



Family Nevrorthidae (Insecta, Neuroptera) in mid-Cretaceous Burmese amber

Author: Wichard, Wilfried

Source: Palaeodiversity, 10(1) : 1-5

Published By: Stuttgart State Museum of Natural History

URL: <https://doi.org/10.18476/pale.v10.a1>

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

Family Nevrorthisidae (Insecta, Neuroptera) in mid-Cretaceous Burmese amber

WILFRIED WICHARD

Abstract

The lacewing family Nevrorthisidae (Insecta, Neuroptera) is reported from mid-Cretaceous Burmese amber for the first time. This paper describes the new genus and species *Cretarophalis patrickmuelleri*. Moreover, fossil nevrorthisid larvae are recorded in Burmese amber for the first time. These mid-Cretaceous lacewings are the hitherto oldest representatives of the family Nevrorthisidae.

Key words: *Cretarophalis patrickmuelleri*, Nevrorthisidae, Neuroptera, fossil larva, fossil species, Cretaceous, Burmese amber.

1. Introduction

The small family Nevrorthisidae belongs to the insect order Neuroptera. All over the world this family comprises 19 extant species belonging to four genera. They are distributed in warm-temperate or subtropical regions, namely in the Mediterranean region, with the genus *Nevrorthus* (MONSERRAT & GAVIRA 2014), in South Asia with the genera *Nipponeurorthus* and *Sinoneurorthus* (LIU et al. 2012, 2014), and in southeast Australia with *Austroneurorthus* (ASPÖCK 2004). In addition, nine fossil species belonging to five extinct genera of Nevrorthisidae are reported from the Eocene Baltic amber. *Rophalis relictus* is a very common fossil species in the Eocene; it is also found in the Bitterfeld amber (Germany) and in the Rovno amber (Ukraine). Previously, these Eocene amber species were the only known fossil nevrorthisids (WICHARD 2016).

In Burmese amber, an adult and two larvae of Nevrorthisidae have been recently found. These amber inclusions reveal the first evidence of the presence of the family Nevrorthisidae in the mid-Cretaceous (Albian–Cenomanian), with an age of about 100 million years (SHI et al. 2012; ROSS 2015). In the first record of the Burmese amber arthropod taxa (ROSS et al. 2010) listed six Neuroptera families: Berothidae, Coniopterygidae, Nymphidae, Osmyliidae, Psychopsidae, and Rachiberothidae). Since that time some further families have been reported from Burmese amber, e.g. Babinskaiidae (LU et al. 2017) and Diptero-mantispidae (LIU et al. 2016). The small family Nevrorthisidae, however, was not yet described except by GRIMALDI et al. (2002: fig. 28e), who illustrated a larva of “apparent Nevrorthisidae”, but this determination is doubtful (cf. MAKARKIN & PERKOVSKY 2009). MAKARKIN (2016) pointed to an undescribed lacewing in XIA et al. (2015, right upper photograph on page 101), which possibly proves to be an adult of the family Nevrorthisidae. Here, an adult specimen and larvae from Burmese amber are described.

Acknowledgements

My thanks go to the reviewers, ULRIKE ASPÖCK and VLADIMIR MAKARKIN, for providing valuable comments. I thank PATRICK MÜLLER and CARSTEN LAMMERSKÖTTER for loaning the Burmese amber pieces with the nevrorthisid inclusions. The flattened small amber with the embedded adult (holotype) is donated to the Staatliches Museum für Naturkunde, Stuttgart, Germany (SMNS) by PATRICK MÜLLER. Last but not least, many thanks to the editor GÜNTER SCHWEIGERT for giving the paper its final shape.

2. Material and methods

The fossil specimens, completely embedded in small amber blocks, were cut out from larger Burmese amber pieces. An adult female is visible in ventral and dorsal view. The hindwings are partially covered by the forewings. The genitalia show signs of strong decomposition and maceration. Moreover, two larvae including mouthparts and legs are nearly completely preserved and visible in lateral view, legs partially with indication of decomposition.

