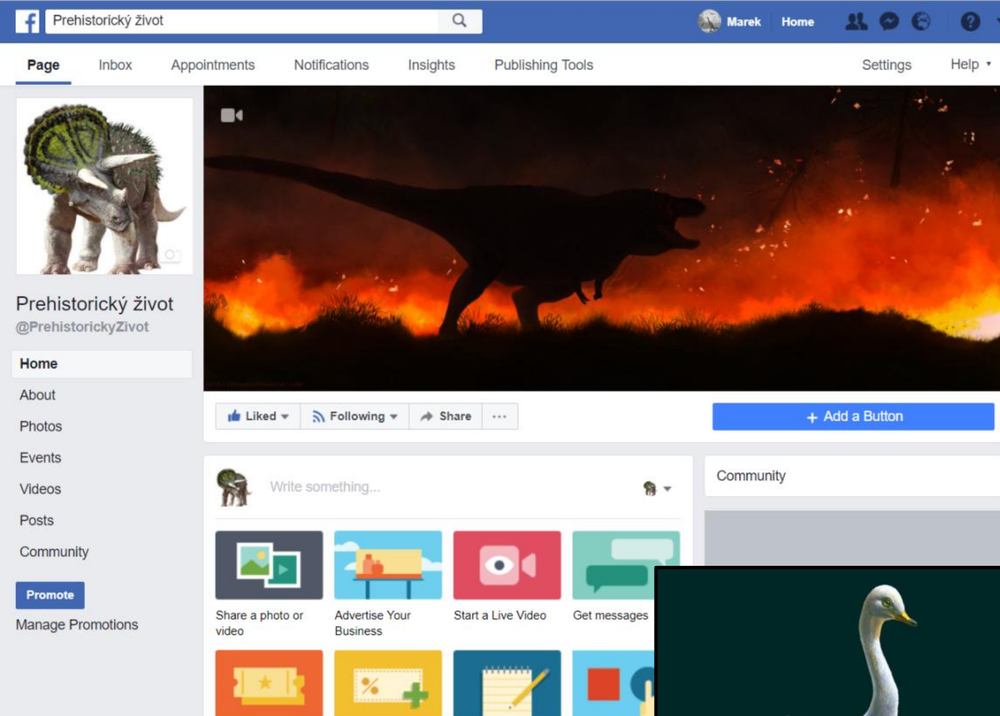
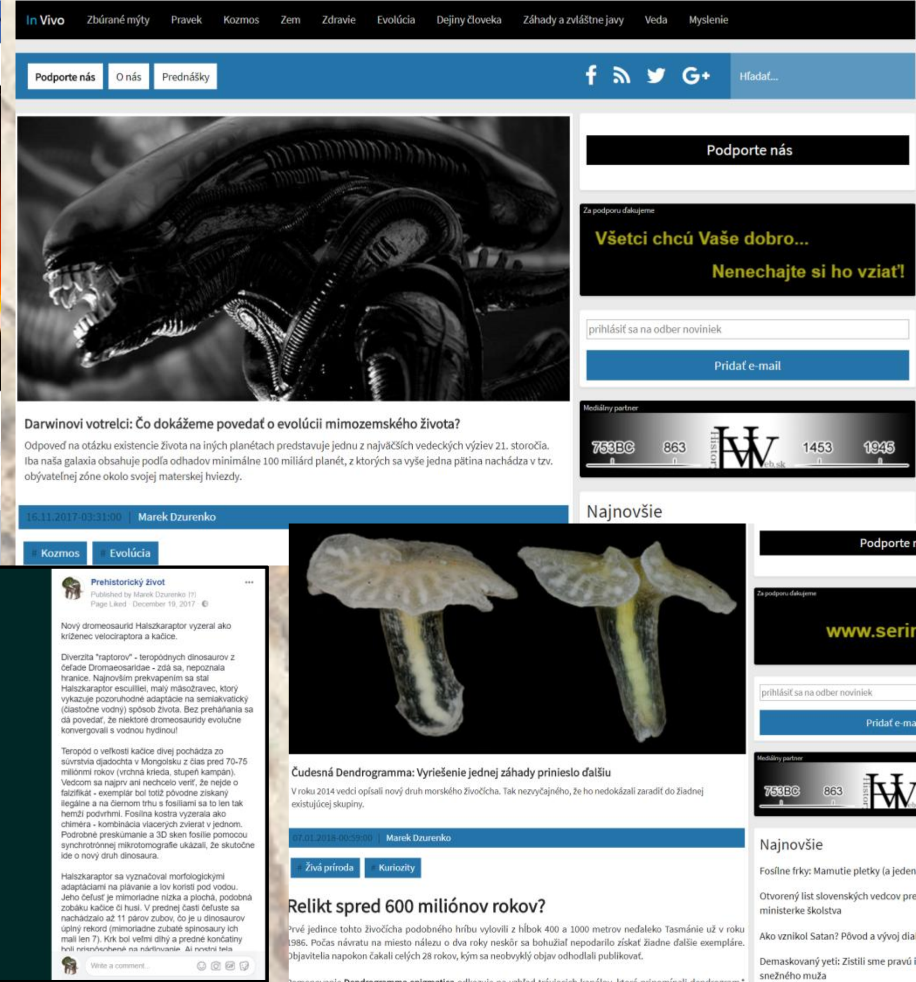
Kalligrammatidae

