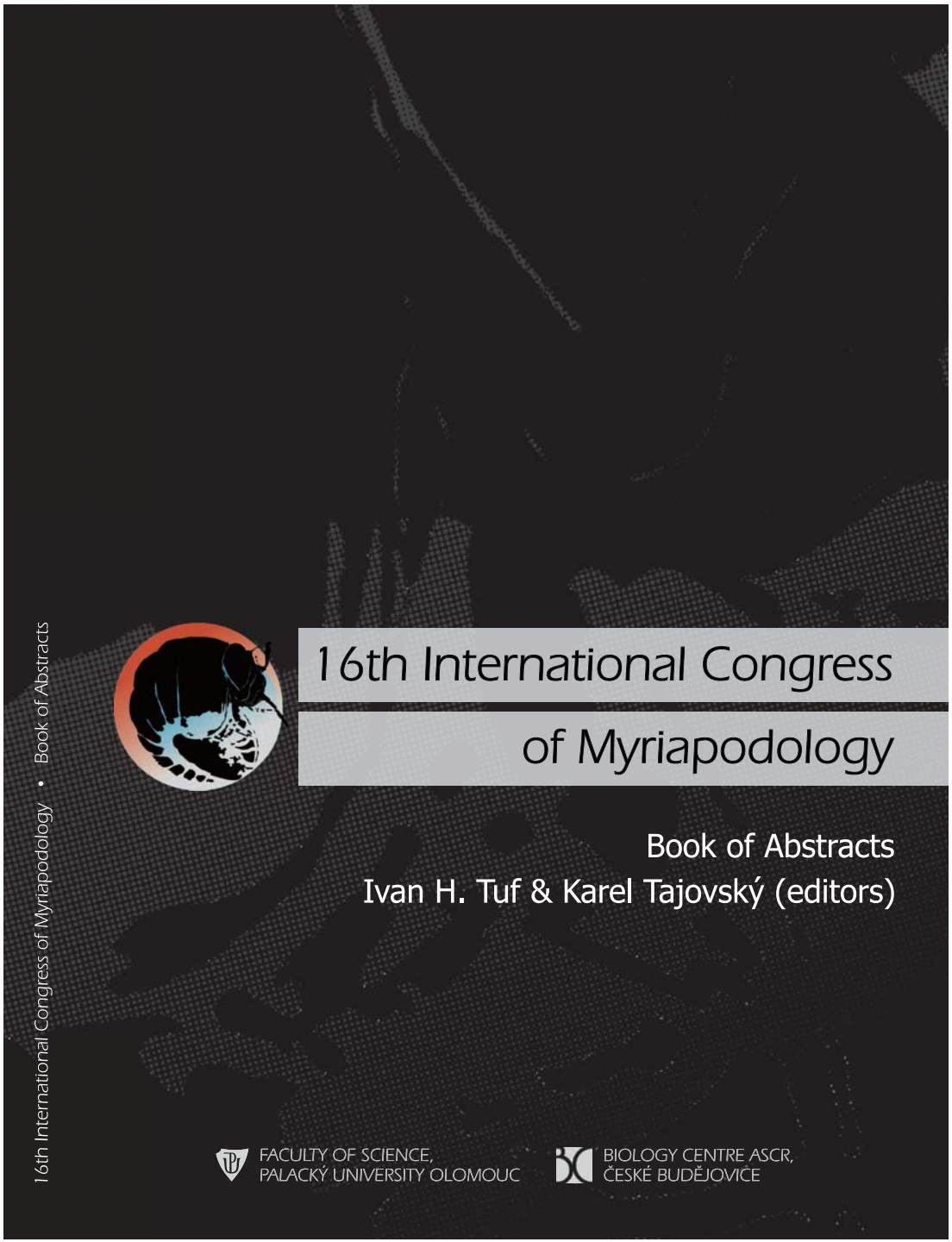

16th International Congress of Myriapodology

Book of Abstracts

Olomouc 2014

16th International Congress of Myriapodology

Book of Abstracts

Ivan H. Tuf & Karel Tajovský (editors)

FACULTY OF SCIENCE,
PALACKÝ UNIVERSITY OLOMOUC

BIOLOGY CENTRE ASCR,
ČESKÉ BUDĚJOVICE

Editors: Ivan H. Tuf, Karel Tajovský

Organizers: Faculty of Science, Palacký University Olomouc
Institute of Soil Biology, BC ASCR České Budějovice

Organizing team:
Ivan H. Tuf, Karel Tajovský,
Blanka Krausová, Michaela Kratochvílová, Martina Janáčková

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Content

Welcome

Dear colleagues and friends,
welcome to the 16th International Congress of Myriapodology!

After a nice, smaller but all the more friendly conference in Brisbane, Australia, we move from the Southern Hemisphere back to Europe. Already during the first historic Congress at Paris in 1968, there was a resolution that the second ICM would be held in 1971 at Brno, in the former Czechoslovakia. Because of the unfavourable political changes during that time this decision was ultimately cancelled. Now, after 43 years we have an opportunity to invite all CIM members and their friends to Olomouc, the Czech Republic.

The 16th International Congress of Myriapodology (16ICM) is held in the main building of the Faculty of Science, Palacký University Olomouc, from **Sunday, 20 July to Friday, 25 July, 2014.**

The scientific programme includes the lectures and poster presentations with a wide spectrum of different aspects of research on myriapods. Unfortunately no presentation at this Congress is dedicated to velvet worms. In addition to the scientific part, we have prepared social events both for participants and their accompanying persons; a welcome party, the main congress excursion, trips for accompanying persons, and a congress dinner.

Hopefully the time during the Congress, including all other events, will provide sufficient opportunities for fruitful discussion, establishing new contacts, and inspiration for future research on myriapodology. The content of this Book of Abstracts providing the information about in sume 109 abstracts of 197 authors and co-authors from 32 countries can be usefull tool for your orientation.

We hope you enjoy the 16ICM and your time in Olomouc!

Karel Tajovský
Ivan H. Tuf
Blanka Krausová
Michaela Kratochvílová
Martina Janáčková

Organizing team of 16ICM

A welcome from the Centre International de Myriapodology (CIM)

This volume contains the abstracts of presentations at the 16th International Congress of Myriapodology, to be held at Olomouc, Czech Republic, 20-25 July, 2014.

Some 91 myriapodologists have registered for the Congress, well over half the membership of the CIM. This volume contains summaries of some 58 lectures and 51 posters that will be presented in Olomouc. Given the size of our community, these figures demonstrate that myriapodologists continue to recognise the value of our gatherings, and we can be optimistic that congresses will continue to attract a healthy level of participation in future years.