The specimens were examined under a Leica M5 or MZ12.5 dissecting microscope (Leica, Wetzlar, Germany). Pictures were taken by a Leica stereomicroscope M 420 Apozoom equipped with the Canon EOS 600D using the EOS utility software and the Zerene Stacker programme. All illustrations were edited with Adobe Elements 15, using Wacom Intuos4 tablet.

Terminology: The wing venation terminology (Fig. 1) follows KUKALOVA-PECK & LAWRENCE (2004) using the venation abbreviations in text and figures: A – Analis; CuA – Cubitus Anterior; CuP – Cubitus Posterior; MA – Media Anterior; MP – Media Posterior; R – Radius; RA – Radius Anterior; RP – Radius Posterior and RP1, RP2, RP3, RP 4 or RP3+4 – subordinate branches of Radius Posterior; Sc – Subcosta. Following OSWALD (1993) the forewing crossveins are arranged in more or less aligned gradate series. These series are numerically designated 1 to 4 starting at the base of the wing: 1 – basal, 2 – inner, 3 – middle, 4 – outer crossvein gradate series.

The larval head and mouthparts terminology and abbreviations (Fig. 2) follow BEUTEL et al. (2010): ant – antenna; md – mandible, mxst – maxillary stylet; pl – palpus labialis; ro – rostrum.

