XIII International Symposium of
NEUROPTEROLOGY

17–22 **June** 2018 ♦ Laufen / GERMANY

Programme & Abstracts

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13th International Symposium of Neuropterology

17th to 21st June 2018,
Laufen/Salzach, Bavaria, Germany

Hosted by the

Bavarian Academy for Nature Conservation and Landscape Management (ANL)

Local organizers and hosts:

Marianne Krause & Christian Stettmer

Organizing committee:

Michael Ohl, Axel Gruppe, Veronika Hierlmeier, Lukas Kirschey & Florian Weihrauch

Imprint

Programme & Abstracts, XIII International Symposium of Neuropterology,
17–21 June 2018, Laufen, Germany

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Welcome to Neuropterology 2018!

Dear participants,
We warmly welcome you to the 13^{th} International Symposium of Neuropterology in Laufen on River Salzach. The symposium was initiated in 1980 and is organized every three years. After the second symposium took place in Hamburg in 1984, this is the second time that it is being held in Germany. More than 50 neuropterists from 17 countries from all over the world have been registered and will present and discuss their research. The symposium is accompanied by a one-day excursion for all participants and a four-day post-symposium excursion for registered participants, giving us the opportunity to explore the beautiful Bavarian landscape and the diversity of Neuropterida in southern Germany. The diverse topics of the symposium organized in eight thematic sessions reflect the interdisciplinary and diverse nature of the conference. The wide range of perspectives on Neuropterida, from microstructures to taxonomy and from development to faunistics, offers the chance to establish crosslinks between disciplines. We hope that this will encourage fruitful discussions and help to foster new research ideas and alliances.

We hope you will enjoy the symposium!

The Organizing Committee
Michael Ohl, President of the International Association of Neuropterology
Axel Gruppe
Veronika Hierlmeier
Lukas Kirschey
Florian Weihrauch

Neuropterology 2018: General information

Host

Bayerische Akademie für Naturschutz und Landschaftspflege (ANL)
Seethalerstraße 6
83410 Laufen/Salzach
Germany
Phone: +49 8682 8963–0

Symposium venue

Seminar- und Kongresshotel Kapuzinerhof
Schlossplatz 4
83410 Laufen/Salzach
Germany
Phone: +49 8682 954–0

Congress office

in the Aula of the Kapuzinerhof, in front of the lecture hall:
Sunday 17 June 2018, 15:00–19:00
Monday 18 June 2018, 08:30–09:00
Tuesday 19 June 2018, 08:30–09:00
Wednesday 20 June 2018, 08:30–09:00
Thursday 21 June 2018, 08:30–09:00
and upon request during all breaks

IAN business meeting

will take place in the Kapuzinerhof in the lecture hall on Wednesday 20 June 2018, 16:30–18:00.

Neuropterology 2018: Agenda

Sunday, 17th June 2018

15:00	Congress office and registration
17:00	**Ice-breaker**
18:00	**Opening keynote lecture** **Chair: Michael Ohl** On wings of lace: Diversity and evolution of Neuropterida **Michael S. Engel**
19:00	Dinner

Monday, 18th June 2018

08:30	Congress office and registration
09:00	Opening and welcome words
09:30	**Session 1a. Phylogeny** **Chair: Ulrike Aspöck**
09:30	**Keynote lecture** New insights into the phylogeny and evolution of Megaloptera **Xingyue Liu**
10:30	**Coffee break**
11:00	**Session 1b. Phylogeny** **Chair: Ulrike Aspöck/Michael Ohl**
11:00	Phylogeny of Chrysopidae with an emphasis on morphological evolution **Laura C.V. Breitkreuz**, Michael S. Engel, Shaun L. Winterton & Ivonne J. Garzon-Orduna
11:30	Note on the immature stage and female morphology of *Osmylus bipapillatus*, with reference to the systematic significance (Neuroptera, Osmylidae) **Han Xu**, Yongjie Wang & Zhiqi Liu
12:00	On the study of Korean Coniopteryginae (Neuroptera: Coniopterygidae): Molecular trees conflict between 16S and COI **Kim Seulki** & Cho Soowon
12:30	**Lunch**

14:00	**Session 2. Fossils** **Chair: Michael S. Engel**
14:00	Geometric morphometrics and the evolution of wing patterns in fossil Neuroptera **James E. Jepson**, Maria E. McNamara, Dong Ren, Chaofan Shi & Norman MacLeod
14:30	The Neuropterida from the mid-Cretaceous of Myanmar **Xiumei Lu** & Xingyue Liu
15:00	New fossil Raphidioptera (Insecta: Neuropterida) in the Mesozoic of northeastern China **Yanan Lyu**
15:30	Mesozoic Chrysopidae: a review of current knowledge **Alexander Khramov**
16:00	**Coffee break**
16:30	**Session 3. Neuropterology and beyond** **Chair: Xingyue Liu**
16:30	»Catálogo Taxônomico da Fauna do Brasil«: the technology contributing against taxonomic impediment – Neuroptera example **Caleb Califre Martins** & Renato Jose Pires Machado
17:00	Setting up a Neuropterology research lab: Synergistic experiences in undergraduate mentorship **Joshua R. Jones**
17:30	Lacewings and Citizen science in Italy: a young but very promising relationship **Agostino Letardi**
19:00	**Dinner**

Tuesday, 19th June 2018

08:30	Congress office
09:00	**Session 4. Morphology** **Chair: John Oswald**
09:00	**Keynote lecture** Towards a homologization of the male genital sclerites of Coniopterygidae (Neuroptera) – a tightrope dance **Ulrike Aspöck**
10:00	Small, but oh my! Effects of miniaturization on the head anatomy in Coniopterygidae **Susanne Randolf**, Dominique Zimmermann & Ulrike Aspöck
10:30	**Coffee break**
11:00	**Session 5. Development, chemical ecology and micro-structures** **Chair: Susanne Randolf**
11:00	Metathetely and its implications for the distribution of Raphidioptera **Horst Aspöck**, Viktoria Abbt, Ulrike Aspöck & Axel Gruppe
11:30	Chemical ecology of Chrysopidae: perspectives of synthetic attractants **Sandor Koczor**, Ferenc Szentkirályi & Miklós Tóth
11:00	The dimensions of the dust of dustywings (Neuroptera, Coniopterygidae) Sarah Bastyans, Felix Fenzl, Michael Gebhardt & **Axel Gruppe**
12:30	**Lunch**
13:30	**Mid-congress tour** Coach journey, incl. brown-bagged dinner, collecting and light-trapping. First stop: Weitsee-Lödensee (until 18:00), second stop: Schönramer Filz (after 18:00)

Wednesday, 20th June 2018

08:30	Congress office
09:00	**Session 6a. A focus on Myrmeleontidae** **Chair: Dušan Devetak**
09:00	**Keynote lecture** Into the pit: evolution, diversity and biology of the larvae of Myrmeleontiformia **Davide Badano**
10:00	In search of *Myrmeleon bore*: Bavaria's rarest Neuropteran? **Florian Weihrauch**
10:30	**Coffee break**
11:00	**Session 6b. A focus on Myrmeleontidae** **Chair: Bruno Michel**
11:00	Predatory behavior of two antlion species under different conditions **Vesna Klokočovnik** & Dušan Devetak
11:30	Behavioral, bioenergetic and morphological characteristics of ant lion larvae with obligatory (sit-and-wait) and facultative pit building strategies, respectively, under natural and laboratory conditions (Neuroptera, Myrmeleontidae) **Cristiano Pires**
12:00	The genus *Nosa* Navás, 1911 (Neuroptera, Myrmeleontidae, Palparinae) **André Prost**
12:30	Owlflies are derived antlions: anchored phylogenomics and a revised phylogenetic classification of the family Myrmeleontidae (Insecta: Neuroptera) Renato J.P. Machado, Jessica Gillung, Shaun L. Winterton, Ivonne J. Garzon-Orduna, Alan Lemmon, Emily Lemmon & **John Oswald**
13:00	**Lunch**
14:00	**Poster session** (including a brief oral presentation to each poster of max. 3 minutes) **Chair: Florian Weihrauch**
16:00	**Coffee break**
16:30	**IAN business meeting**
19:00	**Dinner**