The scope of the subjects of the talks demonstrates that we are working on a diverse range of topics. Our traditional strengths – including taxonomy, morphology, biogeography, faunistics and phylogeny – remain strongly represented, as one would expect. It is reassuring for the health of our discipline to see these core strengths are being supplemented by additional, innovative research approaches. Along these lines, we will hear talks on new approaches to imaging and microscopy, bioinformatics and databases, emerging biochemical approaches, and more molecular systematics than we have had in previous CIM congresses. Presentations likewise come from a promising diversity of investigators. Participants span a very broad range of nations as well as career durations, from long-established leaders of myriapodology to students who will be attending a CIM congress for the first time.

On behalf of the CIM, I extend thanks to our hosts in Olomouc – Karel Tajovský, Ivan Tuf and their team – for generously offering to host this Congress, keeping us informed of developments in the lead-up to the Congress via an informative website, and preparing this volume.

Greg Edgecombe
CIM President

General information

Registration desk

The registration desk is open on Sunday, 20 July, from 16:00 to 22:00 at the entrance of the main building of the Faculty of Science, Palacký University Olomouc, (17. listopadu 1192/12, Olomouc; coordinates 49.592358, 17.263750).

During the following Congress days it will be open from 8:30 on the second floor near the Congress Hall. Staff at the registration desk will offer information, accept cash payments (CZK only) for tours by accompanying persons, additional lunches etc.

Supportive functions

Wireless internet connection will be accessible during the Congress in the Congress Venue using specific login and password; there is internet connection using cable in rooms in Student Dormitory too (cables have to be a part of room equipment). Information about connection is available at the registration desk.

Presentations

The lectures are limited to 25 min including discussion. Please pass your presentation files of your lectures to the staff in Congress Hall in sufficient time before your lecture, i.e. at morning before the day's first session or during the lunch break.

Posters can be put up in the foyer of the Congress Hall throughout the entire Congress. Please pass your posters to organizers at the registration desk, and they will arrange them.

Social programme, meals and refreshments

The Welcome Party will take place on the top floor of the Congress Venue at Sunday, 20 July, from 19:00.

Coffee breaks and lunches during the congress days will be served directly nearby the Congress Hall in the Congress Venue. Additional orders for lunches (e.g. for accompanying persons) can be done at registration desk.

On Friday, 25 July, at 19:00, there will be a Congress Dinner in the Congress Venue. There is an extra payment for the Congress Dinner.

Congress excursion

A whole-day Congress excursion will take place on Wednesday, 23 July, starting at 8:30. We shall visit the Javoříčko Caves, the Litovel Brewery (with tasting the beer & lunch) and the Bouzov Castle. The length of the excursion will be ca 10 hours. The excursion fee (guide, transport, admission to castle and caves, brewery, tasting beer, lunch) is included in the full as well as accompanying person fees.

Organizing team

If you need help, ask somebody from our organizing team: Kamila Bártová, Tereza Hájíčková, Martina Janáčková, Lucie Kosíková, Michaela Kratochvílová, Blanka Krausová, Miroslava Kvapilová, Marie Mazáčová, Melina Melliosová, Kristýna Nejedlá, Karel Tajovský, Ivan Hadrián Tuf, Kamila Ulrichová & Adam Vojáček.

Program

SUNDAY, 20 July

16:00-22:00 *Registration*
19:00-22:00 *Welcome Party*

MONDAY, 21 July

from 8:30 *Registration (and during the breaks)*
9:00-9:25 *Opening*

Session 1 *Chair Henrik Enghoff*
9:25-9:50 Joe **Hannibal** *presents* The millipede fauna of the Carboniferous (Stephanian) locality of Montceau-les-Mines, France
9:50-10:15 Megan **Short** *presents* Polyxenida of the Caucasian region
10:15-10:40 *Coffee Break*
10:40-11:05 Zoltán **Korsós** *presents* The millipedes of Palau
11:05-11:30 Stelios **Simaiakis** *presents* Biogeographical patterns in the distribution of European centipedes
11:30-11:55 Natdanai **Likhitrakarn** *presents* Taxonomy, distribution and conservation of millipedes in Thailand
11:55-12:20 Blanka **Ravnjak** *presents* Overview of current state of research on centipede in Slovenia
12:20-13:30 *Lunch*

Session 2 *Chair Zoltán Korsós*
13:30-13:55 Elena **Mikhaljova** *presents* Endemics in the millipede fauna of the Asian part of Russia
13:55-14:20 László **Dányi** *presents* Contribution to the knowledge on the geophilomorph centipedes of the Ryukyu Islands (Japan)
14:20-45:45 Roghaieh **Zarei** *presents* Geophilomorpha of Iran
14:45-15:10 Amazonas **Chagas-Jr.** *presents* Too many legs? A taxonomic review of the centipede *Scolopendropsis*
15:10-15:35 Cuong **Huynh** *presents* Description of a new species of penicillate millipede from the genus *Monographis* found in Vietnam
15:35-16:05 *Coffee Break*

Session 3 *Chair Jean-Jacques Geoffroy*
16:05-16:30 Dragan **Antić** *presents* Family Anthroleucosomatidae – a diversity hotspot on Caucasus
16:30-16:55 Sergei **Golovatch** *presents* The cave Diplopoda of southern China with reference to millipede diversity in Southeast Asia
16:55-17:20 Ana **Komerički** *presents* At the end of the rope: *Geophilus hadesi* n. sp. – the world deepest cave-dwelling centipede
17:20-17:45 Branka **Vode** *presents* Characterictics of centipede assemblies in some frost hollows in Slovenian Dinaric karst
18:30-22:00 *guided short tour into city centre and tasting beer in Svatováclavský brewery (free for accompanying persons)*

TUESDAY, 22 July

Session 4 *Chair Greg Edgecombe*

9:00-9:25 Andy **Sombke** *presents* Past and present – microCT analyses of extant and fossil myriapods

9:25-9:50 Nesrine **Akkari** *presents* Innovative approaches, interactive tools, modern imaging: pushing the boundaries of myriapod taxonomy

9:50-10:15 Pavel **Stoev** *presents* Blowing the dust off the old publications: an enhanced cybertaxonomic checklist of *Eupolybothrus*

10:15-10:40 *Coffee Break*

Session 5 *Chair Pavel Stoev*

10:40-11:05 Oliver **Macek** *presents* Cocktails and pills: A COI primer cocktail for pill millipedes