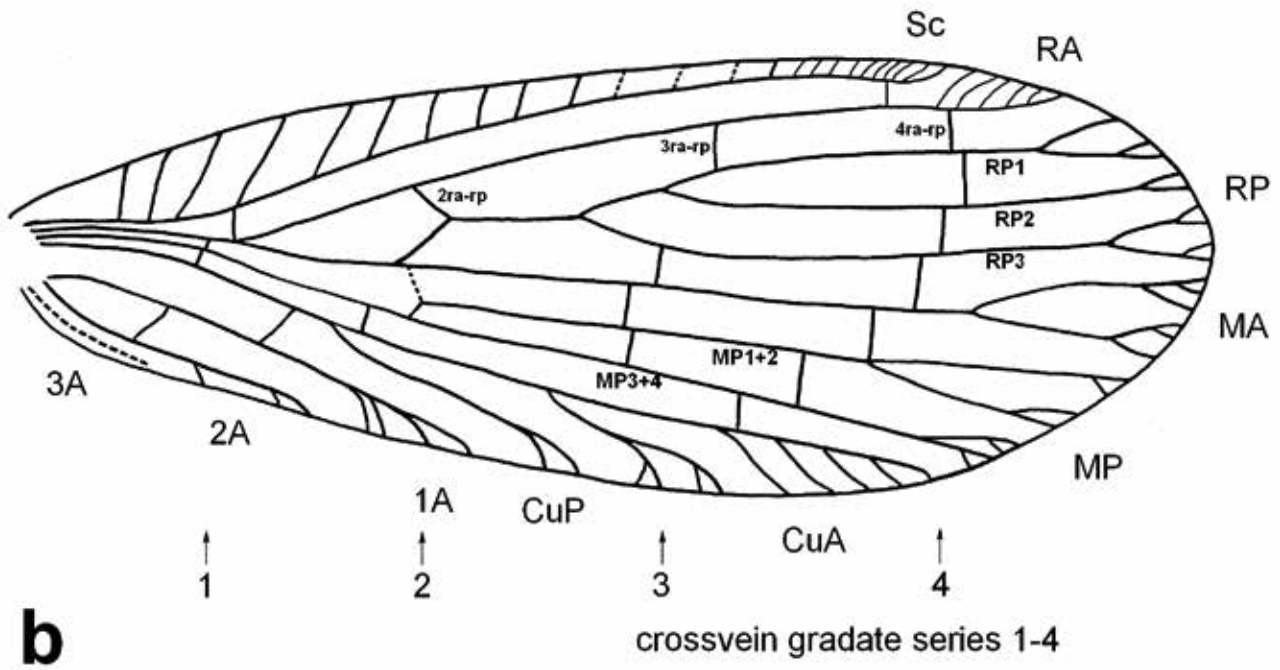
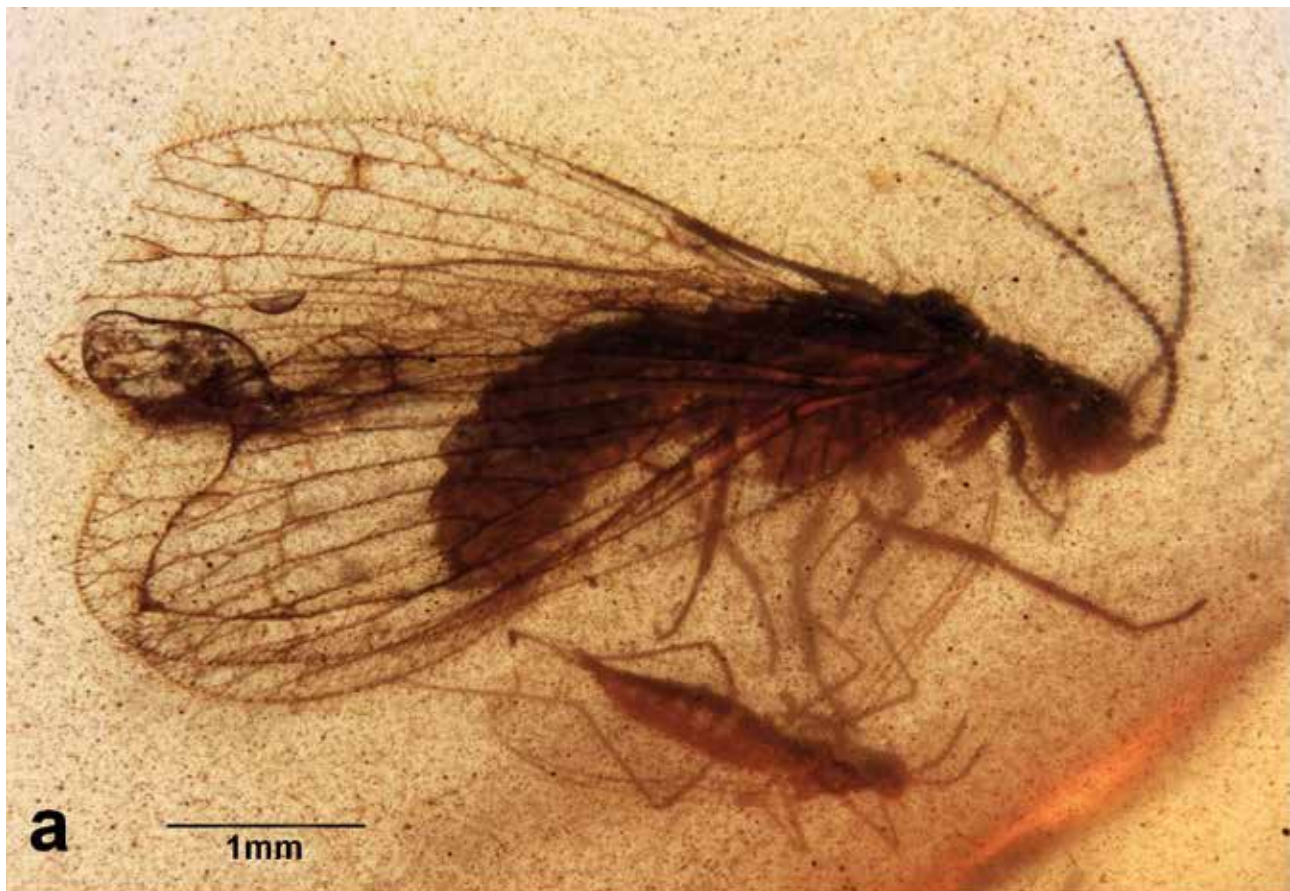


Fig. 1. *Cretarophalis patrickmuelleri* n. gen. et n. sp. in Cretaceous Burmese amber, holotype, SNMS BU-296 (ex coll. PATRICK MÜLLER). **a:** Photograph in lateral view, embedded with a midge. **b:** Drawing of right forewing venation.