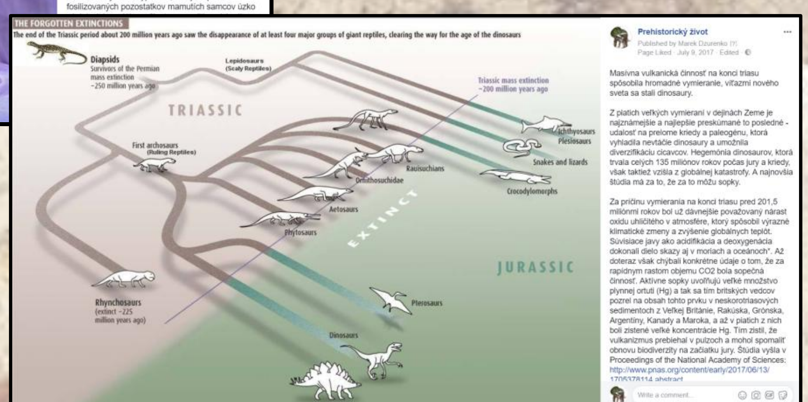
„Motýle“ veku dinosaurov

X. lepidopterologické kolokvium, 25. január 2018, Brno

Marek Dzurenko ● Ústav ekológie lesa SAV ● marek.dzurenko@gmail.com







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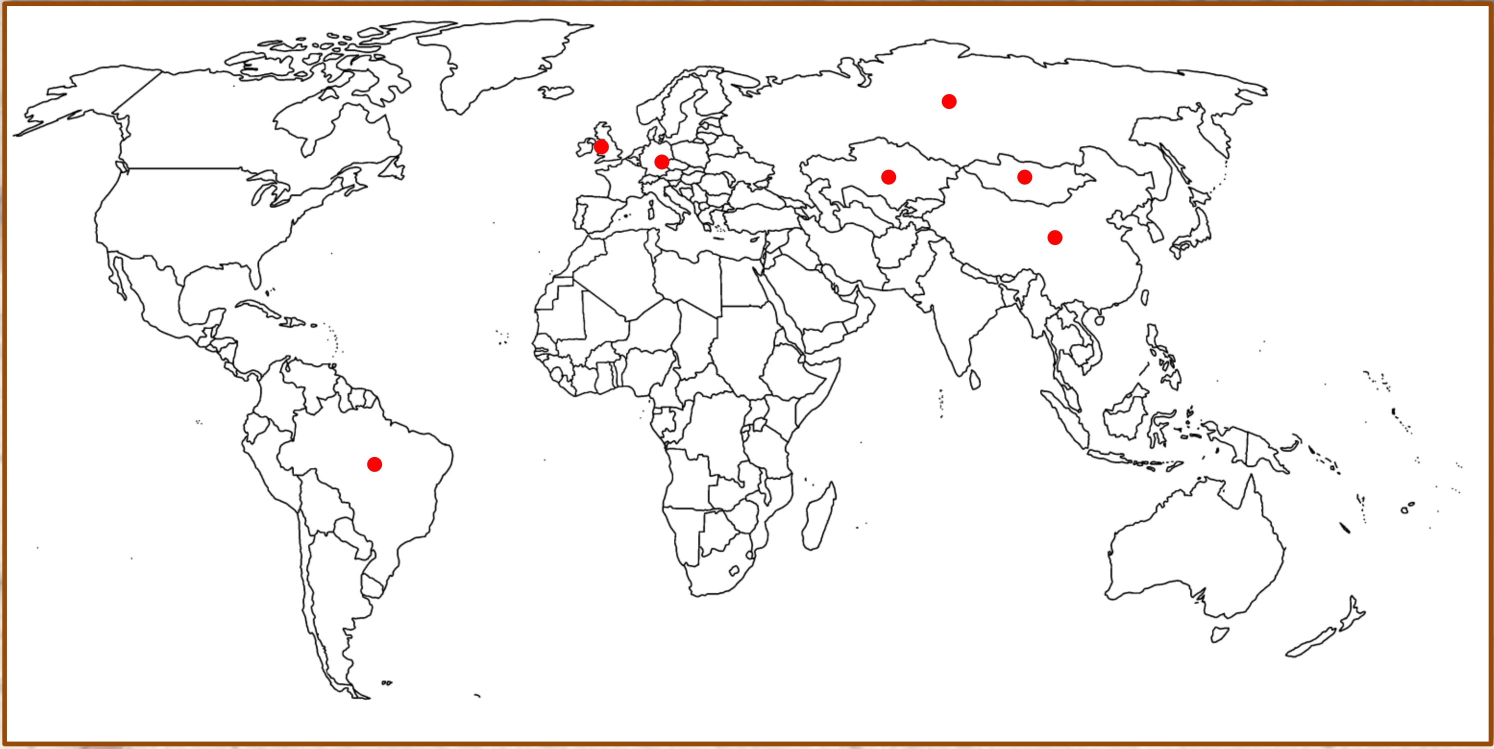
Najviac druhov z Číny (31) a Kazachstanu (8). Známe sú aj z Ruska (2), Mongolska (1), Nemecka (4), Veľkej Británie (1) a Brazílie (2).