Thursday, 21st June 2018

08:30	Congress office
09:00	**Session 7a. Faunistics and biogeography** **Chair: Horst Aspöck**
09:00	**Keynote lecture** Neuropterida from South America: large diversity, largely unknown **Caleb Califre Martins**
10:00	Fantastic lacewings and where to find them **Agostino Letardi** & Roberto A. Pantaleoni
10:30	**Coffee break**
11:00	**Session 7b. Faunistics and biogeography** **Chair: André Prost**
11:00	The impact of forest fire and wind-throw on Neuroptera, Raphidioptera and Mecoptera **Peter Duelli**, Beat Wermelinger, Marco Moretti & Martin K. Obrist
11:30	Lacewings (Neuropterida: Neuroptera, Raphidioptera) in three National Parks in the Balkan Peninsula: Results of short collection trips **Dušan Devetak**, Predrag Jakšić, Vesna Klokočovnik, Tina Klenovšek, Jan Podlesnik, Franc Janžekovič & Hubert Rausch
12:00	Neuroptera of the region of Missour (Morocco) **Michel Bruno** & Alexandre François
12:30	Neuroptera in two protected sand dune areas in the southern rim of the Pannonian Plain **Dušan Devetak**, Predrag Jakšić, Tina Klenovšek, Jan Podlesnik, Franc Janžekovič & Daniel Ivajnšič
13:00	**Lunch**

14:30	**Session 7c. Faunistics and biogeography** **Chair: Agostino Letardi**
14:30	Ascalaphidae larvae from Costa Rica **Johannes Gepp**
15:00	Golden-eyed diversity (Neuroptera: Chrysopidae) in the agro-forest area of Amanous Mountains, Turkey **Hakan Bozdoğan**
15:30	To the limit: Altitude records of Neuroptera in the Bavarian Alps **Florian Weihrauch**, Axel Gruppe & Alfred Karle-Fendt
16:00	**Coffee break**
16:30	**Session 8. Taxonomy** **Chair: Caleb Califre Martins**
16:30	What is really the sub-species *nanceiensis* Séméria, 1980 of the Common green lacewings *Chrysoperla carnea* (Stephens, 1836) sensu lato? (Neuroptera, Chrysopidae) **Dominique Thierry** & Michel Canard
17:00	Crucial first steps for a revision of the *Pseudomallada prasinus* group in Europe (Neuroptera:Chrysopidae) **Peter Duelli**
17:30	Closing ceremony: Outlook and farewell
19:00	**Congress Dinner** in a typical Bavarian brew pub (coach journey)

Friday, 22nd June 2018

10:00	Departure to post-congress field trip (4 days)

Neuropterology 2018: Posters

Distribution of the green lacewing in France by regions – In the frame of the LDL Lacewing Digital Library / World Neuropterida Faunas Module
Michel Canard, Dominique Thierry & Matthieu Giacomino

The current state of knowledge of Polish Chrysopidae: research history, distribution and present-day problems
Roland Dobosz

A review of the current state of knowledge of Mesozoic Mantispidae
James E. Jepson & Michael Ohl

Preliminary results of NEUIT (Barcoding of Italian Neuropterida) project
Agostino Letardi, Davide Badano & Paul D.N. Hebert

Seven new species, one neotype, one new male and new distribution records for *Isostenosmylus* Krüger, 1913 (Neuroptera: Osmylidae)
Caleb Califre Martins, Adrian Ardila-Camacho, Renato Jose Pires Machado, Oliver S. Flint, Jr. & Lionel A. Stange

Mantispidae of the Área de Conservación Privada (ACP) Panguana, Peru
Ernst-Gerhard Burmeister, Michael Gebhardt & Axel Gruppe

What is the presumed owlfly illustrated in Aldrovandi's *De animalibus insectis* (1602)?
Rinaldo Nicoli Aldini

On some morphological abnormalities found in Neuroptera
Rinaldo Nicoli Aldini

Contribution to the study of the fine structure of the egg in the genus *Pseudomallada* Tsukaguchi, 1995 (Neuroptera, Chrysopidae)
Rinaldo Nicoli Aldini

Geographic and seasonal range of the antlions recorded in the United Arab Emirates
Anitha Saji, Zamzam Alrashdi, Pritpal Soorae & Shaikha Al Dhaheri

Imaginal diet of *Chrysoperla renoni* (Lacroix, 1933) (Neuropterida, Chrysopidae)
Johanna Villenave-Chasset, Dominique Thierry & Michel Canard

Diverse beaded lacewings from the Cretaceous Burmese amber
Yongjie Wang, Shuo Huang & Dong Ren

Current status and species diversity of the Neuroptera (lacewings, antlions & owl flies) in the United Arab Emirates
Zamzam Alrashdi, Anitha Saji, Pritpal Soorae & Shaikha Al Dhaheri

Neuropterology 2018: Abstracts
(in chronological order)

Opening keynote lecture

On wings of lace: Diversity and evolution of Neuropterida

Michael S. Engel

University of Kansas & American Museum of Natural History, 1345 Jayhawk Blvd, Lawrence, KS 66045, USA; <msengel@ku.edu>

The last 25 years of systematic research into the superorder Neuropterida (Raphidioptera, Megaloptera, and Neuroptera), have brought significant changes to our understanding of the evolution of lacewings, snakeflies, dobsonflies, and their diverse relatives. Phylogenetic estimations based on diverse data sources, ranging from adult and larval morphology to genomes, have begun to converge on enduring patterns, and fascinatingly many corroborate hypotheses put forth by Cyril Withycombe nearly a century ago. The synthesis of these data along with continued exploration of the neuropteridan fossil record has given a new perspective on the historical evolution and classification of Neuropterida, requiring a revision of their higher organization and providing focus on future directions for neuropterology.

Session 1. Phylogeny

Keynote lecture

New insights into the phylogeny and evolution of Megaloptera

Xingyue Liu

Department of Entomology, China Agricultural University, Beijing 100193, P.R. of China; <xingyue_liu@yahoo.com>

Megaloptera is a basal holometabolous insect order as a group of "living fossils" whose evolutionary history attracts great interest because of its antiquity and important systematic status in Holometabola. Here the current knowledge and recent progress on the phylogeny and evolution of Megaloptera are summarized. The global species diversity of extant Megaloptera is overviewed. The fossils of Megaloptera are critically discussed. The intergeneric phylogeny of Megaloptera based on morphological data gave a compelling hypothesis on the diversification and historical biogeography of Megaloptera. However, the present phylogenetic study based on mitochondrial genomic data provides new evidence for understanding the phylogeny and evolution of Megaloptera.

Phylogeny of Chrysopidae with an emphasis on morphological evolution

Laura C.V. Breitkreuz, Michael S. Engel, Shaun L. Winterton & Ivonne J. Garzon-Orduna

University of Kansas, Department of Ecology and Evolutionary Biology, Biodiversity Institute and Natural History Museum, 2041 Haworth Hall, 1200 Sunnyside Avenue, Lawrence, KS 66045, USA; <l.breitkreuz@gmail.com>

The neuropteran family Chrysopidae, commonly known as green lacewings, is a small and ancient clade of cosmopolitan insects, with delicate adults and a rather curious predatory larval stage. Currently, three subfamilies are recognized, Apochrysinae, Chrysopinae and Nothochrysinae. However, their evolutionary relationship remains uncertain as previous attempts, using small morphological data sets or only molecular data, have led to inconclusive results. To further understand chrysopid relationships and morphological character evolution, we inferred a multi locus phylogeny from a large molecular data set of seven genes (16S, COI, CAD, 18S, PepCK, WG and ATPase), and mitogenomic data, in combination with a substantial morphological character matrix, including ca. 75% of all known genera. We here focus on the morphological character evolution inferred from the resulting phylogenetic hypothesis. All subfamilies and most tribes are found to be monophyletic with high support, but the tribe Ankylopterygini renders Chrysopinae paraphyletic. We further investigate the amount of fusion in the chrysopid wing, which is unprecedented in Neuroptera, and which is one of their most conspicuous characters. Besides the traditionally used forewing and male genitalic traits we added a substantial set of hitherto overlooked characters in this study, which are phylogenetically informative especially on higher taxon level, such as vein fusions in fore and hindwing, tibial spurs, tarsal setae and many more. The discussion of characters such as the parameres and gonapsis, wing fusions and larval trash carrying behavior is in the center of this study. Our results show, that numerous homoplastic characters have been subject of convergence and multiple origins or are simply retained plesiomorphies in Chrysopidae, as they occur in several not closely related lineages. The presented work gives insight in the genus level relationships within Chrysopidae and the underlying morphology, including divergence times and character evolution.