3. Systematic palaeontology

Order Neuroptera LINNAEUS, 1758

Family Nevrothidae NAKAHARA, 1958

Genus *Cretarophalis* nov.

Type species: *Cretarophalis patrickmuelleri* n. sp., monotypic.

Etymology: The name *Cretarophalis* of new genera refers to “creta” and “rophalis”. “Creta” means the Cretaceous age and “rophalis” should remember the Eocene nevrothid genus *Rophalis*.

Diagnosis: See diagnosis of type species.

Cretarophalis patrickmuelleri n. sp.
Fig. 1a, b

Etymology: The species *patrickmuelleri* is named after PATRICK MÜLLER. His excellent collection of Burmese amber has facilitated the description of the first Cretaceous nevrothid species.

Holotype: Female embedded in Burmese amber, kept in the collection of the Staatliches Museum für Naturkunde Stuttgart, SMNS BU-296 (ex coll. PATRICK MÜLLER). Preserved in cloudy amber, forewings visible, hindwings partially covered by forewings. Head, antennae and legs present. Female genitalia strongly decomposed.

Diagnosis: Head bearing filiform antennae with slightly enlarged scapus, smaller pedicellus and 31 uniform cylindrical flagellomeres, instead of 25 flagellomeres (*Rophalis*) or of 35 or more flagellomeres in case of all other extinct genera. In forewings costal crossveins simple (like in *Rophalis*, *Electroneurothus*, *Palaeoneurothus*) and not partially branched (like in *Proberotha*, *Balticoneurothus*); Sc and RA running parallel to apical wing margin, only interconnected apically by a crossvein, typically of all nevrothid adults. RP pectinate, three-branched in the subordinate branches RP1, RP2, RP3; in forewing crossvein 3rp3+4 – rp2 absent (as in *Rophalis*). CuA with few small terminal branches.

Description: Small adult female, forewing length 4.5 mm, as small as *Rophalis relicta* from Eocene Baltic amber. Wings light brown, translucent, apical margin rounded. In fore- and hindwings rows of setae along with the wing veins; crossveins often slightly pigmented.

Head: Ocelli absent; antennae filiform, about half as long as forewings, consisting of enlarged scapus, smaller pedicellus, following 31 flagellomeres. Maxillary palps five-segmented, labial palps three-segmented, their terminal segments pointed.

Wings: In fore- and hindwings costal crossveins all simple, not partially branched. Sc and RA running parallel to each other distantly and connected distally by a short crossvein. The area between RA and RP interrupted by three crossveins: 2ra–rp, 3ra–rp and 4ra–rp. Crossvein 2ra–rp participating in the inner crossvein gradate series, crossvein 3ra–rp in the middle crossvein gradate series and crossvein 4ra–rp in the outer crossvein gradate series. RP pectinate, three-branched in the subordinate branches RP1, RP2, RP3. In forewing crossvein 3rp3+4

– rp2 absent. MA simple, apically with terminal forks. MP with a dichotomous branch in MP1+2 and MP3+4. The longitudinal veins always divided apically into small terminal branches at margin. CuA running straight to margin, apically in both forewings pectinately branched; in right wing bifurcated, in left wing trifurcated, always with small terminal branches. CuP with a bifurcate terminal fork. Anal veins A1, A2 and A3 running separately to anal margin; in right forewing A1 with four small terminal forks, A2 with three small terminal forks.