11:05-11:30 Thomas **Wesener** *presents* The GBOL – Myriapoda project: insights and shortcomings in the Barcoding of myriapods

11:30-11:55 Lucio **Bonato** *presents* Unlocking the diversity of European geophilomorph centipedes: from a consistent checklist to an interactive identification tool

11:55-12:20 Petr **Dolejš** *presents* Type specimens of centipedes in the National Museum, Prague (Czech Republic)

12:20-13:30 *Lunch*

Session 6 *Chair Thomas Wesener*

13:30-13:55 Nattarin **Wongthamwanich** *presents* Postembryonic development of the giant pill-millipede *Zephronia siamensis*

13:55-14:20 Jean-Francois **David** *presents* The life cycle of *Ommatoiulus sabulosus aimatopodus* in southern France

14:20-45:45 Cuong **Huynh** *presents* Segmentation and leg development in penicillate millipedes

14:45-15:10 Bojan **Ilić** *presents* Sexual body size and shape dimorphism in *Apfelbeckia insculpta*

15:10-15:35 Christian **Kronmüller** *presents* On the function of the ultimate legs in some Scolopendridae

15:35-16:05 *Coffee Break*

Session 7 *Chair Karel Tajovský*

16:05-16:30 Markus **Koch** *presents* Feeding mechanisms in myriapods: the evolution of tentorial mobility revisited

16:30-16:55 Vladimír **Šustr** *presents* Digestive enzymes in digestive tract of spirostreptid and spirobolid millipedes

16:55-18:30 *Poster Session*

WEDNESDAY, July 23

8:30-18:30 *Excursion*

THURSDAY, July 24

Session 8 *Chair Willi Xylander*

9:00-9:25 Günther **Raspotnig** *presents* Beyond benzoquinones: chemical diversity of defensive secretions in the Julida

9:25-9:50 Dragan **Antić** *presents Pachyiulus hungaricus* – a model-system for semiochemical analysis and antimicrobial testing

9:50-10:15 Grzegorz **Kania** *presents* Compounds of defensive secretion in millipede species of Julida

10:15-10:40 *Coffee Break*

Session 9 *Chair Markus Koch*

10:40-11:05 Carsten **Müller** *presents* The epidermal glands of Myriapoda: ultrastructural diversity, function and phylogenetic resolving potentials

11:05-11:30 Henrik **Enghoff** *presents* Ectoparasitic fungi (Laboulbeniales) on millipedes

11:30-11:55 Eivind **Undheim** *presents* Centipede venom evolution: casting light on a neglected group of venomous animals

11:55-12:20 Bojan **Mitic** *presents* Defensive secretion of proteinaceous glues by *Henia illyrica*

12:20-13:30 *Lunch*

Session 10 *Chair Bruce Snyder*

13:30-13:55 Irina **Zenkova** *presents* Diversity and distribution of centipedes in plain and mountain ecosystems of the Kola North

13:55-14:20 Pavel **Nefediev** *presents* A review of the anthropochore fauna of Asian Russia, with new records from the Altai Province, Siberia

14:20-45:45 Gabriella **Papastefanou** *presents* Centipede assemblages along an urbanization gradient in the city of Heraklion (Crete, Greece)

14:45-15:10 Jean-Jacques **Geoffroy** *presents* Building biodiversity in Paris area (France): green roofs and vegetated facades as habitats for myriapod and woodlice communities

15:10-15:35 Pavel **Kocourek** *presents* Millipedes of Prague (Central Bohemia)

15:35-16:05 *Coffee Break*

Session 11 *Chair Megan Short*

16:05-16:30 Karel **Tajovský** *presents* Climate and weather versus millipedes – a little story of *Cylindroiulus caeruleocinctus*

16:30-16:55 Irina **Semenyuk** *presents* Climatic factors and the ecological diversity of millipede communities in a latitudinal gradient

16:55-17:20 Dávid **Bogyó** *presents* Habitat associations of millipedes in a grassland-edge-forest complex

17:20-17:45 Stelios **Simaiakis** *presents* Modelling and predicting centipede species distribution in Norway

17:45-18:10 Ivan **Tuf** *presents* Bait traps for sampling soil dwelling myriapods

FRIDAY, July 25

Session 12	*Chair Amazonas Chagas-Jr.*
9:00-9:25	John **Lewis** *presents* On the consistency of some taxonomic characters in the Scolopendromorpha and comments on two problematic genera
9:25-9:50	Greg **Edgecombe** *presents* Species delimitation and phylogeography of *Newportia* in the Mesoamerican region and implications for widespread morphospecies
9:50-10:15	Warut **Siriwut** *presents* Morphological and molecular variation in the common large centipede *Scolopendra dehaani* in Thailand
10:15-10:40	*Coffee Break*
Session 13	*Chair Stelios Simaiakis*
10:40-11:05	Varpu **Vahtera** *presents* First molecular data and the phylogenetic position of the peculiar Borneo centipede *Edentistoma octosulcatum*
11:05-11:30	Laura **Del Latte** *presents* A molecular-based study on *Stenotaenia* species diversity and relationships in the Italian region
11:30-11:55	Thomas **Wesener** *presents* Steps towards a better supported phylogeny of the Diplopoda: additional morphological characters via modern imaging techniques
11:55-12:20	Jan Philip **Oeyen** *presents* The phylogeny of the pill millipedes: first insights and a basic framework
12:20-13:30	*Lunch*
Session 14	*Chair Nes Akkari*
13:30-13:55	Bojan **Mitic** *presents* Parental care in centipedes: a phylogenetic perspective
13:55-14:20	Boyan **Vagalinski** *presents* What is the value of non-gonopodal sexual characters in the systematics and phylogeny of the family Julidae?
14:20-45:45	Piyatida **Pimvichai** *presents* Systematics of the millipede family Pachybolidae, with emphasis on the Southeast Asiatic fauna
14:45-15:10	João Paulo **Pena-Barbosa** *presents* A phylogenetic framework of the family Chelodesmidae
15:10-15:35	Hans **Reip** *presents Loboglomeris rugifera* – an example of color polymorphism in Glomerida
15:35-16:05	*Coffee Break*
16:05-17:30	*CIM agenda & closing*
19:00-23:00	*Congress Dinner (not included in Fee)*

List of posters

Darina **Bachvarova**, Aleksandar **Doichinov** & Pavel **Stoev**: Habitat preferences and effect of environmental factors on the seasonal activity of *Lithobius nigripalpis* L. Koch, 1867 (Chilopoda: Lithobiomorpha: Lithobiidae)

