



白垩纪中期缅甸琥珀蜚蠊目昆虫一新种 (蜚蠊目: 自由蜚蠊科)*

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摘要 文中根据产自白垩纪中期缅甸琥珀中的一块蜚蠊标本, 建立一新种 *Stavba vrsanskyi* sp. nov., 归入自由蜚蠊科(Liberiblattinidae)。新种与 *Stavba babkaeva* Vršanská and Vršanský, 2019 不同之处在于其头部近三角形, 前翅R脉简单且无二级分支, M脉分支较少。新材料的发现进一步增加了白垩纪缅甸琥珀中蜚蠊的生物多样性。

关键词 *Stavba vrsanskyi* sp. nov. 蜚蠊目 白垩纪中期 缅甸琥珀

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A NEW COCKROACH (INSECTA: BLATTARIA: LIBERIBLATTINIDAE) FROM MID-CRETACEOUS BURMESE AMBER

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Abstract A new species, *Stavba vrsanskyi* sp. nov., is established and attributed to the family Liberiblattinidae on the basis of a blattarian specimen from mid-Cretaceous Burmese amber. The new species differs from *Stavba babkaeva* Vršanská and Vršanský, 2019 in the following characteristics: triangular head shape, R of forewing without

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secondary branches and less M. This new find provides novel biology diversity in Blattaria in mid-Cretaceous Burmese amber.

SYSTEMATIC PALEONTOLOGY

Class Insecta Linnaeus, 1758

Order Blattaria Latreille, 1810

Family Liberiblattinidae Vršanský, 2002

Genus *Stavba* Vršanská, 2019

Type species *Stavba babkaeva* Vršanská and Vršanský, 2019 by original designation.

***Stavba vrsanskyi* sp. nov.**

urn:lsid:zoobank.org:act:6F839E45-4C25-4260-BD69-5A70247B1F91
(Figs. 1, 2)

Derivation of name The species name is dedicated to Prof. Peter Vršanský (Geological Institute, Bratislava, Slovak Republic), thanks for his kind guidance and help.

Material Holotype: NIGP172159. Nearly complete adult, male.

Diagnosis (adult only) Small and long body; head approximately triangular; pronotum nearly round and covered back part of head. In forewing, SC simple and strong, R simple without secondary branch, M with only two branches. In hind wing, R and M less, M curved and with 2 branches.

Description Head (Fig. 1-C) kept intact, slightly carbonized, approximately triangular (1.2×0.5 mm), hypognathous, with elongated narrow eyes. Antennae filiform, preserved completely, scape sturdy, pedicel thin and long, flagellum divided into 28 segments on the right and 33 on the left. Pronotum nearly circular, slightly elongated, slightly vaulted, nearly planar, covered back part of head. Forelegs (Fig. 1-D) raptorial; coxa very long and wide, narrowing from top to bottom, 1.2 mm long, 0.2 mm wide in center; trochanter curved, short; femur (1.5×0.2 mm), terminating with row of spines and 1 apical spur; tibia thin and long (0.6×0.1 mm), with three spines and four spurs; tarsus long (ca. 0.8 mm), divided into 4 tarsomeres. Mid legs cursorial, femur strong (1.4×0.2 mm), tibia strong with at least 8 spines. Hind leg (Fig. 1-E) basically cursorial, long, strong, femur very strong and wide (1.5×0.5 mm), tibia very long (1.9×0.16 mm), with at least 22 spines. Body long 7.52 mm.

Forewing (Fig. 2) elongated and transparent, anterior margin arched, outer margin straight until rounded

apex, apex round and not sharp. Left forewing 6.5 mm long and 2.16 mm wide. Intercalary veins and cross-veins distinct and numerous, and cross-veins dense in Rs area, M area and CuA area. Upper middle part of right forewing damaged, about 6.34 mm long and 2.24 mm wide. Left forewing slightly indistinct and cross-veins invisible. Sc in right forewing very strong, simple, short, in left forewing simple, normal and damaged. Left forewing, R1 curved, with 6 veins reaching costal margin, and without secondary branch. Rs differentiated, ending in costal margin, with 3 branches. M with 2 straight branches, reaching apex. CuA with 3 medium sized branches. CuP simple, short and extremely curved, with 4 branches. Right forewing damaged basally, R with 8 branches, M with 2 branches, CuA with 3 branches. Left hind wing transparent, 5.96 mm long and 2.22 mm wide, the top 1/2 overlaps with the right forewing when saving, apex rounded. Anterior margin arched. Sc straight and not obviously strong, reaching 1/2 of costal margin. R1 with 3 curved branches, ending in costal margin. Rs with 3 branches, with secondary branches. M slightly curved, with 2 short branches, ending at apex. CuA with 6 medium sized branches, CuA1 and CuA2 slightly curved, and the last four branches are extremely curved, with one secondarily branched vein (second one posteriormost), ending in outer margin. Distinct intercalary veins and cross-veins in the CuA area. CuP simple. Right hind wing damaged (most overlap with the body) and slightly deformed, only the lower edge can be observed, veins intermittent and curved. Cercus (Fig. 1-F) only one reserved (ca. 1.4 mm), divided into 7 segments.