Najrozšírenejšie rody: *Kalligramma* a *Kalligrammula*



Taxonómia a diverzita

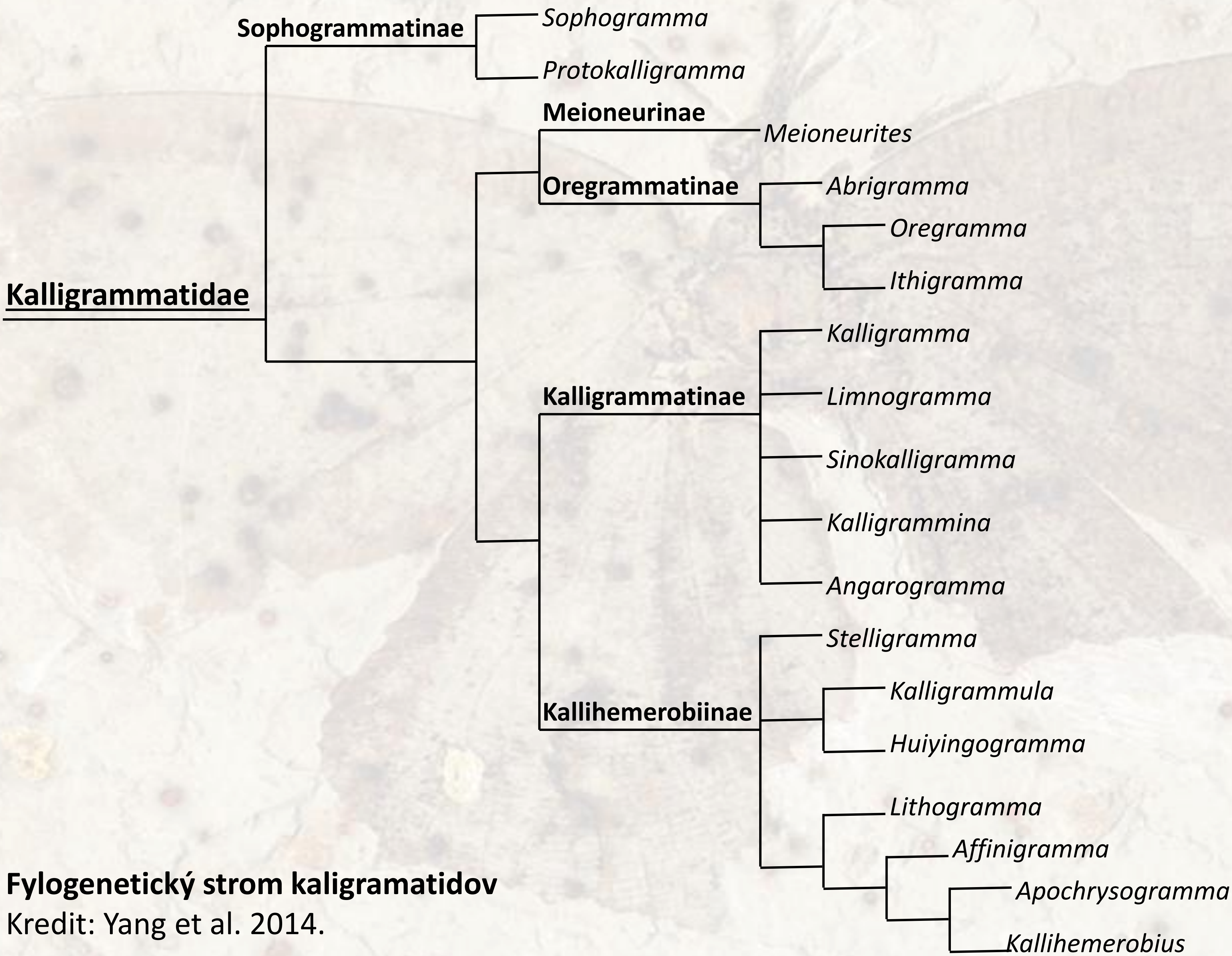
Neuroptera: †**Kalligrammatidae** Handlirsch, 1906

20 rodov, 51 druhov.