Genitalia: Female genitalia strongly macerated and decomposed, above all densely covered by cloudy amber; outlines of the tergites of 8th and 9th segments, the ectoproct and the gonocoxite of 9th segment are passably visible.

Larvae of Nevrothidae
Fig. 2a, b

Material: Larva in Cretaceous Burmese amber, embedded together with a cockroach (amber stored in coll. PATRICK MÜLLER); larva in Cretaceous Burmese amber (amber stored in coll. CARSTEN LAMMERSKÖTTER).

Description: Body elongate and slender, length 7–8 mm. Head including the mandibles about 1.2 mm in length. Prothorax length about 1.2 mm, proximal part 1/3 and distal part about 2/3 of the prothorax length. Head and prothorax dorsoventrally flattened, sclerotised and brown colored. Meso-, metathorax and abdomen more cylindrical, white coloured, “verlumpt”. All six legs present, with signs of decomposition and maceration. Head capsule ventrally with a long median gula, dorsally with frontoclypeus and a frontomedian triangular rostrum (ro), frontolaterally with a pair of typical filiform antennae (ant). Mouthparts with a pair of five-segmented palpus labialis (pl). Mandible and maxillary stylet forming a functional complex (md + mxst). The head is articulated at the thorax via the so-called “Rollengelenk” (ZWICK 1967).

4. Discussion

The new extinct species, *Cretarophalis patrickmuelleri* n. gen. et n. sp., is recorded from mid- Cretaceous Burmese amber in Southeast Asia. In the warm temperate region of Southeast Asia some extant nevrothid species are distributed and belong to the genera *Nipponeurothus* and *Sinoneurothus* (LIU et al. 2012, 2014). The extinct Cretaceous species is apparently not closely related to the extant Asian taxa. The forewing venations show clear differences by comparison: 1. Costal crossveins are unbranched in *Cretarophalis* but patially branched in both extant genera. 2. Crossvein 3rp3+4 – rp2 is absent in the fossil species but present in *Nipponeurothus* and *Sinoneurothus* and present in all other extant and extinct species, except for *Rophalis relicta*. 3. Cubitus anterior is five- to eight-branched in *Nipponeurothus* and *Sinoneurothus* but two- to three-branched in the Cretaceous species *Cretarophalis patrickmuelleri* n. gen. et sp.