Remarks (adult) *Stavba vrsanskyi* sp. nov. is very similar to *S. babkaeva* Vršanská and Vršanský, 2019, but *S. vrsanskyi* sp. nov. differs from the latter in the following characteristics: head approximately triangular and pronotum covered back part of head; coxa of two forelegs are not significantly different; in forewing, R simple without secondary branches, M only have 2 branches; hind wing slightly shorter than forewing, R and CuA with less branches.

Type locality and horizon Hukawng Valley, Kachin Province, northern Myanmar; Late Cretaceous (earliest Cenomanian).

Key words *Stavba vrsanskyi* sp. nov., Blattaria, mid-Cretaceous, Burmese amber

1 前言

蜚蠊泛指蜚蠊目昆虫, 俗称蟑螂, 已经在地球上存在了大约 3.2 亿年(谭娟杰, 1980; Vršanský *et al.*, 2002; 梁军辉等, 2006; Chen *et al.*, 2019)。它们是古生代和中生代陆地生态系统中的优势昆虫类群, 已报道的化石大约 1500 种(Vršanský, 2008; Chen *et al.*, 2019)。

Liberiblattinidae 科由 Vršanský (2002) 建立, 已报道 14 属 15 种(Vršanský *et al.*, 2019b)。该科在侏罗纪—白垩纪蜚蠊的系统发育中占有重要位置(Vršanský *et al.*, 2012), 并被认为是最古老的社会性蜚蠊的直系祖先(Vršanský, 2010; Vršanský *et al.*, 2012)。Vršanský 等(2018)报道了产自白垩纪中期缅甸琥珀中的 Liberiblattinidae 科一新属新种: *Stavba babkaeva* Vršanská and Vršanský, 2019, 认为是一种捕食性蜚蠊蟑螂, 其翅膀显示了由病理性 DWV 病毒引起的畸形翼病毒感染症状(Vršanský, 2019b)。

本文根据产自缅甸琥珀一块蜚蠊标本建立了 *Stavba* 属一新种, 并根据标本的保存状态对其埋藏方式进行了分析。

2 材料与方法

研究材料来自缅甸北部克钦邦胡康河谷的琥珀矿。胡康河谷的缅甸琥珀最早被 Helm (1892, 1893) 研究并命名为 “burmite”, 含有丰富的动植物内含物, 构成了白垩纪多样性最高的琥珀生物群(Ross *et al.*, 2010; Shi *et al.*, 2012; Kania *et al.*, 2015; Yu *et al.*, 2019)。该琥珀矿的沉积年龄为 98.8 ± 0.6 Ma (由锆石的 U-Pb 定年测定)(早 Cenomanian 期)(Shi *et al.*, 2012; Kania *et al.*, 2015)。

材料现保存在中国科学院南京地质古生物研究所。使用 ZEISS AXIO Zoom V16 系统和 Zen 软件完成照片拍摄, 使用 Combine ZP 软件将 13—40 个不同焦的平面的图像进行聚焦堆叠。线条图使用绘图软件 CorelDraw X8 绘制, 并使用 Photoshop CS6 优化。

翅脉术语采用 Comstock 和 Needham (1899) 的方案, 目前用于蜚蠊翅脉命名(Vršanský *et al.*, 2018, 2019a, 2019b)。另见 Li 等(2018)对蜚蠊翅脉系统的适当阐释。

3 系统古生物学

昆虫纲 **Insecta Linnaeus, 1758**

蜚蠊目 **Order Blattaria Latreille, 1810**

自由蜚蠊科 **Family Liberiblattinidae Vršanský, 2002**

建造蜚蠊属 **Genus Stavba Vršanská, 2019**

模式种 *Stavba babkaeva* Vršanská and Vršanský, 2019

弗氏建造蜚蠊(新种) ***Stavba vrsanskyi* sp. nov.**

urn:lsid:zoobank.org:act:6F839E45-4C25-4260-BD69-5A70247B1F91 (图 1, 2)