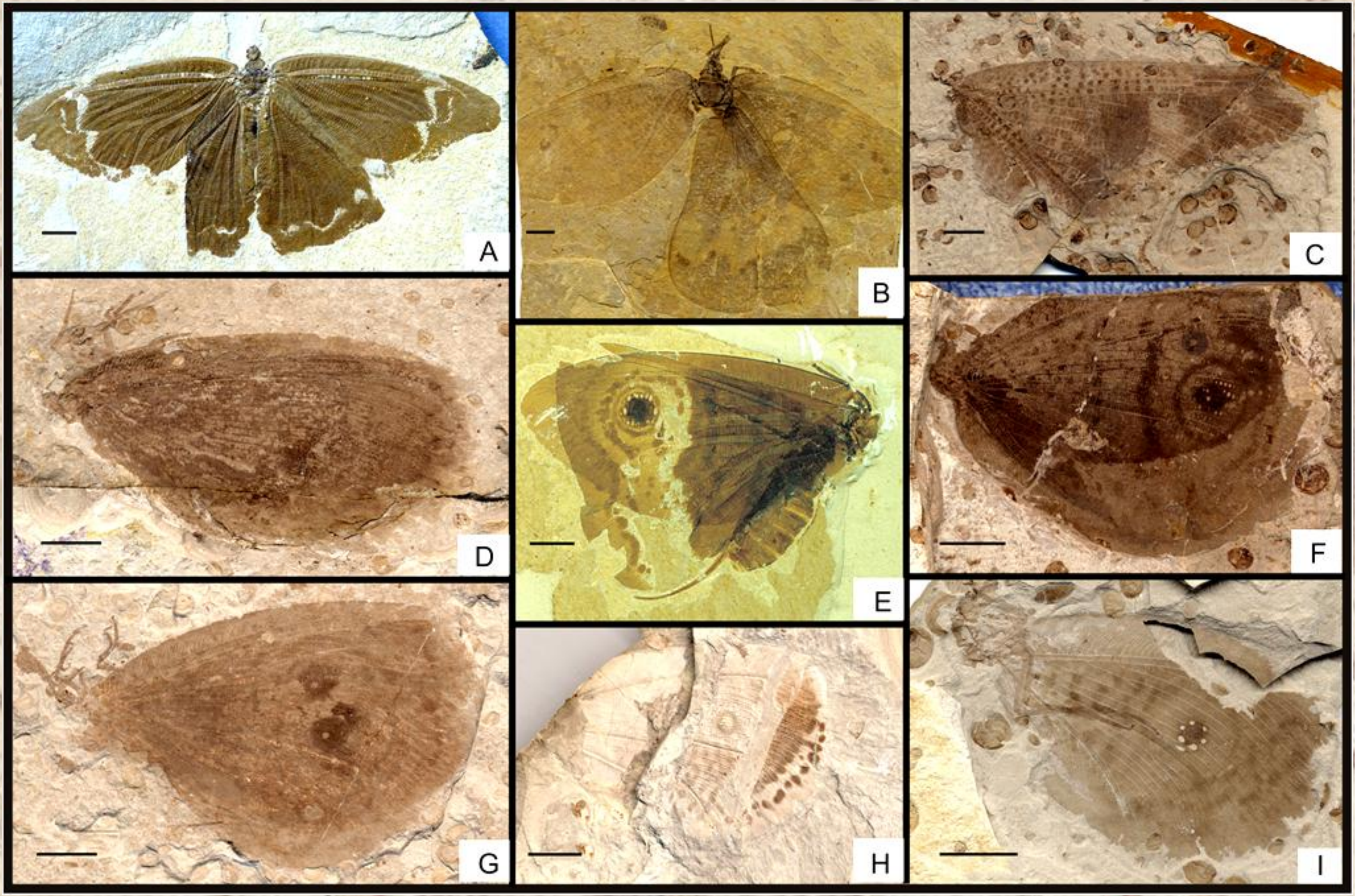
Anton Handlirsch
1865 - 1935

Kalligrammatinae *Angarogramma* *Kalligramma* *Kalligrammina* *Limnogramma* *Sinokalligramma*	**Kallihemerobiinae** *Affinigramma* *Apochrysogramma* *Huiyingogramma* *Kalligrammula* *Kallihemerobius* *Lithogramma* *Stelligramma*
Meioneurinae *Meioneurites*	**Oregrammatinae** *Abrigramma* *Ithigramma* *Oregramma*
Sophogrammatinae *Protokalligramma* *Sophogramma*	***incertae sedis*** *Makarkinia* *Palparites*

Kalligramma haeckeli



Fylogenetický strom kaligramatidov
Kredit: Yang et al. 2014.



A: *Sophogramma lii*, B: *Oregramma aureolosa*, C: *Stelligramma allochroma*, D: *Affinigramma myrioneura*,
E: *Oregramma illecebrosa*, F: *Kalligramma circularia*, G: *Affinigramma myrioneura*, H: *Apochrysogramma rotundum*,
I: *Kalligramma brachyrhyncha*

Anatómia a morfológia

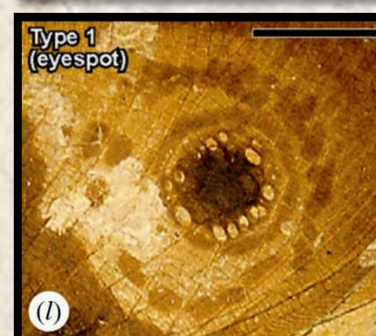
Telo dlhé >50 mm, dĺžka krídel až 160 mm (*Makarkinia*). Nitkovité tykadlá. Niektoré mali dlhé kladielko (*Oregramma*).

Nápadné konvergencie s motýľmi (okrem Sophogrammatinae):