Note on the immature stage and female morphology of *Osmylus bipapillatus*, with reference to the systematic significance (Neuroptera, Osmylidae)

Han Xu, Yongjie Wang & Zhiqi Liu

Department of Entomology, China Agricultural University, Beijing 100094, P.R. of China; <hanny_90@163.com>

The genus *Osmylus* Latreille (Osmylidae: Osmylinae) contains 21 species distributed in the Palaearctic and Oriental regions and only one species, *O. fulvicephalus* (Scopoli, 1763), is found in Europe while the rest is distributed in Asia. Relative to the stud-

ies on taxonomy of the osmylid adult, the larva is less concerned about. As far, the larva of seven species has been described: *Osmylus fulvicephalus* (Scopoli, 1763), *O. hyalinatus* McLachlan, 1875, *O. pryeri* McLachlan, 1875, *O. tessellatus* McLachlan, 1875, *Spilosmylus flavicornis* (McLachlan, 1875), *Stenosmylus tenuis* (Walker, 1853) and *Isostenosmylus* sp. But these larvae were not described in detail and then compared until Matsuno (2016). Furthermore, the biology of the immature stage of osmylid larvae remains mysterious. The terminal instar larva and female of *Osmylus bipapillatus* Wang & Liu, 2010 are described. The larva is characteristic of six setae on frontal edge of cranium, four setae on DPm2 of mesothorax and four setae on the DPp2 from 1st to 7th abdomen segments. And there is a curved and fingerlike processus on the forcoxa of the female but not in male, probably representing a sexual dimorphism in Osmylidae. And biology of the immature stage is also illustrated and recorded.

On the study of Korean Coniopteryginae (Neuroptera: Coniopterygidae): Molecular trees conflict between 16S and COI

Kim Seulki & Cho Soowon

Chungbuk National University, Chungdae-ro 1, Seowon-Gu, Cheongju, Chungbuk 28644, South Korea; <neurosk84@gmail.com>

The subfamily Coniopteryginae is a highly diversified group of Coniopterygidae. Previously, only two species of Coniopteryginae were recorded in Korea: *Semidalis aleyrodiformis* and *Conwentzia pineticola*. Here we provide a preliminary molecular phylogenetic relationship of the Coniopterygidae of Korea based on two mitochondrial genes, 16S rRNA and COI. The result showed that genetic diversity level, on average, of the COI sequences was much higher than that of the 16S sequences. While the 16S rRNA tree is similar to the MP or ML tree of Wang and Liu (2007), the COI tree is different in that *Conwentzia* is paraphyletically grouped with *Semidalis* before being a sister group to *Coniopteryx*, and *Spiloconis* is sister to (*Heliococonis*+*Coniocompsa*). While the *S. aleyrodiformis*-like species in the tree show enough sequence variations to be considered as different from *S. aleyrodiformis*, most of them are either morphologically same or sub-species in other studies. This result needs a discussion on how to solve the problematic issue regarding the *aleyrodiformis* species complex.

Session 2. Fossils

Geometric morphometrics and the evolution of wing patterns in fossil Neuroptera

James E. Jepson, Maria E. McNamara, Dong Ren, Chaofan Shi & Norman MacLeod

University College Cork, Coláiste na hOllscoile Corcaigh, College Road, Cork T12 K8AF, Ireland; <james.jepson@ucc.ie>

Wing colour patterns are the basis of diverse insect communication strategies and so are critical to understanding evolutionary processes affecting this group, especially the roles of innovation, homology, and convergence. Fossil insects often exhibit wing colour patterns. However, with the exception of a single study on eyespot patterning in Kalligrammatidae, there has been no systematic investigation of the evolution of fossil insect colour patterns. We have investigated colour patterns in Middle Jurassic neuropterans from the Daohugou Lagerstätte in China using novel geometric morphometric methods. Digital wing images from 270 specimens were placed into 11 broad morphogroups (e.g. vertical stripes, apex pattern, eyespots, spots) visually, and then analysed directly using eigenimage analysis. Preliminary results indicate that the majority of specimens can be organized into color-pattern clusters that correspond broadly to our informal visual groupings, thus confirming the ability of the eigenimage technique to represent geometric color-pattern groups correctly. However, regions of overlap do occur between these informal pattern groups, suggesting that such qualitative visual categorizations may not be mutually exclusive geometrically. These results indicate that quantitative, geometric methods of analysis can be applied to non-traditional morphometric data and can be used to include such data in studies of evolutionary diversity through time.

The Neuropterida from the mid-Cretaceous of Myanmar

Xiumei Lu & Xingyue Liu

China Agricultural University, 17 Qinghua E Rd, Haidian Qu, Beijing Shi, P.R. of China, 100083; <xiumeilu@cau.edu.cn>

This presentation summarizes the current research progress of the systematics of Neuropterida from the mid-Cretaceous amber of Myanmar. Hitherto, totally 76 species in 67 genera 22 families are recorded. We make emphasis on the taxonomy and phylogenetic study of Kalligrammatidae and Myrmeleontidae etc.

New fossil Raphidioptera (Insecta: Neuropterida) in the Mesozoic of northeastern China

Yanan Lyu

China Agricultural University, 17 Qinghua E Rd, Haidian Qu, Beijing Shi, P.R. of China, 100083; <lvyanan214@cau.edu.cn>

The fossil snakefly from the Lower Cretaceous (upper Barremian) of the Yixian Formation of Liaoning Province, China and the Middle Jurassic (Aalenian–Bajocian) of the Jiulongshan Formation of Inner Mongolia, China is reviewed. Ten genera and fifteen species are recorded. A key to genera of Baissopteridae and a key to Mesoraphidiidae are provided.

Mesozoic Chrysopidae: a review of current knowledge

Alexander Khramov

Borissiak Palaeontological Institute, Profsoyuznaya str. 123, Moscow, Russia; <a-hramov@yandex.ru>

Today, the Chrysopidae is the second largest family of Neuroptera, comprising about 1,200 species. First green lacewings appear in fossil record in the latest Middle Jurassic. The earliest record of Chrysopidae has been reported from Daohugou locality, China (Khramov et al. 2015). Green lacewings have been quite abundant in the Middle Jurassic-Early Cretaceous localities since their first appearance. The percentage of specimens of Chrysopidae to all fossil Neuroptera is 1.2% in Daohugou, 11.4% in Karatau (Upper Jurassic), 11.5% in Baissa, 17.3% in Khasurty, 30.3% in the Yixian formation and 5.2% in Bon-Tsagan; the last four localities are Early Cretaceous in age (Khramov 2018).

Almost all Mesozoic green lacewings belong to the extinct subfamily Limaiinae, except for a couple of rare genera, whose subfamily affiliation is not established. Cosmopolitan genus Mesypochrysa Martynov, 1927 and very closely allied genera, which are likely to be its synonyms (Khramov et al. 2015), make up the majority of Mesozoic Limaiinae (>90% of specimens). *Mesypochrysa* can be seen as the most abundant and widespread taxon among all Mesozoic lacewings. Nineteen species of *Mesypochrysa* have been described to date. Apart from Asian region, this genus was reported from Early Cretaceous Durlston Formation (England) and Crato Formation (Brazil). Besides *Mesypochrysa*, there are three well-established genera of Mesozoic Limaiinae: *Baisochrysa* Makarkin, 1997, *Aberrantochrysa* Khramov, 2018 and *Parabaisochrysa* Lu et al., 2018. In contrast to *Mesypochrysa*, these genera are present only at 1–2 localities each, with very few specimens known. *Mesypochrysa* and *Baisochrysa* existed during the Late Jurassic-Early Cretaceous, *Aberrantochrysa* and *Parabaisochrysa* during the Early Cretaceous only. The Upper Cretaceous record of Chrysopidae is scarce, with the only one bad-preserved specimen of *Cretachrysa* Makarkin, 1994 described from the Cenomanian of the Far East (Russia), which probably belongs to Limaiinae.

Except for *Parabaisochrysa xingkei* Liu et al., 2018 from the Burmese amber, all other adult specimens of Mesozoic green lacewings come from rocks, so the Mesozoic amber record of adult Chrysopidae is almost non-existent. The situation with the larvae of Mesozoic green lacewings from the Cretaceous ambers is somewhat better (in rocks they are absent). Chrysopoid larvae *Hallucinochrysa* Perez-de la Fuente et al., 2012 was described from Albian Spanish amber. This bizarre-looking creature bore long tubercles on its back, used for carrying plant debris. Chrysopoid larvae with similar modifications were reported from Burmese and Lebanese ambers (Wang et al. 2016). However, subfamily or even family affiliation of these larvae with long tubercles is unknown, for such extremely elongated abdominal structures have no parallels in any extant species of Chrysopidae. Theoretically, these larvae could represent immature stages of Limaiinae or some members of Chrysopoidea (Nel et al. 2005). Finally, newly-hatched lacewing larva described from Campanian Canadian amber as Chrysopidae (Engel & Grimaldi 2008) belongs to Berothidae, according to Wedmann et al. (2013).