词源 种名来源于斯洛伐克共和国布拉迪斯拉发地质研究所 Peter Vršanský 教授的姓, 以感谢他对我们的指导和帮助。

材料 正模: NIGP172159。几乎保存完整的成虫个体, 雄性。

种征 身体细长且较小。头部近三角形。前胸背板近圆形, 覆盖了头部的后半部分。前翅 SC 脉简单粗壮, R 脉无二级分支, M 脉仅两个分支。后翅 R 脉、M 脉分支少, M 脉弯曲并有两个分支。

描述 头部(图 1-C)完整, 轻微碳化, 近似三角形(1.2×0.5 mm), 下口式, 复眼窄长。触角线状, 保存相对完整; 柄节粗壮, 梗节细长, 左触角鞭节分为 33 节, 右触角鞭节仅保存基部 28 节。前胸背板近圆形, 略长, 截面略呈拱形, 近平面, 覆盖头部的后半部分。前足(图 1-D)捕捉足, 基节非常长而宽, 向末端变窄, 长 1.2 mm, 中心处宽 0.2 mm; 转节弯曲, 较短; 股节 1.5×0.2 mm, 具一排刺和一较长的端距; 胫节细长(0.6×0.1 mm), 具 3 个刺和 4 个距; 跗节长(约 0.8 mm), 分为 4 节。中足(图 1-D)步行足, 股节粗壮(1.4×0.2 mm), 胫节较粗, 至少有 8 个刺。后足(图 1-E)步行足, 长,