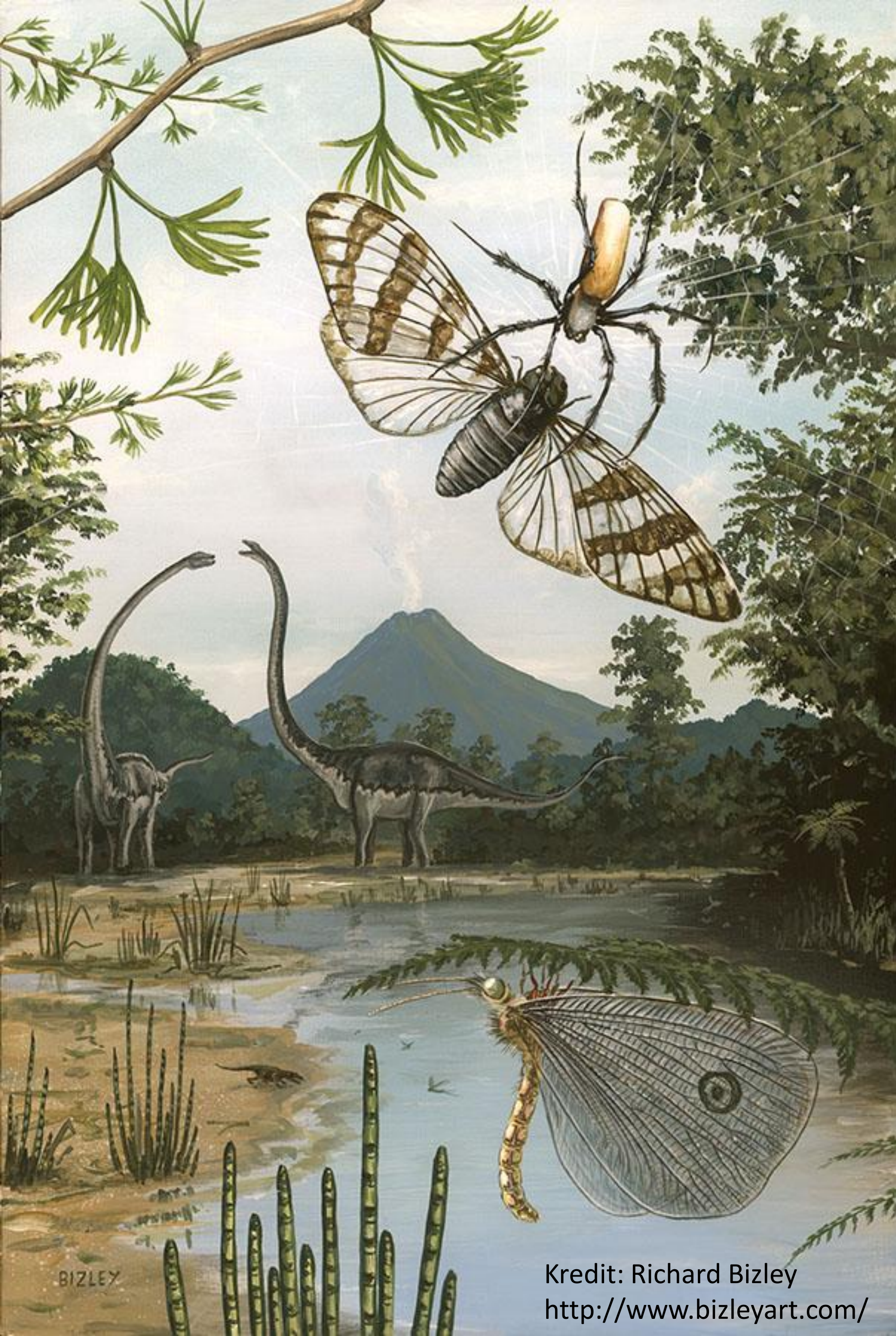
1. Široké krídla so šupinami.
2. Vzory a očné škvrny na krídlach.
3. Premena ústnych orgánov z hryzavých na cicavé, vznik trubicovitého proboscisu.
4. Savé pumpy v prednej časti hlavy.

Makarkinia kerneri, krídlo

Kallihemerobiinae gen. et sp. indet. Nákres cuciaka pri pohľade zhora (žltým). →



Oregramma illecebrosa
Detail krídlovej škvrny



Kredit: Richard Bizley
http://www.bizleyart.com/

Paleoekológia a paleobiológia
Trópy až subtrópy. Termofilné.

Škvrny na krídlach – obranný mechanizmus? (Aves, Pterosauria)

Denná aktivita, slabé letové schopnosti.

Potrava: Imága peľ nahosemenných rastlín (Bennettitales, Cycadales, Caytoniales). Larvy pletivá semien.

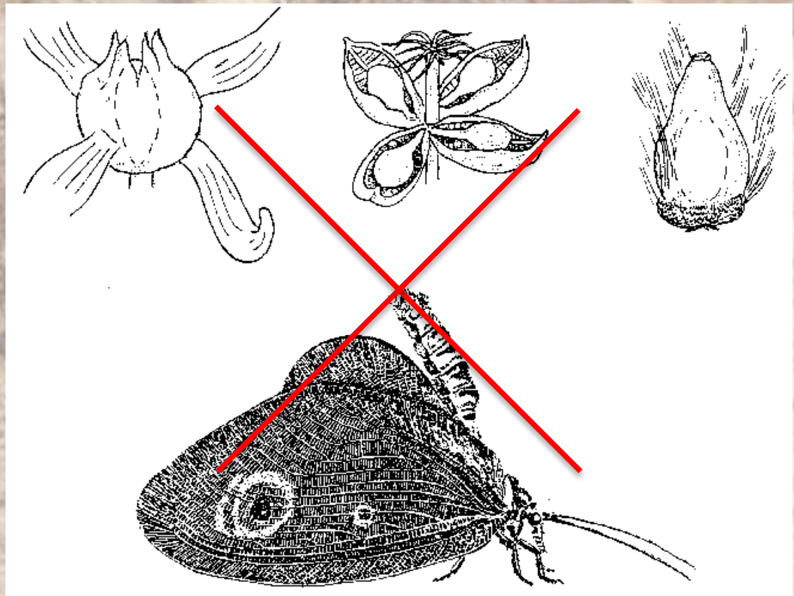
Anurognathus vs Kalligramma, Kredit: Dmitry Bogdanov

Extinkcia

Zmena ekologických vzťahov medzi rastlinami a hmyzom v dôsledku rozvoja krytosemenných rastlín:

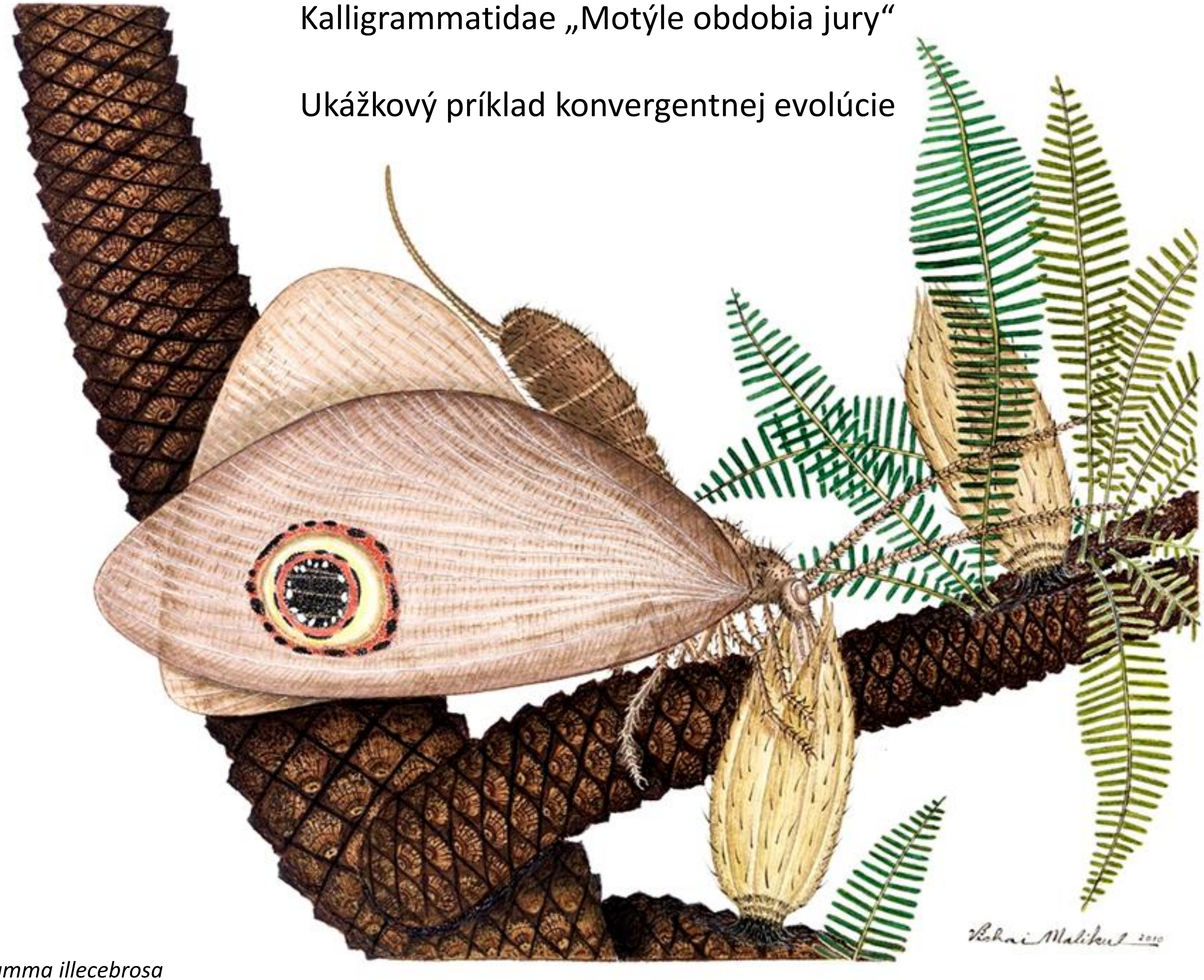
1. Zánik asociácií hmyzích druhov s nahosemennými rastlinami.
2. Laterálny transfer týchto asociácií z nahosemenných na krytosemenné rastliny.
3. Vznik nových asociácií s krytosemennými rastlinami.

O 50 miliónov rokov (paleogén) neskôr – objavenie sa denných motýľov (Rhopalocera).



Kalligrammatidae „Motýle obdobia jury“

Ukážkový príklad konvergentnej evolúcie

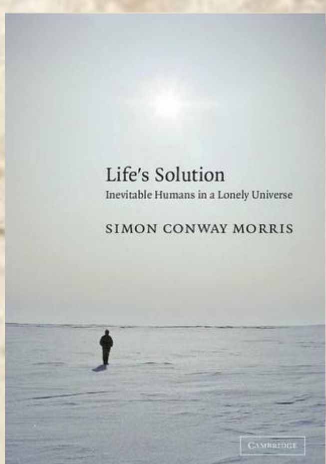


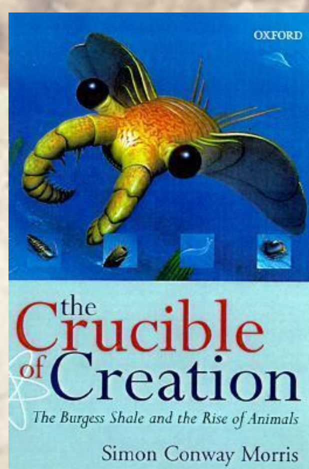
Oregramma illecebrosa
Autor: Vichai Malikul

Simon Conway Morris
1951 -

v s

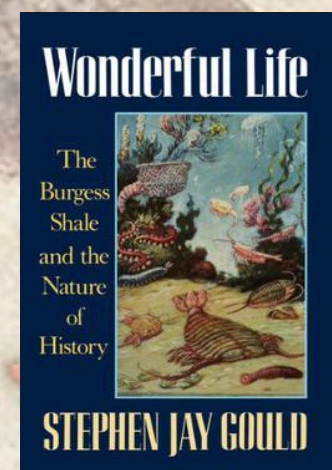
Stephen Jay Gould
1942 - 2002





Life's Solution, 2003
The Crucible of Creation, 1998

Je vznik konvergentných foriem nevyhnutný? Alebo je súčasná biota prevažne výsledkom nepredvídateľnej náhodnosti?