Extant subfamilies of Chrysopidae enter the fossil record only in the Cenosoic era. Limaiinae, once flourished in the Mesozoic, survived into the early Eocene as a minor part of green lacewing assemblage, outnumbered by Nothochrysinae. The extinction of Limaiinae was probably linked to the rise of ants, which became much more numerous during the Eocene (Khramov 2015). The larvae of Limaiinae could have lacked defense mechanisms, like trash-carrying behavior and high maneuverability, which are needed for feeding on aphids and other Sternorrhyncha protected by ants. If this hypothesis is correct, we could expect to find plump-bodied naked Mesozoic larvae without abdominal tubercles alongside with *Hallucinochrysa*-like specimens, with the former belonging to Limaiinae, and the latter to some other group of Chrysopoidea. To settle the question, more study is needed on green lacewings larvae from Lebanese, Spanish and Burmese and other Cretaceous ambers.

The project is supported by RFFI grant 16-04-01498.

Session 3. Neuropterology and beyond

»Catálogo Taxônomico da Fauna do Brasil«: the technology contributing against taxonomic impediment – Neuroptera example

Caleb Califre Martins & Renato Jose Pires Machado

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The Catálogo Taxonômico da Fauna Brasileira (CTFB) is an online website (fauna.jbrj.gov.br), which was elaborated by a team of more than 500 zoologists (mostly Brazilian) who have worked in an integrated way to generate the first valid species list to different Brazilian animals groups. This is an initiative from the Brazilian Society of Zoology and aims to reduce taxonomic impediment in Brazil. Brazil is a megadiverse country with 117,295 animal valid species cataloged, of which 84,500 are Hexapods. Neuroptera is updated by two researchers (Renato Jose Pires Machado and Caleb Califre Martins) and currently has 421 valid species and 79 genera with confirmed records for 24 States and possible occurrence to remaining three Brazilian States. Brazil has representatives of all seven Neuroptera superfamilies and ten out of 16 families (Coniopterygidae, Sisyridae, Osmylidae, Dilaridae, Hemerobiidae, Berothidae, Mantispidae, Chrysopidae, Ascalaphidae, Myrmeleontidae). It is important to highlight the high degree of endemism of the Brazilian Neuroptera (217 endemic species, more than 50% of the recorded species). The most diverse families are Chrysopidae with 183 species (117 endemic), followed by Mantispidae with 51 species (15 endemic), Myrmeleontidae with 47 species (14 endemic) and Coniopterygidae with 46 species (31 endemic), which were all recently revised, except for the Myrmeleontidae that will probably be second-most diverse soon.

Setting up a Neuropterology research lab: Synergistic experiences in undergraduate mentorship

Joshua R. Jones

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For most of us, scientific research is at the heart of our neuropterological experience. Often, the most elucidating results arise through collaborations among peers with complementary skill sets. For those of us in the academe, however, we are often expected to devote a considerable portion of our limited time to mentoring students who may not yet have a full suite of research skills, and this may seem like a draw upon our research productivity. However, through vision, careful planning, and effective guidance, we can help young people with little background preparation to learn effective research techniques, and to make professional-level, collaborative, research contributions.

In this presentation I describe my experience in setting up a small Neuropterology research lab, and in bringing in a team of young and diverse students with limited research backgrounds to participate in the research process. I describe how I determined my objectives, interacted with department leadership to secure permission and logistical support, procured lab space, materials, and financial resources, recruited students, trained them, and helped them to set their own goals to accomplish a diversity of research-based, mutually-beneficial, publication-quality outcomes. Though all still in development, anticipated products include museum-quality arthropod collections, publication-ready scientific illustrations, monograph reference material databases, interactive taxonomic websites, and more.

Lacewings and Citizen science in Italy: a young but very promising relationship

Agostino Letardi

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Citizen science is growing as a field of research with contributions from diverse disciplines, promoting innovation in science, society, and policy. Citizen science platforms (i.e. iNat, https://www.inaturalist.org/) and capacity-building programmes foster the visibility of projects and establish networks for knowledge exchange within and among members of the citizen science community. Several recent events of citizen science in Italy (mainly by means of bioblitzes) gave a new perspective to the knowledge of Neuropterida in Italy.

Session 4. Morphology

Keynote lecture

Towards a homologization of the male genital sclerites of Coniopterygidae (Neuroptera) – a tightrope dance

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The most famous definition of homology is to be found in Owen's (1843) glossary: "HOMOLOGUE The same organ in different animals under every variety of form and function". It expresses exactly the phenomenon we deal with when trying to homologize the male genital sclerites of Coniopterygidae. Our philosophy behind this trial is a triple strategy:

i) The hypothesis of serial homology of genital sclerites (irrespective excessive transformations or losses), ii) The hypothesis of the gonocoxite-concept, and iii) gonocoxite patterns trump accessory patterns.

Archaeognathan Machilidae are equipped with serially homologous gonocoxites, gonostyli and gonapophyses in the abdominal segments and serve as a model for Neuropterida where these sclerites are restricted to the terminal segments and are adapted to copulatory function (Aspöck & Aspöck 2008). The whole set is rarely expressed. The identity of the genital sclerites representing this set may be camouflaged by excessive modelling of form, by reduction, or even loss, by shifting, or by fusion of sclerites to sclerite-complexes. In Neuropterida segments 9, 10, and 11 are concerned. In a first step it has to be considered to which segment a specific sclerite belongs. In a second step it may be addressed as gonocoxite, gonostylus or gonapophysis 9, 10 or 11. If gonocoxites, gonostyli or gonapophyses are not discernible in the compound of a sclerite this complex may just be addressed as gonocoxite-complex 9, 10, or 11. In case of doubtful sclerites a hypothesis in the sense of the gonocoxite concept is of more heuristic value than to hypothesise accessorial *de novo* structures and create new names for the Brucheiserinae – apart from their unusual appearance – surprise with a complete set of genital sclerites comprising unambiguously elements of gonocoxite-complexes 9, 10, and 11. The evidence of spiracula in segment 8 and a callus cerci (Sziráki 2007) exhibit a rather plesiomorphic pattern within the family.

Coniopteryginae – in spite of their heterogeneity and often bizarre modifications concerning genital sclerites – allow to interpret gonocoxite-complexes 9, 10, and 11.

Certain genera of the Aleuropteryginae face us with the phenomenon of a terminal sternite 8, whereas sternite 9 is invaginated and considerably modified or even lost. However, the gonocoxite-complex 10 may serve as a landmark.

The present hypothesis of a sister-group relationship Brucheiserinae + Coniopteryginae as sister-group of Aleuropteryginae (Zimmermann et al. 2009) is upheld. The phylogenetic position of Coniopterygidae within Neuroptera – either as sister-group of the rest or as sister-group of the dilarid-clade, or nested somewhere else – is still unsettled but might be promoted by the current campaign of homologization.

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Small, but oh my! Effects of miniaturization on the head anatomy in Coniopterygidae.

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The evolution of extremely small body size is a common phenomenon in different insect orders. Structural, physiological and physical constraints have dramatic effects on the morphology and result in reduction, simplification and morphological novelties. Among Neuroptera the Coniopterygidae are the midgets, with a forewing length of only 2–5 mm. The effects of miniaturization on their head anatomy and convergent modifications in other miniaturized insect species are outlined. In Coniopterygidae miniaturization results in a relative increase of the brain size, a simplified tracheal system, a reduced number of ommatidia and a reduced diameter of the facets, a bell-shaped ocular ridge, a weakly sclerotized cuticle and the presence of wax glands.

The phylogenetic placement of miniaturized clades often represents a challenge, as the consequences of miniaturization can hamper the phylogenetic signals. This is certainly true for Coniopterygidae and is reflected in the various positions they have taken in the neuropteran tree. The support for a position as sister group to the rest of Neuroptera versus one as sister group to the dilarid clade is discussed.

Session 5. Development, chemical ecology and micro-structures

Metathetely and its implications for the distribution of Raphidioptera

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It is well-known that snakeflies need a decrease of temperature during hibernation to develop to adults. Most species of both families of the order (Raphidiidae, Inoceliidae) need usually two years (rarely one year, but sometimes several years) for the completion of the life cycle, whereby the last larval stage (of 9 to 15 instars) overwinters as the mature larva in quiescence, pupates in spring and yields the adults usually +/- two weeks later. This mode of life cycle represents Type I (Aspöck 2002). [In Type II pupation happens already in autumn, the pupa hibernates and yields the adult in spring, while in Type III the larva pupates in (early) summer, the adult hatches a few weeks later.] Most species of Raphidiidae and probably all Inocelliidae represent Type I.