Michaela **Bodner** & Günther **Raspotnig**: "Chemical cocktails" – the defensive secretions of the Cylindroiulini (Diplopoda, Julida)

Francesca **Bortolin**, Lucio **Bonato**, Laura **Del Latte** & Giuseppe **Fusco**: Himantariids of the genera *Haplophilus*, *Nesoporogaster* and *Stigmatogaster*: A preliminary molecular phylogeny

Chao-chun **Chen**, Sergei **Golovatch** & Hsueh-Wen **Chang**: Review the East and Southeast Asian millipede genus *Nedyopus* Attems, 1914 (Diplopoda, Polydesmida, Paradoxosomatidae, Nedyopodini)

Cathrin **Conrad** & Thomas **Wesener**: The status of enigmatic, microendemic pill millipede species of the genus *Glomeris* in northern Italy (Diplopoda, Glomerida)

Fabio Germán **Cupul-Magaña** & Julián **Bueno-Villegas**: Myriapods records at the Chamela-Cuixmala Biosphere Reserve, Jalisco, Mexico

László **Dányi**: Slide mounting of centipedes: A review and two new methods for making permanent and temporary slides

Peter **Decker**: Revision of the family Andrognathidae in Southeast Asia (Diplopoda: Platydesmida) with descriptions of six new species

Peter **Decker**: Some important taxonomical characters in the Australian genus *Pogonosternum* (Diplopoda: Polydesmida: Paradoxosomatidae)

Tvrtko **Dražina**: Diplopod subterranean biodiversity – a case from Croatian part of Dinaric Karst

Aleksandr **Evsyukov** & Sergei **Golovatch**: The millipede genus *Strongylosoma* Brandt, 1833 in the Caucasus (Diplopoda, Polydesmida, Paradoxosomatidae)

Andrei **Giurginca**, Karel **Tajovský** & Ivan H. **Tuf**: Millipedes (Diplopoda) and centipedes (Chilopoda) from the city of Bucharest, Romania: An introduction study

Gero **Hilken**, Gregory D. **Edgecombe**, Carsten H.G. **Müller**, Andy **Sombke** & Jörg **Rosenberg**: The tracheal systems of three species of Notostigmophora (Chilopoda): Notes on interaction of tracheae with epidermal glands

Barbara **Jäschke**, Andreas **Gerlach**, David **Russell** & Jörg **Römbke**: Direct and indirect effects of climate change on decomposition activity of diplopods

Maja **Kastelic** & Ivan **Kos**: Changes of centipede communities on abandoned agriculture land in »Zgornja kolpska dolina« (Osilnica, Slovenia)

Pavel **Kocourek** & Jan **Mourek**: *Polyxenus lagurus* – the usefulness and beauty in detail

Mzia **Kokhia**, Manana **Lortkipanidze** & Oleg **Gorgadze**: Diplopod feeding activity in relation to habitat choice in eastern Georgia, Caucasus

Christian **Kronmüller**: Male sexual organs as a new key feature in modern taxonomy within the genus *Scolopendra* (Chilopoda, Scolopendromorpha Scolopendridae)

Michalina **Kszuk-Jendrysik**, Agnieszka **Sosinka**, Magdalena M. **Rost-Roszkowska**, Jitka **Vilimova**, Karel **Tajovský**, Izabela **Poprawa**, Marta **Hyra**, Lidia **Sonakowska** & Karolina **Kamińska**: Types of secretion in the midgut epithelium of millipedes (Myriapoda, Diplopoda)

Michalina **Kszuk-Jendrysik**, Agnieszka **Sosinka**, Magdalena M. **Rost-Roszkowska**, Jitka **Vilimova**, Karel **Tajovský**, Izabela **Poprawa**, Marta **Hyra**, Lidia **Sonakowska** & Karolina **Kamińska**: Ultrastructure of the digestive cells in millipedes (Myriapoda, Diplopoda)

Michalina **Kszuk-Jendrysik**, Agnieszka **Sosinka**, Magdalena M. **Rost-Roszkowska**, Jitka **Vilimova**, Karel **Tajovský**, Izabela **Poprawa**, Marta **Hyra**, Lidia **Sonakowska** & Karolina **Kamińska** & Angelika **Marchewka**: SEM image of the midgut epithelium of *Telodeinopus aoutii* (Myriapoda, Diplopoda)

Małgorzata **Leśniewska**, Piotr **Jastrzębski**, Marzena **Stańska** & Izabela **Hajdamowicz**: Centipede (Chilopoda) diversity in the Bug River Valley (E Poland)

Carlos A. **Martínez-Muñoz**: Type locality assignation to *Rhinocricus duvernoyi* (Karsch, 1881) (Diplopoda: Spirobolida: Rhinocricidae)

Bojan M. **Mitić**, Nebojša V. **Živić**, Dalibor Z. **Stojanović**, Dragan Ž. **Antić**, Bojan S. **Ilić** & Slobodan E. **Makarov**: The centipedes (Chilopoda) of Serbia (including Kosovo and Metohija)

Andrej **Mock** & Karel **Tajovský**: Ján Gulička (1925–2009) – famous and almost forgotten Slovak (Czechoslovak) myriapodologist

Andrej **Mock**, Karel **Tajovský**, Martina **Žurovcová**, Dorottya **Angyal** & Pavel **Kocourek**: *Hungarosoma bokori* Verhoeff, 1928 (Diplopoda, Chordeumatida), a tiny and enigmatic millipede: Redescription and new light to its systematics, ecology and biogeography

Carsten H.G. **Müller**, Jörg **Rosenberg** & Andy **Sombke**: The shaft organ of *Scutigera coleoptrata*: The long-sought hygroreceptor of scutigeromorph centipedes?

Carsten H.G. **Müller** & Nicholas J. **Strausfeld**: Searching for the ancestral motion-detecting circuit of Mandibulata

Carsten H.G. **Müller**, Thede **Witschel**, Thomas **Hörnschemeyer**, Michael **Laue** & Andy **Sombke**: Fine structure of trimodal beak-shaped sensilla of *Scutigera coleoptrata* (Chilopoda: Scutigeromorpha)

Pavel S. **Nefediev**, Iurii V. **Dyachkov** & Julia S. **Nefedieva**: Fauna and ecology of millipedes (Diplopoda) in the Tigirek State Nature Reserve, Russian Altai

Julia S. **Nefedieva**, Pavel S. **Nefediev**, Miroslava B. **Sakhnevich** & Iurii V. **Dyachkov**: Distribution of millipedes (Diplopoda) along an altitudinal gradient in the south of Lake Teletskoye, Altai Mts.