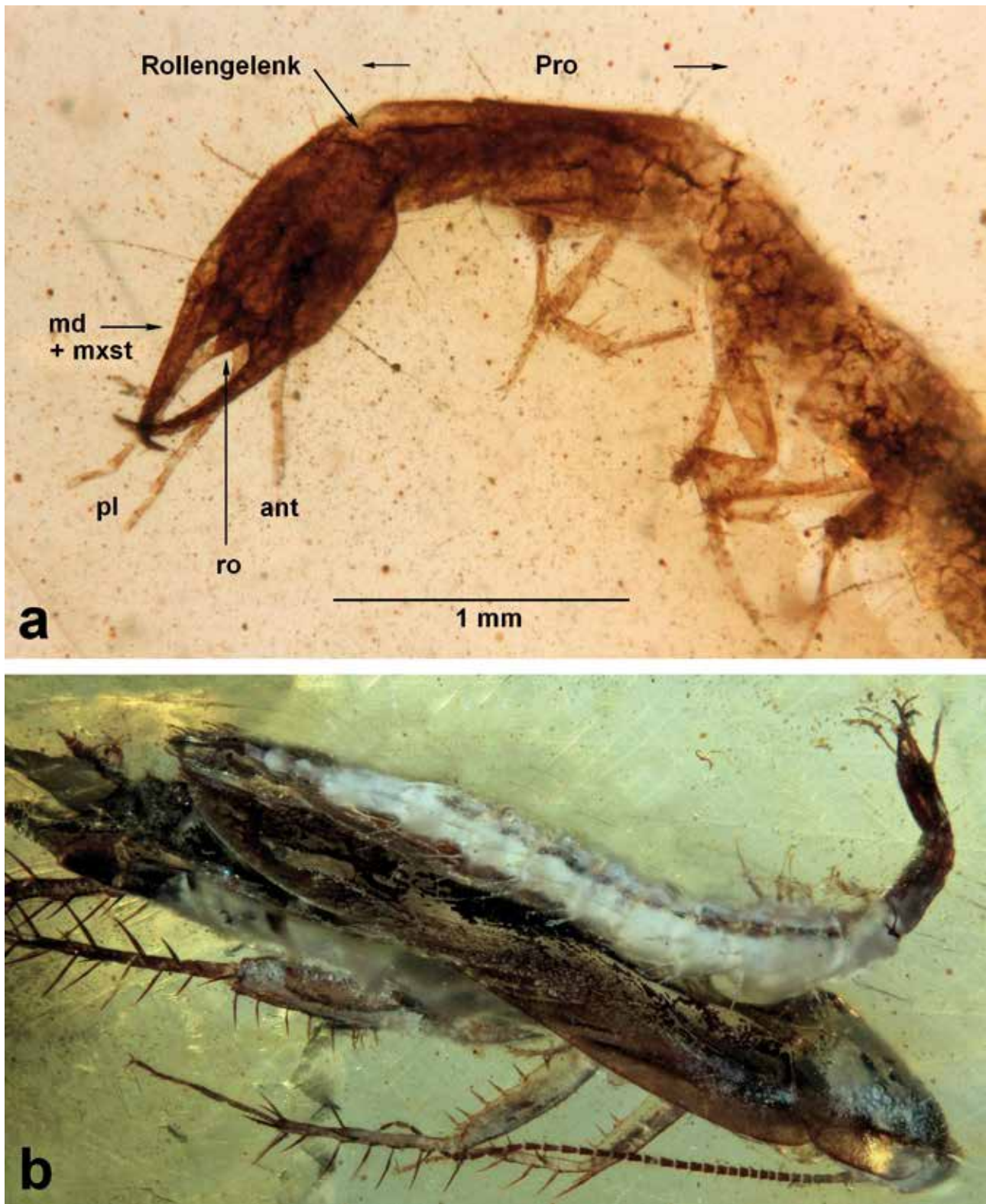


Fig. 2. Larvae of family Nevrothidae in Cretaceous Burmese amber. **a:** Head and thorax in lateral view (amber stored in coll. CARSTEN LAMMERSKÖTTER). **b:** Larva in lateral view, embedded with a cockroach (amber stored in coll. PATRICK MÜLLER).