If a hibernation of the last larval stage with a chilling period is withheld, the larva cannot pupate properly, but achieves only an incomplete pupation with pathomorphological characters of antennae, of eyes, appearance of wing pads and sometimes disordered last abdominal segments. This phenomenon has been called prothetely, but in reality it represents metathetely in the form of an unsuccessful pupation. Prothetely means appearance of characters of a later stage, metathetely means that characters of the prior stage remain unchanged. This is the case in metathetelic snakeflies: They look like larvae with a few pathomorphological pupal characters, and they move like larvae. Sometimes only slight alterations (e.g. by enlarged eyes) can be observed, but nevertheless they are the result of an unsuccessful pupation. Usually these metathetelic pupae die after a few weeks, but very rarely they can even moult and lead to disordered adult.

Thus, it is apparent that decrease of temperature during winter is a precondition for the occurrence of snakeflies, and, indeed, so far, Raphidioptera have only been found in regions with decreased temperature in winter. These are large parts of the Palaearctic region as well as of the Nearctic region and in higher altitudes in the transition zones to the Orientalis and to the Neotropis respectively. The tropical regions as well as the Southern Hemisphere lack Raphidioptera.

Recent experimental studies have shown that the necessary degree of chilling temperature on one hand and the length of the chilling period on the other hand are different in different species (Abbt 2016, Aspöck et al. 2018). This may explain why some species have large distributions, while others are restricted to very small areas. So far the hormonal physiology of the phenomenon of metathetely has not yet been investigated. There is still a large open field of research.

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Chemical ecology of Chrysopidae: perspectives of synthetic attractants

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Acquirement or exchange of information through chemical substances is a very ancestral form of interaction between an individual and its environment. Several organisms use chemical stimuli for orientation to food sources, partners or to avoid potential hazards. Chemical ecology deals with the chemical mechanisms included in these intra- and interspecfic interactions, and the compounds involved are called semiochemicals.

Green lacewings (Chrysopidae) as predatory organisms are important agents of biological control and some species are available commercially as well. However, these are generally from international sources and may contain non-native species, why it seems more feasible to apply native species in biological pest control. A promising way to attract native lacewings present in the environment to a given site could be achieved by the use of semiochemicals.

Several reports are available on response of green lacewing adults to olfactory stimuli, such as plant-, aphid- or lacewing-derived semiochemicals. In some cases the behavioral effects of these stimuli are very remarkable, including influence on oviposition site choice of females.

Our aim is to provide a brief overview of the chemical ecology of Chrysopidae, including perspectives from the view of both research and practical applications.

The research was partially supported by the PD115938 NKFIH grant and the János Bolyai Research Scholarship of the Hungarian Academy of Sciences.

The dimensions of the dust of dustywings (Neuroptera, Coniopterygidae)

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Most neuropterists know Coniopterygidae in two different forms: whitish, flying insects or translucent specimens immersed in alcohol. The dusty cover of Coniopterygidae was studied more than one decade ago by Nelson et al. (2003). According to this work, the 'dust' consists of wheel-like micro-structures secreted from wax-glands on the insect's body. Chemically, it is composed mainly of lipids with a 24-carbon fatty acid as main component.

Apart from this study, not much is known about the dustywing micro-structures. Therefore, we defined six parameters to quantitatively describe the dimensions of the structures, which were measured on SEM micrographs.

We present pictures and data of the micro-structures found on the bodies of the species *Aleuropteryx juniperi*, *Helicoconis luteus*, *Coniopteryx pygmaea* and *Semidalis pseudouncunata*. The shape of the structures of all species conforms to Nelson et al. (2003), but we found two different structure types in Aleuropteryginae. Some dimensional parameters differ significantly from species to species. We conclude that there might be a phylogenetic signal in these structures apart from a hitherto unknown function of the micro-structures.

Session 6. A focus on Myrmeleontidae

Keynote lecture

Into the pit: evolution, diversity and biology of the larvae of Myrmeleontiformia

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Myrmeleontiformia comprise several entirely fossil groups and few extant families: Psychopsidae, Nymphidae, Nemopteridae, Myrmeleontidae + Ascalaphidae and, according to recent phylogenomic evidence, Ithonidae. No systematic or phylogenetic discussion about the relationships among and within these families could be undertaken without considering their larvae, an extraordinary source of phylogenetic data. Highly adept ambush hunters, the larvae of Myrmeleontiformia are characterized by trap-like jaws, strongly sclerotized head capsule, complex head-thorax articulation and specialized body setae and protuberances. Moreover, they developed remarkable strategies to increase the effectiveness of their hunting technique, such as camouflaging, burrowing and, in some antlions, pit-building. From the shadows of Mesozoic forests to the shining glare of today's deserts, myrmeleontiforms colonized a diverse array of terrestrial microhabitats in spite of a relatively conservative morphology. Fossil and phylogenetic clues suggest that Myrmeleontiformia evolved as arboreal predators and later independently invaded soil in different lineages. Although several myrmeleontiforms still thrive in their ancestral arboreal niche, most species are associated with soil, especially in arid environments. In particular, Myrmeleontidae were remarkably successful in exploiting diverse microhabitats, partitioning themselves in different ecological niches to avoid reciprocal competition.

In search of *Myrmeleon bore*: Bavaria's rarest Neuropteran?

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According to current knowledge, the district of Kelheim harbours an extremely isolated population of *Myrmeleon bore*, representing the only known Bavarian population of this species and in addition the only known population north of the Alpine arc up to the Upper Rhine Valley in Rhineland-Palatinate. In order to elucidate the actual status of this occurrence of *M. bore*, which is of nationwide significance, in 2012 the regional situation of funnel building Myrmeleontidae was monitored.

In the course of the study, a method was developed to discriminate the three Myrmeleontidae species occurring in the area, *Euroleon nostras*, *Myrmeleon bore* and *M. formicarius*, as second and third instars in the field. In total, more than 5,000 ant-lion funnels were recorded and assigned to one of the three species by determining 5–10% of unearthed larvae per funnel field. Using only the maximum number of funnels found during each monitoring, a total of 776 individuals of *E. nostras*, 323 of *M. bore*, and 2,886 of *M. formicarius* were identified. In a conservative extrapolation, annual larval populations of at least 2,000 *E. nostras*, 1,000 *M. bore* and 10,000 *M. formicarius* are to be expected in the area.

The occurrence of *M. bore* was confirmed with certainty only for a partial area near Offenstetten, where it was found on a small scale in five subareas. This underscores the urgent need to protect *M. bore* in the region, because the only Bavarian population could become extinct by a single emergency. Targeted searches for the species in other dune regions of Bavaria, especially in Franconia, did not yield another record of *M. bore* so far.

Predatory behavior of two antlion species under different conditions

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Antlion larvae show little behavioral plasticity during prey capture and feeding, their repertoire of behavioral patterns is more or less stereotyped. In this study we observed behavior of two antlion species, a pit-builder (*Euroleon nostras*) and non-pit-builder (*Neuroleon microstenus*), both considered as ambush predators but with different predatory strategies. We exposed larvae to different conditions during prey capture and feeding and compare their behavior to the control group, where larvae were undisturbed. We used two different stimuli, visual and vibrational and for the non-pit-building larvae we also change substrate to smaller particle size. In the non-pit-building larvae we also observed consistency of the behavioral pattern called prey carcass removal.

Behavioral patterns during prey capture and feeding occurred with variable frequency depending on the condition in both species. We noticed two main differences in behavior under the stimuli: a) quiescence, when larvae were exposed to stimuli, and b) increased frequency of changing ambush position after feeding in the non-pit-building larvae.

Prey clearing pattern was not consistent in individuals. Either larva removed prey with dropping or tossing. Under the stimuli larvae use prey dropping more frequently compared to the control group. The research was preliminary and more observation needs to be done.

Behavioral, bioenergetic and morphological characteristics of ant lion larvae with obligatory (sit-and-wait) and facultative pit building strategies, respectively, under natural and laboratory conditions (Neuroptera , Myrmeleontidae)

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Myrmeleontidae larvae belonging to two different prey capture strategies were investigated, namely the so-called sit-and-wait larvae (also obligatory pit builders) and larvae with facultative construction strategy. The latter is also called mixed strategy, since their individuals can either construct traps for an ambush strategy, or they can also actively hunt their prey. The larvae of the two strategies differ in their body morphology and in the morphology of their traps. The aim of this research was to conduct comparative studies on the behavior and morphology of the respective population. The success of the two predation strategies is used to infer about their phylogenetic evolution and adaptation mechanisms used by this group of Myrmeleontidae.