Jan Philip **Oeyen** & Thomas **Wesener**: The evolutionary history of the rediscovered Austrian population of the giant centipede *Scolopendra cingulata* Latreille, 1829 (Chilopoda, Scolopendromorpha)

Ansgar **Poloczek**, Martin **Pfeiffer**, Rolf **Schneider** & Michael **Mühlenberg**: The Chilopods of the Khentey-Mountain Range, Northern Mongolia: Communities from different forest-types under a varying fire regime

Michal **Rendoš** & Andrej **Mock**: Diversity and spatiotemporal dynamics of myriapods in forested talus deposit (Slovakia, the Western Carpathians)

Karina **Sánchez-Echeverria**, Ignacio **Castellanos** & Julián **Bueno-Villegas**: Microhabitat use by the millipede *Rhysodesmus byersi* (Polydesmida, Xystodesmidae) in an introduced pasture and a pine-oak forest in Mexico

Karina **Sánchez-Echeverria**, Ignacio **Castellanos** & Julián **Bueno-Villegas**: Relationship between millipede body size and altitude, latitude, precipitation, and temperature (Polydesmida: Xystodemidae: *Rhysodesmus*)

Pavel **Saska**, Milan **Kos** & Jan **Lukáš**: Diel activity of *Cylindroiulus caeroleocinctus*

Warut **Siriwut**, Ueangfa **Bantaowong**, Chirasak **Sutcharit**, Gregory D. **Edgecombe**, Piyoros **Tongkerd** & Somsak **Panha**: First record of the scolopendrid centipede genus *Digitipes* Attems, 1930 from Myanmar

Andy **Sombke**, Gero **Hilken**, Jörg **Rosenberg** & Alfred **Ernst**: Structure and distribution of antennal sensilla in centipedes

Bruce A. **Snyder**: Notes on the life history and ecology of grassland millipedes

Vladimír **Šustr**, Stanislava **Semanová** & Karel **Tajovský**: Individual development of Spirostreptidae: Morphological observations and quantitative measurements

Nikolaus U. **Szucsich**, Daniela **Bartel**, Karen **Meusemann**, Ryuchiro **Machida**, Bernhard **Misof** & Günther **Pass**: The phylogenetic position of Symphyla and Pauropoda: A phylogenomic approach

Karel **Tajovský**: Long term changes in millipede assemblages (Diplopoda) in alpine habitats on granite and limestone bedrocks in the West Tatra Mts., Slovakia

Karel **Tajovský** & Ivan H. **Tuf**: Annotated checklist of millipedes (Diplopoda) of the Czech Republic

Ivan H. **Tuf**, Lucie **Čmielová** & Jan **Šipoš**: Volvation of pill millipede *Glomeris pustulata*

Ivan H. **Tuf** & Karel **Tajovský**: Annotated checklist of centipedes (Chilopoda) of the Czech Republic

Lukáš **Velíšek** & Karel **Tajovský**: Communities of myriapods (Diplopoda and Chilopoda) in mountain spruce forests after bark beetle outbreak with different subsequent management: Differences or similarities?

Karin **Voigtländer**, Peter **Decker**, Ulrich **Burkhardt** & Jörg **Spelda**: An annotated checklist of Sympyhla and Pauropoda (Myriapoda) of Germany

Thomas **Wesener**: Morphological adaptations of the Termitodesmidae, the only obligate insectophilous millipede family (Diplopoda, Glomeridesmida)

Jolanta **Wytwer**, Karel **Tajovský**, Tomasz **Lamorski**, Paweł **Nicia**, Václav **Pižl**, Josef **Starý** & Maria **Sterzyńska**: Do patches of alder bog forest enhance the myriapod diversity in the Cartpathians?

Willi E. R. **Xylander**: Cellular immune reactions in Myriapoda: Hemocytic encapsulation in vitro

Accompanying person program

Monday, 21 July, start at 14:30, length 2-3 hours, price 300 CZK (≈11 EUR)
Guide tour in historic city Olomouc

- Holy Trinity Column
- Town Hall
- Church of St. Maurice
- Church of the Virgin Mary of the Snow
- St Michael´s Church
- Chapel of St. John Sarkander
- Six Baroque fountains (Hercules, Caesar, Jupiter, The Triton, Mercury, Neptune)

Price includes: guide, tour with a professional foreign language commentary on the history of Olomouc, up the tower in Church of St. Maurice

Tuesday, 22 July, start at 9:00, length 5-6 hours, price 470 CZK (≈ 17 EUR)
Bus trip to Helfštýn Castle and The Zbrašov Aragonite Caves near town Teplice nad Bečvou

- Helfštýn Castle
- The Zbrašov Aragonite Caves

Price includes: guide, transport, admission to castle and caves
Price does not include: lunch

Wednesday, 23 July, start at 8:30, length ca 10 hours, price is included in Fee
Whole-day congress excursion

- The Javoříčko Caves
- Litovel Brewery with tasting beer
- Bouzov Castle

Price includes: guide, transport, admission to castle and caves, brewery, tasting beer, lunch

Thursday, 24 July, start at 9:00, length ca 5 hours, price 500 CZK (≈ 18 EUR)
Bus trip to Kroměříž

- Archbishop´s Chateau in Kroměříž – UNESCO World Heritage
- Gardens

Price includes: guide, transport, admission to castle and gardens
Price does not include: lunch

Friday, 25 July, start at 10:00, length ca 5 hours, price 300 CZK (≈ 11 EUR)
Trip to Svatý Kopeček (Saint Hill) above Olomouc City

- ZOO Olomouc
- Minor Basilica of the Visitation of the Blessed Virgin Mary

Price includes: guide, tickets to city public transport, admission to ZOO
Price does not include: lunch

Abstracts of lectures and posters arranged in alphabetical order of authors

Presenting authors of lectures are underlined

Innovative approaches, interactive tools, modern imaging: Pushing the boundaries of myriapod taxonomy

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Despite the urgent need to document the planet's diversity, the morphology-based taxonomy is facing a continuous decline and a lack in human and financial resources. Since the time of Linnaeus approximately 1.9 million species have been described which, however, accounts for only a moderate fraction of global species diversity. This forces taxonomists to look for alternative methods that could accelerate the pace of species discovery and description. In today's rapidly developing world, the use of the modern technologies has become vital in any taxonomic work to enhance and catalyze species descriptions. However, in myriapodology, only a few attempts have been made in this respect, ranging from using next generation molecular sequencing, jumping into the vast world of cybertaxonomy, to exploring novel methods of species illustration and presenting identification keys.