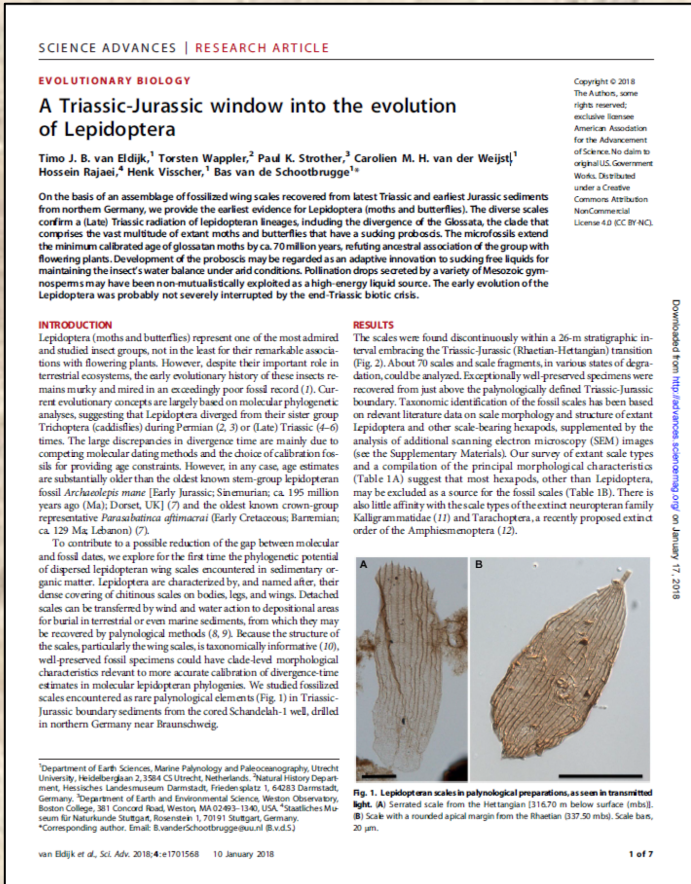


Wonderful Life, 1989

Najstaršie Lepidoptera
(bazálne Glossata) z prelomu triasu/jury.
Posúvajú vznik glosátnych lepidopter
o 70 miliónov rokov.

Vznik Lepidoptera nesúvisel s rozvojom
krytosemenných rastlín.
Peľové kvapôčky nahosemenných rastlín
ako zdroj v arídnych podmienkach.

Formy podobné dnešným potočníkovcom
(Micropterigidae).



EVOLUTIONARY BIOLOGY

A Triassic-Jurassic window into the evolution of Lepidoptera

Timo J. B. van Eldijk,[1] Torsten Wappler,[2] Paul K. Strother,[3] Carolien M. H. van der Weijst,[1] Hossein Rajaei,[4] Henk Visscher,[1] Bas van de Schootbrugge[1]*

On the basis of an assemblage of fossilized wing scales recovered from latest Triassic and earliest Jurassic sediments from northern Germany, we provide the earliest evidence for Lepidoptera (moths and butterflies). The diverse scales confirm a (Late) Triassic radiation of lepidopteran lineages, including the divergence of the Glossata, the clade that comprises the vast multitude of extant moths and butterflies that have a sucking proboscis. The microfossils extend the minimum calibrated age of glossatan moths by ca. 70 million years, refuting ancestral association of the group with flowering plants. Development of the proboscis may be regarded as an adaptive innovation to sucking free liquids for maintaining the insect's water balance under arid conditions. Pollination drops secreted by a variety of Mesozoic gymnosperms may have been non-mutualistically exploited as a high-energy liquid source. The early evolution of the Lepidoptera was probably not severely interrupted by the end-Triassic biotic crisis.

INTRODUCTION

Lepidoptera (moths and butterflies) represent one of the most admired and studied insect groups, not in the least for their remarkable associations with flowering plants. However, despite their important role in terrestrial ecosystems, the early evolutionary history of these insects remains murky and mired in an exceedingly poor fossil record (*1*). Current evolutionary concepts are largely based on molecular phylogenetic analyses, suggesting that Lepidoptera diverged from their sister group Trichoptera (caddisflies) during Permian (*2*, *3*) or (Late) Triassic (*4*–*6*) times. The large discrepancies in divergence time are mainly due to competing molecular dating methods and the choice of calibration fossils for providing age constraints. However, in any case, age estimates are substantially older than the oldest known stem-group lepidopteran fossil *Archaeolepis mane* [Early Jurassic; Sinemurian; ca. 195 million years ago (Ma); Dorset, UK] (*7*) and the oldest known crown-group representative *Parasabatinca aftimacrai* (Early Cretaceous; Barremian; ca. 129 Ma; Lebanon) (*7*).