The research was totally experimental, using only individuals from the L3 larval stage. In addition to the biometric method, a morphological analysis was performed based on microscopy. The main parameters of analysis were: the mass of the individuals, the tampon of the traps, the construction timing and the energy balance. All these parameters differed significantly between subjects of the two strategies.

The genus *Nosa* Navás, 1911 (Neuroptera, Myrmeleontidae, Palparinae)

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The genus *Nosa*, introduced by Navás in 1911, was redefined by Insom & Carfi (1989). Fifteen taxa were at some point assigned to the genus, although as a result of synonymies Stange's (2004) catalog recognizes only two species, *Nosa tigris* (Dalman) and *Nosa tristis* (Hagen). A review of the type material, based essentially on male genitalia, indicates that the taxon *tristis* Hagen and its two subspecies, *tristis niansanus* Kolbe and tristis brevifasciatus Stitz, do not belong to *Nosa* and should return to the group of spe-

cies within African *Palpares* that have not been assigned to new genera yet. On the other hand it is proposed to consider that the genus *Nosa* Navás consists of four valid species *Nosa leonina* Navás, Nosa tigris (Dalman), *Nosa hamata* (Kolbe), and *Nosa adspersa* Navás. Synonymies are discussed. The known geographical distribution of each species is given.

Owlflies are derived antlions: anchored phylogenomics and a revised phylogenetic classification of the family Myrmeleontidae (Insecta: Neuroptera)

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The first phylogenomic analysis of the antlions is presented, based on 325 gene loci captured using Anchored Hybrid Enrichment techniques. A total of 215 species were analyzed using maximum likelihood and Bayesian techniques. The included species consisted of 170 traditional Myrmeleontidae, 37 putative near-outgroups from the larger Myrmeleontoidea, and 8 far-outgroups from the non-myrmeleontoid Neuroptera. Both Myrmeleontidae (antlions) and Ascalaphidae (owlflies) were recovered as paraphyletic with respect to each other. The subfamilies traditionally assigned to Myrmeleontidae and Ascalaphidae were also recovered as either para- or polyphyletic. Almost all antlion tribes sensu Stange (2004) were recovered as monophyletic, but almost all subtribes were recovered as paraphyletic. Thus, the results obtained share some similarities, but many incongruences, with the traditional classification of Myrmeleontidae. A new phylogenetic repartitioning and reclassification of the antlions and owlflies is proposed based on these results. The new structure incorporates the Ascalaphidae into the Myrmeleontidae and divides the expanded Myrmelentidae into four subfamilies – Ascalaphinae, Myrmeleontinae, Dendroleontina, Nemoleontinae – and 18 tribes. Some of the more interesting phylogenetic results of the new analysis will be discussed.

Session 7. Faunistics and biogeography

Keynote lecture

Neuropterida from South America: large diversity, largely unknown

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Known Neuropterida diversity includes about 6,500 extant species of alderflies and dobsonflies (Megaloptera), snakeflies (Raphidioptera) and lacewings (Neuroptera).

Neuropterida has representatives worldwide, but Raphidioptera do not have extant representatives in South America — snakeflies are known to have inhabited the continent due to the fossil record. South America has a complex geological history and heterogeneous relief and climate, rendering more than 25 biogeographical domains and great biological diversity. Among the Neuroptera families, 12 occurs in South American with more than 820 species distributed in 125 genera, while both families of Megaloptera are present with ca. 60 species in seven genera. Chrysopidae is the neuropterid family with largest number of species in South America (319); *Leucochrysa* is the most diverse genus, with more than 100 described species; Myrmeleontidae has the highest number of genera (33). The Neuropteroid fauna has a relatively high diversity in the continent, as well as a considerable degree of endemism even at higher taxonomic levels – 48% (63 of 132) of the genera of the group are known to occur only in South America. There is a huge hidden, unknown diversity of the group in South America; it is estimated that at most 50% of the species diversity of the group has been described so far, number even less for immature stages, which demonstrates the necessity for further studies to understand this diversity in South America.

Fantastic lacewings and where to find them

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Do some mythical Neuropterida really appear only in beneficial astral conjunctions, or is our eco-ethological knowledge of these fantastic insects too patchy yet? Some examples from the decades of our field experiences are given.

The impact of forest fire and wind-throw on Neuroptera, Raphidioptera and Mecoptera

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In Swiss forests, the mid-term effects of forest fires and wind-throws on species compositions of Neuroptera, Raphidioptera, and Mecoptera were assessed in four different projects with standardized flight interception traps. The four disturbances ranged from wind-throws in alpine spruce forest and lowland deciduous forest to winter forest fires and summer fires. Thirty species were too scarce for quantitative analyses, but of the other 52 species 73% profited from the disturbance and became more abundant in the years after the fire or wind-throw. More species (18) were most abundant in moderately disturbed forest than in strongly disturbed plots (16). Only 14 species, mainly Hemerobiidae, had their maxima in the undisturbed forest. A table is provided listing species per disturbance and ranging them as over-all winners (more specimens in disturbed plots) or losers (more specimens in undisturbed forest).

Lacewings (Neuropterida: Neuroptera, Raphidioptera) in three National Parks in the Balkan Peninsula: Results of short collection trips

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During the course of three neuropterological Balkan expeditions in 2014, 2015 and 2017, short visits to three national parks were conducted. A survey of the collected lacewing species (Neuropterida: Raphidioptera, Neuroptera) in the Fir of Drenova National Park, Albania, the Tara National Park, Serbia, and the Pelister National Park, Macedonia, is presented. The distribution and ecological traits of some rare and interesting lacewing species are discussed.

Neuroptera of the region of Missour (Morocco)

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The region of Missour is located in the Oriental region of Morocco. A survey on Myrmeleontidae and Ascalaphidae was carried out during several years. Results of the collections are presented.

Neuroptera in in two protected sand dune areas in the southern rim of the Pannonian Plain

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The Pannonian Plain is large sedimentary lowland in Central/South-eastern Europe. Two protected sand dune areas in the southern rim of the Pannonian Plain were occasionally surveyed for the presence of Neuroptera. The smaller one, Djurdjevac sands in Croatia, occupying about 0.2 km^2, is a special geographical and botanical reserve. The larger area, Special Nature Reserve Deliblato sands in Vojvodina province, Serbia, covers about 300 km^2. In these reserves, among other lacewings, a few rare antlion species were recorded. Vegetation dynamics of the study areas was determined with a multispectral LANDSAT satellite imagery. To evaluate the change in vegetation density, a vegetation index (NDVI) was used for each time window. Moreover, a pixel level regression tool was applied to measure the dynamics and pattern of the succession process. As a result of the ecological succession (in both reserves) and reforestation (in Deliblato sands) in the past, the rate of the habitat loss and degradation process of the sand dune ecosystems increased to the level less suitable for the antlions assemblages.

Ascalaphidae larvae from Costa Rica

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Four different Ascalaphidae larvae were found in the coastal regions of Costa Rica. The external morphology and behaviour are described. The flat larvae are coloured in camouflage and are exceedingly inactive. They spend weeks sitting on the surface areas of big leaves where they, in a cautiously selective manner, catch insects which are climbing past them. The duration of development lies between one and two years. Captive breeding up to the state of imagines is challenging and rarely successful.

Golden-eyed diversity (Neuroptera: Chrysopidae) in the agro-forest area of Amanous Mountains, Turkey

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This study was conducted in the Amanous Mountains in Turkey. The collected lacewing specimens from agro-forest area of Amanous Mountains identified and estimation of species richness, species evenness, and species diversity were made by Shannon diversity Index. The data was obtained during May–October 2017 by netting, hand picking, pitfall traps and light traps. A total of 341 individuals belonging to 12 species from five genera of Chrysopidae were successfully identified from both study sites. The results showed that the undisturbed forest had higher abundance and diversity of lacewing families as compared to disturbed forest. The effects of site characteristics and habitat complexity on golden-eyed family diversity are discussed.