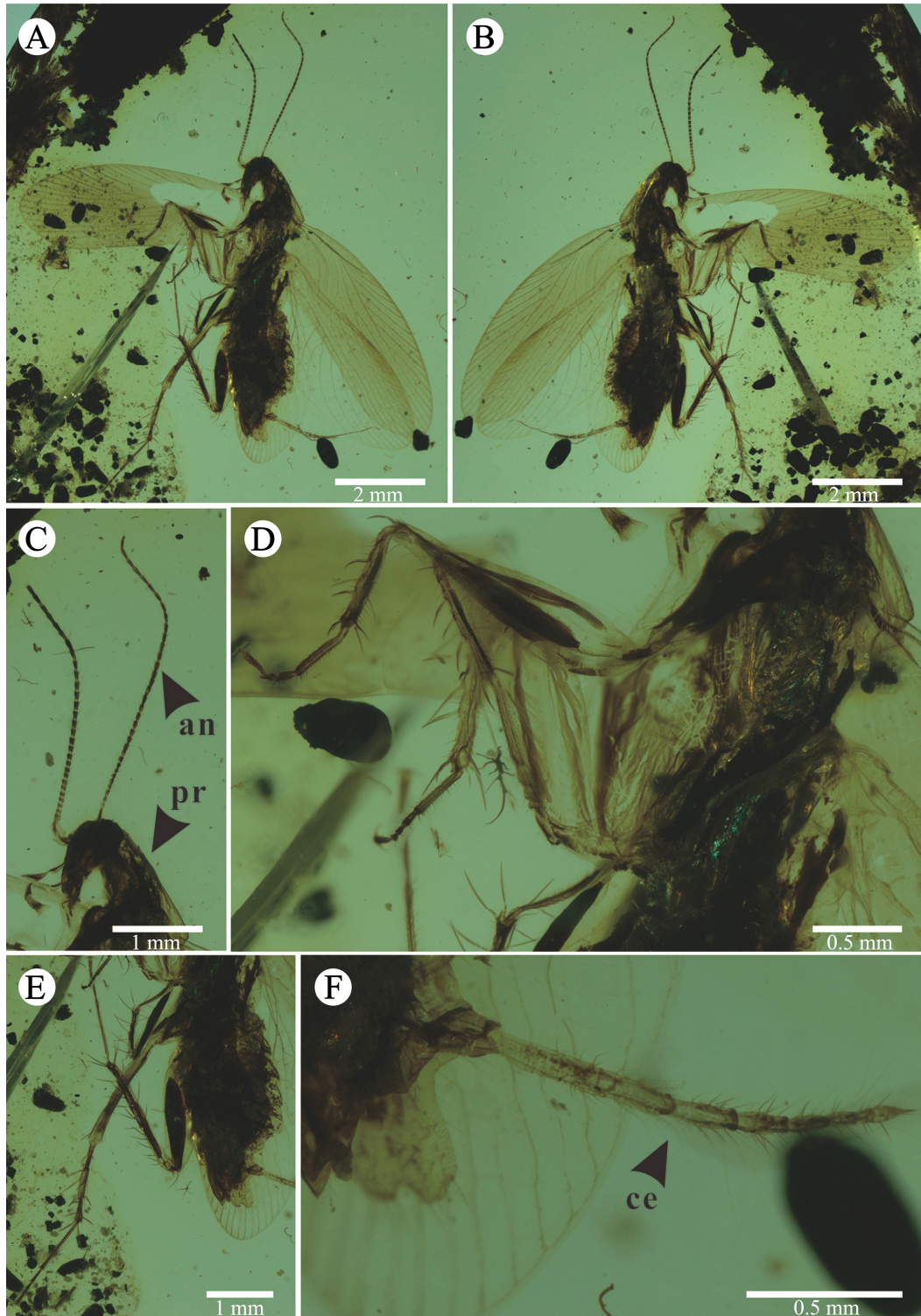


图1 弗氏蜚蠊(新种), 正模标本, 光学图像。

Fig. 1 *Stavba vrsanskyi* sp. nov., holotype, photographs.

A. 标本侧腹视; B. 标本侧背视; C. 头部和前胸, 侧腹视; D. 中、后胸和前、中足; E. 腹部和后足; F. 尾节。缩写: an. 触角; pr. 前胸背板; ce. 尾须。
A. habitus in lateroventral view; B. habitus in laterodorsal view; C. head and prothorax in lateroventral view; D. mesothorax, metathorax, forelegs and mid legs; E. abdomen and hind legs; F. terminalia. Abbreviations: an. antennae; pr. pronotum; ce. cercus.

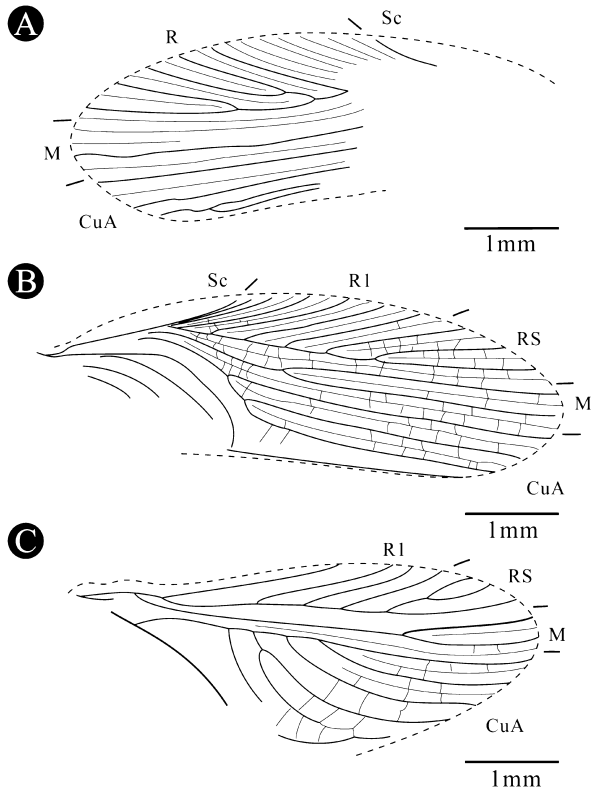


图2 弗氏蜚蠊(新种), 正模标本, 翅膀线条图。

Fig. 2 *Stavba vrsanskyi* sp. nov., holotype, line drawing of wings.

A. 右前翅; B. 左前翅; C. 左后翅。缩写: Sc. 亚前缘脉; R. 径脉; R1. 第1径脉; RS. 径分脉; M. 中脉; CuA. 第1肘脉。

A. right forewing; B. left forewing; C. left hind wing. Abbreviations: Sc. Subcosta; R. Radial; R1. first Radial; RS. Radial Sector; M. Media; CuA. first Cubitus.

