apophysis longer than tibial apophysis.

Description of MB.A. 2815. Relatively complete specimen (right leg II mostly missing), best seen in dorso–lateral view (Figs. 1–2). Body oval, flattened, length ca. 1.2 mm; maximum width of prosoma ca. 1.0 mm, of opisthosoma ca. 0.9 mm. Ocularium raised and ornamented with at least five curving thorns (whereby thorns here have a thick base and then taper about midway along their length into a sharp spine); ocularium length and width ca. 0.14 and 0.23 mm respectively, distance from front of carapace ca. 0.2 mm. Distinct pattern of triad of forward-projecting spines immediately in front of ocularium (Figs. 1a, 2b). Opisthosoma, particularly the posterior portion, ornamented with numerous backwards-pointing thorns, each consisting of a thicker base with a short, stiff seta at the tip. Chelicerae equivocal. Pedipalps with distinct apophyses projecting from both patella and tibia (Figs. 1a, 2b). Palpal femur disto-medial with one setose, apophysis-like protrusion. Patellar apophysis long, somewhat spatulate – almost reaching length of tibia – and highly setose on its mesal surface as well as apophysis tip. Tibial apophysis short and blunt, projecting mesally and again bearing numerous setae. Legs moderately long, leg II markedly longer than others (leg formula from longest to shortest: II, IV, III, I); approximate total lengths: I, 2.0 mm; II, 6.0 mm; III, 2.4 mm; IV, 3.2 mm. Trochanter, femur, patella and tibia of all legs more robust, again with

distinct arrangement of thorns topped with stiff setae, arranged in discrete rows along length of limb article. Tibia to tarsus more slender. Basal part of the tibia with two robust thorns; distal portion of the legs otherwise with stiff setae only. Metatarsi dorsally bear short thorns and strong setae. Tarsi subdivided into ca. seven tarsomeres in each leg where visible (exact number equivocal on some legs); proximal and distal-most tarsomeres longer than those in between. All legs end, where preserved, in a single, curved claw. Genital characters could not be resolved.

Discussion. The new Baltic amber fossil is similar in habitus to the previous record from Bitterfeld, which Dunlop and Mitov (2009, Figs. 27, 31–32) tentatively assigned to *Lacinius erinaceus*. In the present study, we also considered a similar-looking, spiny harvestman genus: *Homolophus* Banks, 1893. For details of this taxon, see e.g. published descriptions of *H. afghanus* (Roewer, 1956), *H. chitralensis* (Roewer, 1956), *H. trinkleri* (Roewer, 1956) and *H. turcicus* (Roewer, 1959). Note that Roewer (1956, 1959) originally described these species under *Euphalangium*; for a generic synonymy, see Cokendolpher (1987). We also consulted Snegovaya's recent (2012) description of *Homolophus nakhichevanicus* Snegovaya, 2012. We believe that we can exclude the amber inclusions from *Homolophus* based on the presence in the fossils of a triad of spines at the front of the carapace (Figs. 1b, 2b) and the additional presence of spines on the metatarsi of the legs (Fig. 2a). In many *Homolophus* species, there are two principal, diverging forward-pointing spines – or "Gabelzähnchen" – at the front of the carapace, surrounded by a group of denticles sometimes forming a crown. The remaining *Homolophus* species only have a group of frontal denticles. Furthermore, the metatarsi of the legs of *Homolophus* are normally smoother than the spiny metatarsi seen in the amber specimens; only some *Homolophus* species have denticles/tubercles ventrally.

We thus believe that both amber fossils can be comfortably referred to as *Lacinius*, although the absence of genital characters in these inclusions will always preclude an unequivocal assignment. The fossils are more spiny than the modern species *Lacinius angulifer* (Simon, 1878) (see Roewer, 1912: p. 77; Roewer, 1923: Fig. 915), *L. dentiger* (Fig. 3a), *L. ephippiatus* (Koch, 1835) (see Šilhavý, 1956: Table VII, Fig. 28; Martens, 1978: Fig. 619), *L. insularis* Roewer, 1923 (see Roewer, 1923: Fig. 918), and *Lacinius texanus* (Banks, 1893) (see Banks, 1901: Fig. 4; Roewer, 1912: p. 81; Roewer, 1923: p. 743). The fossils thus have more in common in terms of their external morphology with species like *L. horridus* (Panzer, 1794) (Fig. 3b) and *L. erinaceus*. The most specific characteristic of the new Baltic amber fossil is the presence of well-developed apophyses on both the patella and tibia. Apophyses of this form are not present in *Lacinius erinaceus* (see e.g. Dunlop and Mitov, 2009, sub *L. erinaceus*, Figs. 28–29; Kurt and Erman, 2012, Fig. 5c, *L. erinaceus*). We re-examined the original Bitterfeld *Lacinius* record (MB.A. 1661). The original description