To the limit: Altitude records of Neuroptera in the Bavarian Alps

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In the years 2002–2017 records of adult Neuropterida were taken cursorily during excursions to high altitudes of the Bavarian Alps. Although this was not a targeted study, the data will help to shed some light on hitherto unknown vertical distribution limits of several species in Germany. Altogether, twelve species were recorded at altitudes above 1,300 m above sea level. Especially those records from the actual Sub-alpine and Alpine altitudinal belt, which begins above the timber line at 1,500 m a.s.l. are noteworthy and can be attributed to eleven species (3 Chrysopidae, 7 Hemerobiidae and 1 Raphidiidae). Current record holders are the green lacewing *Chrysoperla lucasina* Lacroix, 1912 (seemingly a species found regularly at high altitudes) and the snakefly *Phaeostigma notata* (Fabricius, 1781), both recorded at 2,200 m a.s.l. A special record is also that of one

male *Peyerimhoffina gracilis* (Schneider, 1851) (Chrysopidae), which was collected on 28th March 2018 on a snow field at 1,900 m a.s.l. – however, this record is very likely due to inactive drift of this individual by foehn winds from warmer regions south of the Alps.

Session 8. Taxonomy

What is really the sub-species *nanceiensis* Séméria, 1980 of the Common green lacewings *Chrysoperla carnea* (Stephens, 1836) sensu lato? (Neuroptera, Chrysopidae)

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The taxon *nanceiensis* was compendiously described long ago and assignated a sub-species of the complex of the Common green lacewings. The recent discovery of specimens of the original cohort allowed us to give several characters displaying all the basic traits of *Chrysoperla affinis* (Cc4 into the song-species system) of which it might be designated a legitimate member and become then a new synonym. The conspicuous cephalic ornamentation was tentatively cleared up.

Crucial first steps for a revision of the *Pseudomallada prasinus* group in Europe (Neuroptera:Chrysopidae)

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The identity of some of the species in the *prasinus* group are not clearly defined. With a focus on the most wide-spread and most abundant species, two sympatric morphs of *P. prasinus* Burmeister 1839 were reared and hybridized in search of reproductively separated species. In addition, 28 morphological or biological traits were recorded for live and preserved specimens of most of the European species in the *prasinus* group.

In cross-breeding experiments, *Pseudomallada "marianus"*, and "greenhead *prasinus*", turned out to be separate species, morphologically and biologically distinct when alive. "Greenhead *prasinus*" are small to medium sized and deposit eggs singly, without obligatory diapause in the second instar. In living specimens there is a red or brown suture below the eyes, which can fade with age or preservation. *P. "marianus"* is large, depositing bundled eggs, with an obligatory diapause in about half of the L2. In none of the collected or reared *P. "marianus"* a red or brown suture was observed below the eyes.

Pseudomallada marianus is confirmed as a synonym of *P. prasinus*, depositing bundled eggs, whereas all the smaller morphs of *P. "prasinus"*, depositing single eggs, mostly correspond to the type specimen of *C. aspersa* Wesmael 1841 – and are morphologically distinct from *P. abdominalis*.

Poster session

Distribution of the green lacewings in France by regions – In the frame of the LDL Lacewing Digital Library / World Neuropterida Faunas Module

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There are 50 valid species of Chrysopidae in France, mainland and Corsica together without oversea collectivities. None is considered endemic to France. Few species were very rare, encountered as quasi-unique specimens, coming from outside. Contrary to this rare occurrence, some species were recorded in all the regions.

The current state of knowledge of Polish Chrysopidae: research history, distribution and present-day problems

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Neuropterida are represented in Poland by 103 species from nine families. Chrysopidae (31 species) is one of the two largest families, second only to Hemerobiidae (34 species). The first studies from the early 19th century (Perthes manusc. Weigl 1806) described two species of green lacewings from the area of present-day Poland. From 1802 to 2017 fifty-six authors (as the only or the first co-author) published 134 papers dealing with Chrysopidae. On the basis of bibliographical data and unpublished studies, green lacewings have been found to occur at 542 sites in 455 UTM squares.

A review of the current state of knowledge of Mesozoic Mantispidae

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To-date there have been 30+ fossil specimens of Mantispidae recorded. Within the Mesozoic specimens there have been 11 genera and 13 species of mantispid described. The first recorded mantispid in the fossil record is from the Lower Jurassic of Germany. Other Jurassic mantispids are known from China and Kazakhstan. Cretaceous mantispids are known from the Lower Cretaceous of Siberia and China. In the Upper Cretaceous they are recorded from Kazakhstan and Burmese amber. The majority of taxa are placed within the extinct subfamily Mesomantispinae, with the exceptions of Liassochrysa and Promantispa that are in the extant subfamily Drepanicinae, and Doratomantispa that is considered to be Mantispidae incertae sedis. The aforementioned fossils are considered to be true mantispids, displaying diagnostic characters, both from wing venation and body morphology, which give strong evidence for their affinity. In addition to these, there are Mesozoic fossils that show similar characters to Mantispidae, in their wing venation and body morphology, e.g. the presence of raptorial forelegs, these have often been identified as Mantispidae. These mantispid-like fossils can be separated into two subfamilies currently placed in Berothidae: Mesithoninae and Paraberothinae. Mesithoninae species are found in the Jurassic of Asia, and Paraberothinae are found in amber: from the Cretaceous of Lebanon, Burma, France, USA, and Canada. We review the current state of knowledge of Mesozoic mantispids.

Preliminary results of NEUIT (Barcoding of Italian Neuropterida) project

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DNA barcoding aims at providing an efficient method for species level separation using a partial sequence of the mitochondrial COI gene. But DNA barcode represent just one important descriptor in the framework of the multidimensional species approach. A huge effort of morphological and faunal studies has been realized for the Neuropterida of Italy: the goal of the present project is to create a DNA barcode library for a significant number of Italian species.

Seven new species, one neotype, one new male and new distribution records for *Isostenosmylus* Krüger, 1913 (Neuroptera: Osmylidae)

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The genus *Isostenosmylus* Krüger, 1913 (Stenosmylinae) is endemic to South America and was erected based on wing venation features, with *Osmylus pulverulentus* Gerstaecker, 1894 as the type species. Later more species were added to the genus: *Isostenosmylus morenoi* (Navás, 1928), *I. fusciceps* Kimmins, 1940, *I. fasciatus* Kimmins, 1940, and *I. nigrifrons* Kimmins, 1940. Was only recently that some new species were added: I. contrerasi Ardila-Camacho & Noriega, 2014, *I. septemtrionalandinus* Ardila-Camacho & Noriega, 2014, *I. bifurcatus* Ardila-Camacho et al., 2016, *I. irroratus* Ardila-Camacho et al., 2016, *I. julianae* U. Aspöck et al., 2016 totalizing 10 species and for the genus. The study of recent material from South America revealed seven new species for *Isostenosmylus* (totalizing 17 species) increasing the distribution of the genus to Colombia (Antioquia), Ecuador (Sucumbío), Peru (Cuzco and Machu Pichu), Bolivia (La paz) and Brazil (Paraná) and Argentina (Tucumán) (new country record); we also erected a Neotype to *I. morenoi*, described the male of I. *irroratus* increasing its distribution to

Lara State (Venezuela), we also report new records for *I. pulverulentus* to Paraná State, Brazil and to department of Alto Paraná, Paraguay (new country record). The next steps of this study will focus on the phylogeny and biogeography of the genus.

Mantispidae of the Área de Conservación Privada (ACP) Panguana, Peru

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Mantispidae are among the most familiar but least studied Neuroptera worldwide. Although revisions are needed, recent reviews of Mantispidae allow determination of many species from the Neotropics. So far, no summary of Mantispidae of Peru has been published, but, according to Heckman (2017), six species are assigned to that country.

We studied Mantispidae collected in the ACP Panguana in the Peruvian primary lowland rainforest. 78 specimens have been collected around the ACP Panguana in the last two decades, most of them with light traps. Except of two field trips in 2015, Neuroptera have never been the focus of these field trips.

Altogether, 16 species have been collected with *Dicromantispa grasilis* (Erichson, 1839) (52.2%) and *Zeugomantispa virescens* (Rambur, 1842) (16.6%) being the most abundant ones. Nine out of 16 species are represented by one specimen only. Thirteen species have been recorded for the first time for Peru. Consequently, 19 species of Mantispidae are currently known from Peru.

What is the presumed owlfly illustrated in Aldrovandi's *De animalibus insectis* (1602)?