粗壮, 具有多个侧刺, 股节非常强壮且宽(1.5×0.5 mm), 胫节细长(1.9×0.16 mm), 至少有22个刺。虫体长7.52 mm。

前翅(图2)透明呈近长卵圆形, 前缘拱曲, 外缘近直, 翅尖近圆形。左前翅长6.5 mm, 宽2.16 mm; Rs区, M区和CuA区的横脉明显、数量多且密集。右前翅基前半部分破损, 长6.34 mm, 宽2.24 mm; 保存略差, 观察不到横脉。左前翅Sc脉非常粗, 简单, 直, 短; 该脉在右前翅简单, 直, 但受损。左前翅R1脉弯曲, 共六分支到达前缘, 没有二级分支; Rs脉分为三支, 止于翅缘; M脉分为二支, 直, 达顶角; CuA脉具三支, CuP脉简单, 短而极弯曲, 具四分支。右前翅基部损坏, 直, 但受损; R脉具八分支, M脉二分支, CuA脉三支。左后翅透明, 长5.96 mm, 宽2.22 mm, 顶部二分之一与右前翅重叠,

顶角圆形; 前缘略拱曲; Sc脉直, 没有明显加粗, 止于前缘1/2处; R1脉具三分支, 弯曲, 止于前缘; Rs脉三分支, 并具二级分支; M脉略弯曲, 具二短分支, 止于翅顶角; CuA脉具六分支, 长度中等, CuA1脉和CuA2脉略弯曲, 其余四支强烈弯曲; CuA区存在明显的横脉; CuP脉简单。右后翅受损(大部分与身体重叠)并略微变形, 只能观察到近翅端部边缘的翅脉成断续、扭曲状。左侧尾须(图1-F)完整, 右侧未保存, 长约1.4 mm, 分为7节。

比较(成虫) 新种与模式种伊娃氏蜚蠊 *S. babkaeva* Vršanská and Vršanský, 2019 极为相似, 不同之处前者的头部近三角形, 其后半部分被前胸背板覆盖; 两个前足的基节没有显著差异; 前翅R脉简单、无二级分支, M脉仅具二分支; 后翅略短于前翅, R脉和CuA脉分支明显少。

产地与层位 缅甸北部克钦邦胡康河谷, 上白垩统塞诺曼阶(earliest Cenomanian)。

4 讨论

缅甸北部的白垩纪中期琥珀保存了多样性极高的化石生物群, 其中昆虫最为常见(Cruickshank and Ko, 2002)。树脂分泌后, 通常呈滴状或钟乳状, 沿树干流淌。通常, 林间活动的昆虫碰到新鲜的树脂后, 会被困在粘性的树脂中并被吞没。树脂最终掉落在地上, 经过一系列地质作用变成了琥珀化石(Ross, 1998)。但是本文描述的 *S. vrsanskyi* sp. nov. 标本形成过程可能与此不同。该标本头部轻微碳化, 右前翅树脂包裹之前已经部分受损, 同时标本的四翅展开。现生蜚蠊的翅膀在正常条件下是关闭的, 翅膀的闭合由肌肉控制, 只有在死亡一段时间后, 肌肉才会松弛, 翅膀才能够打开。因此推测样本在死亡一段时间后才被树脂包裹, 并且可能经历了短暂的搬运。

Vršanský 等(2019b)在描述同样产自缅甸琥珀中的 *Stavba babkaeva* 时, 注意到了其翅膀的畸形, 其中前翅变形并认为是病毒感染的症状。他们推测这是由一种属于原始RNA类型的变形翼病毒(DWV)引起的, 这种病毒存在于白垩纪并不意外(Vršanský *et al.*, 2019b)。本文描述的标本同样存

在轻微的翅膀畸形现象, 同时其翅脉显示出间歇性扭曲的现象。这可能进一步证实了 RNA 病毒可能在恐龙时代生态系统中的脊椎动物和无脊椎动物分解者/捕食者之间传播的观点(Vršanský *et al.*, 2019b)。但是, 我们不能排除本文标本的后翅畸形是在沉积过程中形成的可能性。

5 结 论

本文报道和描述了产自缅甸北部胡康河谷琥珀中的 *Liberiblattinidae* 科蜚蠊一新种: *Stavba vrsanskyi* sp. nov., 进一步提高了白垩纪中期缅甸琥珀中蜚蠊的多样性。标本的保存状况说明它是在死亡一段时间后才被树脂包裹, 并最终形成化石。标本翅膀存在畸形现象, 可能支持了 RNA 病毒在恐龙时代生态系统中传播的观点。

致谢 审稿专家提出宝贵修改意见, 斯洛伐克共和国地质研究所 Peter Vršanský 教授指导论文, 在此一并致谢。

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