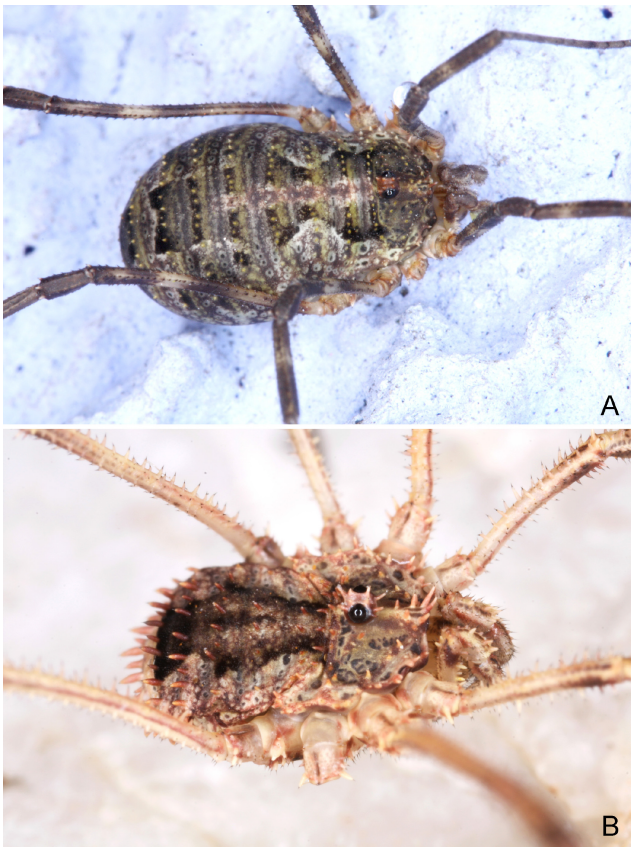

Figure 3. Comparative photographs of two of the more widespread recent European *Lacinius* species. **(a)** Female *L. dentiger* (Koch, 1848) from Graz, Austria. **(b)** The more heavily ornamented *L. horridus* (Panzer, 1795) male from Luberkogel, Austria. Images courtesy of Christian Komposch (Graz).

did not figure the pedipalps so clearly, but upon restudy, we could confirm that patellar and tibial apophyses are present here too. This suggests that the two fossil *Lacinius* records probably are conspecific, but differ from *L. erinaceus* and at least all the modern Palearctic species in this genus.

The closest potential match would be the North American species *L. texanus* Banks, 1893, for which Banks (1893, p. 403) stated that "The patella is prolonged, the inner side and prolongation being covered with short, stiff, black hairs. The tibia is enlarged at the end on the inner side and covered with similar hairs [...]". Unfortunately there is no illustration in the original description to show whether Bank's "prolongation" of the patella is a substantial apophysis as per the fossil specimens, but subsequent figures and/or redescriptions of *L. texanus* by Banks (1901, Fig. 4) and later Roewer (1912, p. 81; 1923, p. 743) do not indicate explicit pedipalpal apophyses. As noted above, the general habitus of *L. texanus* is also less spiny than our amber material, which argues against the fossils being closely related to the living American species.

On balance, we feel justified in proposing a new (fossil) *Lacinius* species diagnosed on the combination of body

ornamentation and pedipalp morphology as above. As noted previously, the new specimen is quite small, and the individual may be immature. Where apophyses are present in phalangiid harvestmen, they can be more prominent in immature instars and become less well expressed in adults. We select the first specimen to be described (MB.A. 1661 from Bitterfeld amber) as the holotype of our new taxon. Since the second (Baltic) specimen is not from the same locality as the holotype, we chose not to treat it as a paratype. The Baltic example of *Lacinius bizleyi* sp. nov. places the genus back at least in the Eocene, and can also be added to the list of harvestmen found in both Baltic and Bitterfeld amber. The other harvestmen common to both ambers are the nemastomatid *Histricostoma tuberculatum* (Koch and Berendt, 1854), the caddid *Caddo dentipalpus* (Koch and Berendt, 1854), the phalangiid *Dicranopalpus ramiger* (Koch and Berendt, 1854) and the sclerosomatid *Leiobunum longipes* Menge, 1854. The Opiliones data thus remain preliminary, but our new fossil contributes to the debate (reviewed by, e.g., Standke, 2008, and Dunlop, 2010) about whether Baltic and Bitterfeld ambers are in fact contemporary deposits, sampling the same (implicitly Eocene) fauna. Alternatively, if Bitterfeld amber is a distinct and younger deposit – and not merely older Baltic amber reworked into younger sediments – it implies that there was something of a faunal continuum in the Paleogene of northern–central Europe. In other words, the same (morpho)species of harvestmen, and probably other arachnids too, can be found in the fossil record of this region of Europe across an Eocene-to-Oligocene time period which may correspond to about 25 million years.

Author contributions. P. G. Mitov and J. A. Dunlop compared the fossil to its living representatives; D. Penney provided the specimen and the data on amber in general. All authors contributed to the species description.

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