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With his work *De animalibus insectis* (1602), U. Aldrovandi (Bologna 1522 – Bologna 1605) occupies a prominent place in the history of entomology. The work includes many descriptions and woodcuts of insects, a number of which today are also identifiable at the level of genus or species, thanks in part to the series of hand-drawn and watercolored "Tavole di animali" (Tables of animals) the author had prepared for making woodcuts for the printed work. For a number of insects, Aldrovandi's descriptions and illustrations are the oldest recognizable in entomological literature. Insects today referable to some Myrmeleontidae and to one Chrysopidae are recognizable in the entomological work by Aldrovandi and have already been studied (Nicoli Aldini 2007). However, among his butterflies and moths we also find the description and illustration of a rather enigmatic insect, which could be an owlfly (Ascalaphidae), although there is some uncertainty, partly due to the discrepancy between its color as shown in the "Tavole di animali" (under the name Papilio subcastaneus) and the description provided in the printed work; above all the combination of the chromatic features reported, which only partially seem compatible with the current genus Libelloides or with other genera of owlflies, is perplexing. Bodenheimer (1929) qualifies this insect as "(*Ascalaphus* sp.)"; the use of brackets denotes perplexity on the part of this renowned historian of entomology. However, of the insects treated by Aldrovandi this is not the only one to arouse uncertainty regarding identification, at both morphological and chromatic levels.

On some morphological abnormalities found in Neuroptera

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Morphological abnormalities in Neuropterida (Raphidioptera, Megaloptera, Neuroptera) have been described and illustrated in the entomological literature only very rarely. It seems that in the orders of Neuropterida, if we ignore the common anomalies observable above all in wings of adult specimens which are either malformations produced during adult emergence or some slight and recurrent anomalies in wing venation, such abnormalities are present less frequently than in some other orders of insects, such as Coleoptera, for which there are also reports of true teratological cases of very obvious deformation, which in contrast it would seem are never observed among Neuropterida. As far as Neuroptera are concerned, the morphological anomalies observed include: partial or total fusion of some contiguous antennomeres (e.g. in adult Coniopterygidae and Hemerobiidae); atrophy of legs (e.g. in adult Chrysopidae and Myrmeleontidae); anomalies of a certain importance, asymmetrical or symmetrical (bilateral) in wing venation (e.g. in Hemerobiidae and Chrysopidae); more or less significant malformations in male or female sclerotized structures of the terminalia (e.g. in Hemerobiidae and Chrysopidae); and some other abnormalities. The present paper focuses attention on some unpublished cases of such anomalies observed by the author, including an example of unilateral antennal aplasia in an adult Myrmeleontidae.

Contribution to the study of the fine structure of the egg in the genus *Pseudomallada* Tsukaguchi, 1995 (Neuroptera Chrysopidae)

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The advent of the scanning electron microscope (SEM) has considerably increased knowledge of the external morphology of the egg of a good number of green lacewings (Chrysopidae), particularly concerning the fine structure of the chorion surface and the micropylar area. Progressive improvements to the SEM and related techniques of examining samples now result in images of ever better quality. To date, observations are available for various genera and several dozens of green lacewing species; a relatively large number of them belong to the genus *Pseudomallada* Tsukaguchi, 1995 (Chrysopinae).

In Europe this genus includes about two dozen taxa of specific or subspecific rank, some of which are difficult to discriminate and problematic as regards their systematic level: research into ootaxonomy by SEM could at least potentially help to resolve some uncertainties. The present preliminary work deals with the external morphology of the egg of some European species of *Pseudomallada*. The fine structure of the chorion surface, micropylar area, length of the stalk, and egg distribution during oviposition can be all useful elements for the above purpose. These observations are compared with the data already given in the literature and deserve to be extended, for this as well as other genera, to the largest possible number of taxa of species-group and also to more populations of each species from different geographic areas within the respective areal, to verify similarities or differences.

Geographic and seasonal range of the antlions recorded in the United Arab Emirates

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The antlions populate various desert and semi-desert habitats of the United Arab Emirates (UAE) in high diversity. The number of antlion species is the highest among all neuropteran families. Antlions (Neuroptera, Myrmeleontidae) were surveyed in the desert areas of the Abu Dhabi Emirate, an area which supplies ample suitable species-rich habitats for the antlion fauna. This study aims to summarize the present knowledge of the antlion fauna of the UAE recorded and to examine the geographic and seasonal range of adult antlions. A faunistic survey was conducted for adult myrmeleontids, using light traps in desert sites more than two decades between 1993 and 2016. A total of 69 species belonging to 26 genera were found, of which one is recorded as a species new to science in the UAE. According to the data collected so far, there are seasonal peaks of activity, a major one in April and May and the minor peaks in September, October and November. The geographic ranges of species are recorded and in which 70% antlion species distribution records in the emirate of Abu Dhabi. Four localities in particular (Al Ajban, Sweihan, Al Aslab, Sultan Bin Tahnoon Farm area) stand out as having a larger number of specimens and species than the other sites examined 964, 134, 33, 26 specimens and 25, 16, 10 & 11 species respectively. By comparison, a rich fauna of antlion species (121) is known from the adjacent Saudi Arabian desert of Arabian Peninsula and the expected species from UAE's invertebrate fauna program indicate that the fauna of antlion has not been sufficiently explored.

Imaginal diet of *Chrysoperla renoni* (Lacroix, 1933) (Neuropterida, Chrysopidae)

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The natural food of the marsh green lacewing *Chrysoperla renoni* was described by examination of gut content of samples from France.

Diverse beaded lacewings from the Cretaceous Burmese amber

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Berothidae is a relatively small family of Neuroptera currently comprised approximately 110 extant described species in 24 genera throughout the world (nec Rhachiberothidae). Up to now, 26 genera with about 40 species have hitherto been described in Berothidae, which ranges from Middle Jurassic to Upper Eocene. The Cretaceous berothids are extraordinarily diverse represented by the Myanmar amber that comprising about nine genera and eleven species. Comparing to the compress fossil insects, the Myanmar amber preserved more details of morphological features especially for the genitalia that is generally hard to be preserved in the compress fossil. Herein, we summarized the known Cretaceous Burmese berothids and also provided the information of genitalia referring to four genera *Haploberotha* Engel and Grimaldi, 2008, *Jersiberotha* Grimaldi, 2008, *Dasyberotha* Engel and Grimaldi, 2008. Additionally, two new genus and species were described, *Magniberotha recurrens* Yuan et al., 2016 and *Maculaberotha nervosa* Yuan et al., 2016 that were assigned to the close affiliations with Berothinae based on the characters of genitalia. The outline of female genitalia of the Burmese amber berothids is significant to understand the classification of fossil Berothidae under the framework of the recent insects, which lay the solid foundation to explore the historical evolution of Berothidae incorporating both fossil and extant.

Current status and species diversity of the Neuroptera (lacewings, antlions & owl flies) in the United Arab Emirates

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The United Arab Emirates (UAE) has a remarkable biodiversity of insects and other arthropods. The knowledge of Neuroptera in the various regions of the UAE is incomplete; in this paper, we specifically deal with current status and species diversity of the Neuroptera in the UAE. Based on the results of UAE Insect Project and EAD's Inventory project with specialists on arthropods significantly improved the knowledge on UAE's Invertebrate fauna. There are nearly 4,000 invertebrate species recorded in the Emirates, including 172 species new to science. The order Neuroptera is the only group recorded from the super-order Neuropterida (net-winged insects), which is a moderate insect order in the UAE. From the geographical situation, various desert and semi-desert habitats of the emirates supports suitable habitats where the ant lions (Myrmeleontidae) populate in high diversity over the territory of the UAE. By comparison, the number of neuropteran species known from the Arabian Peninsula includes records of 121 species of Myrmeleontidae, 62 species of Coniopterygidae, 11 species of Ascalaphidae, 12 species of Nemopteridae, and 4 species of Chrysopidae. In the UAE, Myrmeleontidae is the highest among all neuropteran families and currently includes 41 species. The other families recorded are (with respective species numbers): Coniopterygidae (22), Ascalaphidae (5), Nemopteridae (3), Chrysopidae (5), Berothidae (1), Hemerobiidae (2) and Mantispidae (1). The record of *Tomatarella hoelzeli*, which is a new species described from the UAE, suggests that our current knowledge of species diversity of Neuropterida in the UAE is still incomplete and the probability of finding insect species new to science is very high. Presently, biodiversity surveys are being carried out in many protected areas to discover and to provide comprehensive analysis of the complete Neuroptera fauna.

Neuropterology 2018: Participant list

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Brief introduction to the ANL

The Bavarian Academy for Nature Conservation and Landscape Management (ANL) is a non-university research institution within the context of the Bavarian State Ministry for Environment and Consumer protection (StMUV). Conservation research has a long tradition at our Academy.

The research trend in universities tends more and more toward biochemistry, molecular biology and microbiology. It is, therefore, very important to have a research institution like the ANL to pursue answers to questions posed in the areas of nature conservation and landscape management. The ANL has the important task and obligation to act in this area. Conservation research has been and remains an indispensable foundation that provides guide lines for practical conservation work.

For more information please visit our website:
https://www.anl.bayern.de/english/research/index.htm

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