Here we review the state-of-the art innovative approaches hitherto published in taxonomic works on myriapods, and we present the latest contribution in this field.

LECTURE

Family Anthroleucosomatidae – a diversity hotspot on Caucasus (Diplopoda, Chordeumatida)

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Within order Chordeumatida, with about 50 families, Anthroleucosomatidae is one of the most heterogeneous and least understood. Up to this statement, family Anthroleucosomatidae included 23 genera and about 50 species with a disjunct distribution in Europe, Asia and North America. Of these numbers, even 15 genera and about 35 species can be found on the Balkan Peninsula which made this region as candidate for the one of the main centre of diversification of this interesting group of diplopods, for a long time.

Caucasus, as one of the World biodiversity hotspots, was poorly studied in the terms of Chordeumatida, especially family Anthroleucosomatidae, despite a large collection. Only three monotypic genera, and one *Anamastigona* species were known from this important region. After examination of abundant anthroleucosomatidan material we find out that generic and species diversification on Caucasus are much greater then only four previously described species. Nine new genera and 31 new species for science, as well as one new genus for this region are further evidence of why the Caucasus is one of the diversity hotspots. With four "old" species, we can calculate that Caucasus is inhabited by a total of 36 anthroleucosomatid species within 14 genera. This fact indicates that the Balkan Peninsula and the Caucasus were equally important for diversification of different lineage of Anthroleucosomatidae, and provides a proof about earlier connection between these regions.

General distribution of Caucasian Anthroleucosomatidae showed that only three genera have wider distribution; moreover these genera include the greatest number of species. Of these, genus *Caucaseuma* is more abundant, with nine species, distributed on the Greater Caucasus, only. Genus *Persedicus,* with five species, show the widest distribution: from the Mountain Elburz on the Southeast, to Krasnodar Province on the Northwest. Apart of these two genera, one new genus, with four species, is distributed on the Lesser Caucasus, Southeast part of Greater Caucasus, and with one species on Northwest side of Greater Caucasus. Other genera are with three (one genus), two (five genera) and one (five genera) species, respectively, and with much narrower distribution.

LECTURE

Habitat preferences and effect of environmental factors on the seasonal activity of *Lithobius nigripalpis* L. Koch, 1867 (Chilopoda: Lithobiomorpha: Lithobiidae)

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The activity of animals is defined mostly by internal genetic mechanisms, but physical factors, such as temperature, soil pH, light duration, and humidity, play a role in the regulation of this biological process. For centipedes, for example, humidity is one of the key environmental factors that determine their distribution and activity. However, abiotic and biotic factors such as soil pH, temperature, vegetation type and human disturbance remain relatively understudied and little is known on their importance for the centipede activeness.

Here we present a study on the habitat preferences and seasonal activity of *Lithobius nigripalpis* L. Koch, 1867, a species that is widely distributed in the Balkan Peninsula and Anatolia. The study was carried out from May 2007 to May 2009 in the city of Shumen, NE Bulgaria, and its surroundings. Pitfall trapping was used to determine its seasonal activity and habitat preferences in a range of ecosystems subjected to different degrees of human pressure. Using the software packages SPSS 9.0 and StatPlus 3.5.3 a number of statistical analyses were employed to test which environmental factors are relevant to the activity and distribution of the species and which aren't.

Our study revealed that in the studied region *L. nigripalpis* is euryoecious species, which occurs in all habitat types. However, it demonstrates clear preference for undisturbed open habitats, in particular xerothermic shrubby grasslands of the phytocoenose *Festuco-Brometea*. The species shows highest activity during the summer season (June to September), with peaks in July and August. The environmental factors that have highest significance for its seasonal activity are the air and soil temperatures, and the soil humidity.

The work has been financially supported by project BG051PO001-3.3.06-0003 "Building and steady development of PhD students, post-PhD and young scientists in the areas of the natural, technical and mathematical sciences".

POSTER

"Chemical cocktails" – the defensive secretions of the Cylindroiulini (Diplopoda, Julida)

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Diplopods are well known to produce defensive secretions for chemical protection in a wide sense, such as against predators and microorganisms. The Juliformia, for instance, are known for their benzoquinone-rich secretions, commonly producing 2-methyl-1,4-benzoquinone (toluquinone) and 2-methoxy-3-methyl-1,4-benzoquinone as main components.

We here investigated the defensive chemistry of the Cylindroiulini, a speciose tribe in the family Julidae, proving that cylindroiuline secretions show considerably higher chemical diversity than hitherto expected: in detail, secretions from eight species from all five genera (*Allajulus*, *Cylindroiulus*, *Enantiulus*, *Kryphioiulus* and *Styrioiulus*) were extracted and analyzed by gas-chromatography and mass spectrometry. 1) Except for *Styrioiulus*, an extensive and specifically composed quinone fraction could be detected, comprising compounds out of a pool of seven different quinones, including 2-methyl-1,4-benzoquinone (toluquinone); 2-hydroxy-3-methyl-1,4-benzoquinone; 2-methoxy-3-methyl,1,4-benzoquinone; 2,3-dimethoxy-1,4-benzoquinone; 2,3-dimethoxyhydroquinone; 2-methoxy-3-methylhydroquinone, and 2,3-dimethoxy-5-methyl-1,4-benzoquinone. Toluquinone, a major compound in the defensive secretions of most juliform diplopods is reduced to a minor component in *A. molybdinus* and *K. occultus* and is completely absent from the secretions of *A. dicentrus*, *E. nanus* and *E. transsilvanicus*. In both species of *Styrioiulus* (*S. pelidnus* and *S. styricus*) toluquinone is a minor component and 2-methoxy-3-methyl-1,4-benzoquinone is completely missing. 2) Apart from quinones, a series of alkenols and alkenals was found in the secretions of *Allajulus dicentrus*, a set of different alkanols in *Enantiulus transsilvanicus* and *Cylindroiulus apenninorum* and phenols in *Styrioiulus*. Furthermore, all cylindroiuline extracts exhibited a cluster of compounds of low volatility, mainly constituting of hexyl-esters of long chain carboxylic acids.

These results not only demonstrate a high degree of variation of the "common" juliform benzoquinone-fractions in the secretions of the Cylindroiulini but also a significant contribution of novel, non-benzoquinone components. These novel compounds are considered valuable characters to trace evolutionary lineages in the Cylindroiulini.