5. References

- ASPÖCK, U. (2004): *Austroneurorthus horstaspoecki* nov. spec. – eine neue Art der Familie Nevrothidae aus Australien (Neuropterida: Neuroptera). – *Denisia*, **13**: 177–182.
- ASPÖCK, U. & ASPÖCK, H. (2008): Phylogenetic relevance of the genital sclerites of Neuropterida (Insecta: Holometabola). – *Systematic Entomology*, **33**: 97–129.
- BEUTEL, R., FRIEDRICH, F. & ASPÖCK, U. (2010): The larval head of Nevrothidae and the phylogeny of Neuroptera (Insecta). – *Zoological Journal of the Linnean Society*, **158**: 533–562.
- GRIMALDI D. A., ENGEL M. S. & NASCIBENE P. C. (2002): Fossiliferous Cretaceous amber from Myanmar (Burma): its rediscovery, biotic diversity, and paleontological significance. – *American Museum Novitates*, **3361**: 1–72.
- KUKALOVA-PECK, J. & LAWRENCE, J. F. (2004): Relationships among coleopteran suborders and major endoneopteran lineages: evidence from hind wing characters. – *European Journal of Entomology*, **101**: 95–144.
- LINNAEUS, C. (1758): *Systema naturae per regna tria naturae secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis*. Vol. 1, 10th Edition. – 824 pp.; Holmiae (Salvii).
- LIU, X., ASPÖCK, H. & ASPÖCK, U. (2012): *Sinoneurorthus yunnanicus* n. gen. et n. sp. – a spectacular new species and genus of Nevrothidae (Insecta, Neuroptera) from China, with phylogenetic and biogeographical implications. – *Aquatic Insects*, **34** (2): 131–141.
- LIU, X., ASPÖCK, H. & ASPÖCK, U. (2014): New species of the genus *Nipponeurorthus* NAKAHARA, 1958 (Neuroptera: Nevrothidae) from China. – *Zootaxa*, **3838** (2): 224–232.
- LIU, X., LU, X. & ZHANG, W. (2016): *Halteriomantispa grimaldii* gen. et sp. nov.: A new genus and species of the family Dipteromantispidae (Insecta: Neuroptera) from the mid-Cretaceous amber of Myanmar. – *Zoological Systematics*, **41** (2): 165–172, DOI: 10.1186/zs.201615.
- LU, X., ZHANG, W. & LIU, X. (2017): Discovery of the family Babinskaiidae (Insecta: Neuroptera) in mid-Cretaceous amber from Myanmar – *Cretaceous Research*, **71**: 14–23.
- MAKARKIN, V. N. (2016): The neuropteran assemblage (Insecta) of the mid-Cretaceous Burmese amber confirms transitional character of its biota. – In: DZYUBA, O. S., PESTCHEVITSKAYA, E. B. & SHURYGIN, B. N. (Eds.): Short papers for the Fourth International Symposium of International Geoscience Programme IGCP, Novosibirsk, Russia, Project **608**: 27–29.
- MAKARKIN, V. N. & PERKOVSKY, E. E. (2009): *Rophalis relict* HAGEN (Neuroptera, Nevrothidae) in Late Eocene Rovno amber, with a discussion of the taxonomic status of the genus. – *Denisia*, **26**: 137–144.
- MONSERRAT, V. J. & GAVIRA, O. (2014): A new European species of *Nevrothus* in the Iberian Peninsula (Insecta, Neuropterida) – *Zootaxa*, **3796**: 349–360.
- NAKAHARA, W. (1958): The Neurorthinae, a new subfamily of the Sisyridae (Neuroptera). – *Mushi*, **32**: 19–31.
- OSWALD, J. D. (1993): Revision and cladistic analysis of the world genera of the family Hemerobiidae (Insecta: Neuroptera). – *Journal of the New York Entomological Society*, **101**: 143–299.
- ROSS, A. (2015): Insects in Burmese amber. – *Entomologentagung Frankfurt/M. Programm und Abstracts*: 72.
- SHI, G., GRIMALDI, D. A., HARLOW, G. E., WANG, J., WANG, J., YANG, M., LEI, W., LI, Q. & LI, X. (2012): Age constraint on Burmese amber based on U-Pb dating of zircons. – *Cretaceous Research*, **37**: 155–163.
- WICHARD, W. (2016): Overview and descriptions of Nevrothidae in Baltic amber (Insecta, Neuroptera) – *Palaeodiversity* **9**: 95–111; DOI: 10.18476/pale.v9.a7.
- XIA, F.Y., YANG, G.D., ZHANG, Q.Q., SHI, G.L. & WANG, B. (2015): *Amber: Lives through time and space*. – 196 pp.; Beijing (Science Press). [In Chinese]
- ZWICK, P. (1967): Beschreibung der aquatischen Larve von *Neurorthus fallax* (RAMBUR) und Errichtung der neuen Planipennierfamilie Neurorthidae fam. nov. – *Gewässer und Abwässer*, **44/45**: 65–86.

Address of the author:

Prof. Dr. WILFRIED WICHARD, Institut für Biologie und ihre Didaktik, Universität zu Köln, Gronewaldstr. 2, 50931 Köln, Germany.
E-mail: wichard@uni-koeln.de

Manuscript received: 11 January 2017, revised version accepted: 23 February 2017.