To contribute to a possible reduction of the gap between molecular and fossil dates, we explore for the first time the phylogenetic potential of dispersed lepidopteran wing scales encountered in sedimentary organic matter. Lepidoptera are characterized by, and named after, their dense covering of chitinous scales on bodies, legs, and wings. Detached scales can be transferred by wind and water action to depositional areas for burial in terrestrial or even marine sediments, from which they may be recovered by palynological methods (*8*, *9*). Because the structure of the scales, particularly the wing scales, is taxonomically informative (*10*), well-preserved fossil specimens could have clade-level morphological characteristics relevant to more accurate calibration of divergence-time estimates in molecular lepidopteran phylogenies. We studied fossilized scales encountered as rare palynological elements (Fig. 1) in Triassic-Jurassic boundary sediments from the cored Schandelah-1 well, drilled in northern Germany near Braunschweig.

RESULTS

The scales were found discontinuously within a 26-m stratigraphic interval embracing the Triassic-Jurassic (Rhaetian-Hettangian) transition (Fig. 2). About 70 scales and scale fragments, in various states of degradation, could be analyzed. Exceptionally well-preserved specimens were recovered from just above the palynologically defined Triassic-Jurassic boundary. Taxonomic identification of the fossil scales has been based on relevant literature data on scale morphology and structure of extant Lepidoptera and other scale-bearing hexapods, supplemented by the analysis of additional scanning electron microscopy (SEM) images (see the Supplementary Materials). Our survey of extant scale types and a compilation of the principal morphological characteristics (Table 1A) suggest that most hexapods, other than Lepidoptera, may be excluded as a source for the fossil scales (Table 1B). There is also little affinity with the scale types of the extinct neuropteran family Kalligrammatidae (*11*) and Tarachoptera, a recently proposed extinct order of the Amphiesmenoptera (*12*).

A B

Fig. 1. Lepidopteran scales in palynological preparations, as seen in transmitted light. (**A**) Serrated scale from the Hettangian [316.70 m below surface (mbs)]. (**B**) Scale with a rounded apical margin from the Rhaetian (337.50 mbs). Scale bars, 20 μm.

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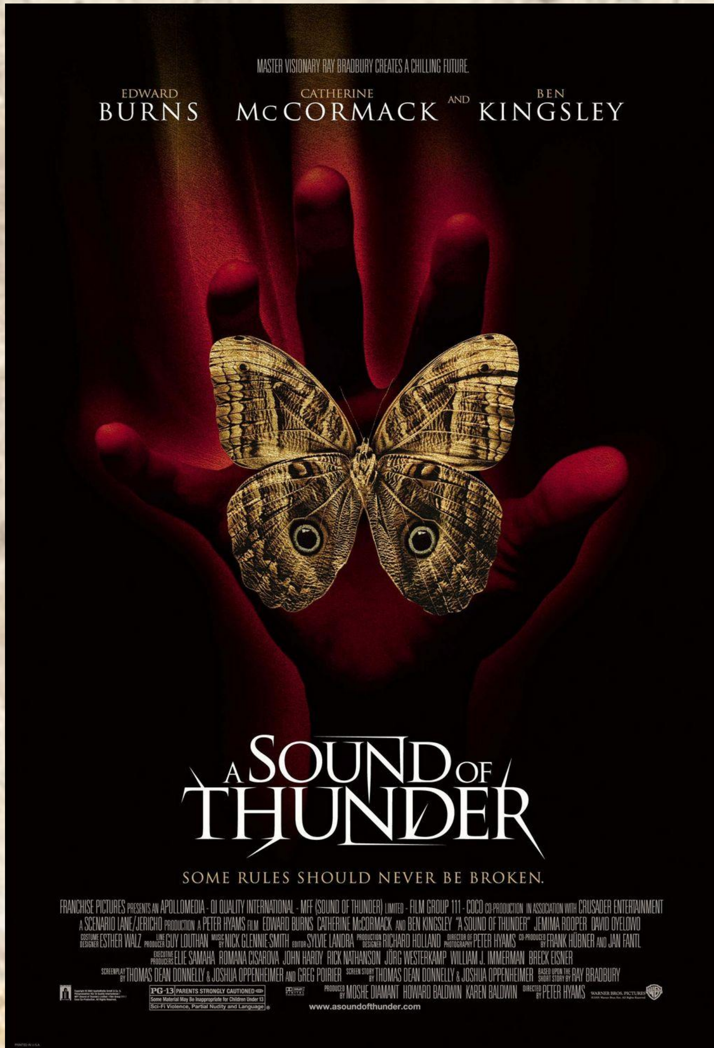
Eldijk TJBvan et al. 2018.
Sci. Adv. 4:e1701568



Ray D. Bradbury: „A Sound of Thunder“, 1952
SK: Hlas hromu
CZ: Burácení hromu

Zdroje:

Bechly, G., Makarkin, V. N. (2016). **"A new gigantic lacewing species (Insecta: Neuroptera) from the Lower Cretaceous of Brazil confirms the occurrence of Kalligrammatidae in the Americas"**. *Cretaceous Research. 58: 135-140.*

Labandeira, C. C. (2010). **"The pollination of Mid Mesozoic seed plants and the early history of long-proboscid insects".** *Annals of the Missouri Botanical Garden*. 97 (4): 469–513.

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https://blogs.scientificamerican.com/artful-amoeba/butterflies-in-the-time-of-dinosaurs-with-nary-a-flower-in-sight/

Ďakujem za pozornosť.