POSTER

Habitat associations of millipedes in a grassland-edge-forest complex

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We studied the habitat associations of millipedes in grassland – forest edge – forest interior habitats in oak forest patches – grassland complex in the Hajdúság Landscape Protection Area (NE Hungary). The habitat types were as follows: (1) a closed oak forest with shrubs and herbs, (2) a forest edge with increased ground vegetation and shrub cover, and (3) a mesophilous grassland with dense herbaceous vegetation. We collected millipedes every month during the vegetation period by litter and soil sifting, using a metal frame (25 cm by 25 cm, and a depth of 5 cm). Millipede individuals were hand sorted in laboratory. There were 30 sifted litter and soil samples: 2 spatial replicates × 3 habitat types × 5 litter sifter. We collected 9 millipede species: *Brachyiulus bagnalli, Brachydesmus superus, Glomeris tetrasticha, Julus terrestris, Kryphioiulus occultus, Leptoiulus cibdellus, Mastigona bosniense, Megaphyllum unilineatum, Polydesmus complanatus*. The most abundant species was *Glomeris tetrasticha*, which was the most abundant species in the forest edge as well. The most abundant species of the grassland habitat was *Megaphyllum unilineatum*, while the most abundant millipede of the forest interior was *Kryphioiulus occultus*. Our result showed that the number of species was less in the grassland than in the edge and in the forest; there were no difference in the number of species between the forest edge and the forest. We found the highest number of individuals in the forest edge. We found by NMDS ordination that there was no difference in the species composition of the millipedes between edge and forest habitats; the grassland habitats were separated from them.

LECTURE

Unlocking the diversity of European geophilomorph centipedes: From a consistent checklist to an interactive identification tool

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The European centipede fauna has been investigated more thoroughly than those in other continents and accounts for more than 1/3 of the nominal species described in the world. Geophilomorpha alone represent more than 1/3 of the known centipedes, both in Europe and in the world. Nevertheless, even in Europe the actual taxonomic diversity of these animals and the geographical and ecological distribution of the species are still at a very unsatisfactory level of knowledge. At present, however, further taxonomic progress, faunistic investigations and ecological research on these animals are hampered and discouraged by the fact that most contributions published in the past by different authors working on different countries are still scattered in the literature, in different languages and often inconsistent and redundant.

As a necessary step towards elaborating a consistent framework to fuel further research on the biology, evolution and ecology of European Geophilomorpha, we synthesized critically all available knowledge into: (i) a preliminary checklist of all known species (179 species, including species of uncertain identity and those whose morphology is only partially known), revising names and reinterpreting synonyms; (ii) an illustrated glossary of the morphological terminology applying to all characters of diagnostic value; (iii) a matrix-based, interactive tool, freely available through the web, to allow identification of all species (www.interactive-keys.eu/chilokey).

LECTURE

Himantariids of the genera *Haplophilus*, *Nesoporogaster* and *Stigmatogaster*: A preliminary molecular phylogeny

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Centipede species traditionally included in the genera *Haplophilus*, *Nesoporogaster* and *Stigmatogaster* represent one of the major radiations within the himantariids. More than 30 species and subspecies have been described belonging to these three genera, but the taxonomy is still very uncertain, as well as the phylogenetic relationships, resulting in uncertainties in classification even at the genus level.

Here we present some preliminary results from a maximum-likelihood phylogenetic analysis of COI and 28S gene sequences from a sample of these himantariid taxa. Because of the difficulty in obtaining specimens suitable for DNA extraction, our starting dataset includes nine taxonomic units only, currently assigned to six species, from most parts of the European range of the group. We found evidence that the species hitherto included in *Haplophilus*, *Nesoporogaster* and *Stigmatogaster* represent a monophyletic clade, and that the northern, oligopodous species *H. subterraneus* most probably originated within a southern pool of polypodous species. Major morphological transformations occurred during the evolutionary radiation of the group. These include the arrangement of the pore-fields, which in some taxa expanded from the anterior part of the trunk to reach the posterior part of it, and the distribution of the coxal pores, which in nearly the same taxa, from the primitive condition of being spread over the entire surface of the coxopleuron, became restricted into a narrow dorsal pouch within it.

POSTER

Too many legs? A taxonomic review of the centipede *Scolopendropsis* (Chilopoda, Scolopendromorpha)

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Taxonomy of *Scolopendropsis* and its close relative *Rhoda* has been unstable for more than 120 years. Both genera are endemic to Brazil and they have in turns been treated either as distinct genera or as one genus. *Scolopendropsis* is composed of two species (*S. bahiensis* (Brandt, 1840) and *S. duplicata* Chagas-Jr, Edgecombe & Minelli, 2008), and *Rhoda* of three species (*R. thayeri* Meinnert, 1886, *R. isolata* Chamberlin, 1944 and *R. spinifer* (Kraepelin, 1903)). Traditionally, the only difference between the two genera has been the number of leg-bearing segments, 23 in *Scolopendropsis* and 21 in *Rhoda*. Schileyko (2006) reviewed the type specimen of *S. bahiensis* and concluded that it is most likely conspecific with *R. calcarata* and the difference in the number of leg-bearing segments would be due to intraspecific variation. As no taxonomic review of the genera has been performed, we here propose a morphological and molecular review of all species of *Scolopendropsis* and *Rhoda*. The type material of all species was examined, except for the type of *S. bahiensis*. More than 150 specimens deposited in the collections of the Museu Nacional (MNRJ), Museu de Zoologia de São Paulo (MZSP), Instituto Butantan (IBSP), American Museum of Natural History (AMNH), Museum of Comparative Zoology (MCZ), National Museum of Natural History, Smithsonian (NMNH) were also examined. Fresh samples of all *Rhoda*/*Scolopendropsis* species from different localities in Brazil and in the type localities were collected. The results of the morphological analysis show that all species of *Rhoda* belong to *Scolopendropsis*. Moreover, it was observed that there are specimens of "*Rhoda thayeri*" from southern Bahia and northern Espírito Santo that differ from the type of "*Rhoda thayeri*" from Santarém, state of Pará. There are also two different morphs assigned to *S. bahiensis* that are differ from the type of *S. bahiensis*. Until obtaining the results from the ongoing molecular work, we prefer to keep the specimens from southern Bahia and from northern of Espírito Santo as "*Rhoda thayeri*" and *S. bahiensis* respectively. All species of *Rhoda* are transferred to *Scolopendrospis* and the genus is now composed of five species. It is likely that the diversity of the genus is greater than we assumed.

LECTURE

Review the East and Southeast Asian millipede genus *Nedyopus* Attems, 1914 (Diplopoda, Polydesmida, Paradoxosomatidae, Nedyopodini)

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The millipede genus *Nedyopus* Attems, 1914 belongs to the monogeneric tribe Nedyopodini and currently contains a total of 14 species. *Nedyopus cingulatus* (Attems, 1898), is the valid type species by original designation, with three junior synonyms: *N. patrioticus* (Attems, 1898), *N. koreanus* Verhoeff, 1936, syn. n., and *N. koreanus niponianus* Verhoeff, 1940, syn. n. Two species are erected from subspecies to full species: *N. ikaonus* (Attems, 1909) status n. and *N. unicolor* (Carl, 1902) status n., the latter taxon with three junior synonyms: *N. hiburizimensis* Miyosi, 1955, syn. n., *N. venustus* Shinohara, 1963 syn. n., and *N. hiburizimensis aquilus* Haga, 1968 syn. n. One species, *N. dawydoffiae* (Attems, 1953), is removed from the genus. All of the species are keyed and their distribution data provided. *Nedyopus* species appear to be localized in distributions. *N. cingulatus* (Attems, 1898) is the only relatively widely spread species, as it occurs across Korea, in the southern parts of the Russian Far East and Japan. Most *Nedyopus* species occur at low elevations, but some congeners endemic to Taiwan live at middle elevations, sometimes even at high altitudes, up to 2553 m a.s.l. Taiwan also possesses a high species diversity of genus *Nedyopus* compared to other regions.

POSTER

The status of enigmatic, microendemic pill millipede species of the genus *Glomeris* in northern Italy (Diplopoda, Glomerida)

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Of the Holarctic pill millipede order Glomerida, the European genus *Glomeris,* commonly encountered by European field zoologists, is by far the most species-rich. The species of *Glomeris* are unevenly distributed across Europe, with only a single species present in northern Germany, Scandinavia and Great Britain, but a hotspot of diversity present in Italy, where 34 species, of them 20 country-endemics, were recorded. However, many of these species are only known from their first description, often dating back more than 100 years, and were only recorded from a single locality. Furthermore, many of these species seem, according to their first description, to be similar to widespread species of variable colouration, such as *G. undulata* Koch, 1844 or *G. connexa* Koch, 1847. To find out whether the species richness of the pill millipedes in Italy is the result of taxonomic inflation combined with a total lack of revisions, or whether it is the result of a more natural process was the aim of this study.

Six of the little-known Italian *Glomeris* species, *G. genuensis*, *G. ligurica*, *G. euganeorum*, *G. primordialis*, *G. oblongoguttata*, *G. oropensis*, were recently collected at their type localities, allowing the undertaking of a molecular analysis. The sequences of their cytochrome c oxidase I gene (COI) of six endemic species were compared with these of other, more widespread pill millipede species. Surprisingly, significant differences (4-10% uncorrected distances) were found between the species. The distribution limits and evolutionary history of the six analysed Italian pill millipede species remain unknown.

POSTER

Myriapods records at the Chamela-Cuixmala Biosphere Reserve, Jalisco, Mexico

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In 1993 the Chamela-Cuixmala Biosphere Reserve was created to protect the tropical deciduous forest and wetlands of the southern coast of Jalisco, Mexico. Thirteen centipedes' species and morphospecies have been previously found in the area. By visual surveys conducted between 2010 to 2013, new information about previously known centipedes' species (*Cryptops* sp., *Scolopendra morsitans* and *S. viridis*). *Newportia* (*Ectonocryptoides*) *quadrimeropus* specimens have been discovered and they are suggested as topotypes. Millipede's families Atopetholidae (*Hiltonius*), Rhinocricidae (*Anadenobolus*) and Xystodesmidae (*Rhysodesmus*), and lithobiomorph centipede family Henicopidae (*Lamyctes*) were recorded for first time in the area increasing the knowledge of the group to the biosphere reserve.

POSTER

Slide mounting of centipedes: A review and two new methods for making permanent and temporary slides

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For proper investigation of certain characters it is inevitable to prepare slides of Chilopoda specimens in order to be able to examine them by compound microscope. Temporary mounting is useful when dealing with larger material e.g. in ecological studies, where the speediness of a method is of advantage, but also when examining type materials, when the reversibility of the method might be of importance. Permanent slides can serve on the one hand as a collection for fast comparison, and on the other hand it is a way of deposition which is less endangered by destroying from drying out and moulding than a sample kept in alcohol.

In spite of their importance, there is apparently no method for temporary nor for permanent mounting of centipedes, which would be appropriate in all ways. Besides reviewing the drawbacks and advantages of different methods mentioned in the literature and tested by myself, two methods are presented here, which have been proved suitable. The use of warm lactic acid-glycerol mixture is suggested for temporary mounting on cavity slides, as a relatively fast and reversible method without the strong swelling effect of pure lactic acid. For preparing permanent slides, combining the traditional kalium hydroxide clearing method with dyeing in Chlorasol Black (solved in glycerol) and hardening in Euparal essence is suggested. This way it is ensured that the objects keep their shape and the contrast of the specimens parts embedded in Euparal is improved.

With the methods presented here, very good results have been achieved regarding practicability of work as well as visibility and faithfulness of the objects.

POSTER

Contribution to the knowledge on the geophilomorph centipedes of the Ryukyu Islands (Japan)

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The Ryukyu Archipelago consists of more than 140 continental islands. It constitutes a long arc-shaped archipelago lying along the edges of the Eurasian and Pacific plates between Japan and Taiwan. Due to its complex palaeogeographical and geological history, the Ryukyu Archipelago have long attracted the interest of biogeographers. Among others, it represents a diversity and endemism hotspot for several arthropod taxa, such as the geophilomorph family Mecistocephalidae.

Despite the former intense myriapodological work in Japan, our previous faunistic knowledge of these islands was largely unsatisfactory. For geophilomorphs there were only occurrence data from 11 islands of the Ryukyus. These sporadic data represented 28 species, a relatively high number considering that the Ryukyu Islands comprises only about 1% of the area of Japan.

During 2009-2012 a series of collecting trips have been carried out throughout the Ryukyu Islands by the last author, which gained geophilomorph specimens from 37 islands. Of this colelction, 212 specimens were investigated, representing 19 species, and more than the half of them (11) belong to the family Mecistocephalidae.

Our results expand the known distribution area of several species, like *Tygarrup takarazimensis* Miyosi, 1957, and *Arrup sauteri* (Silvestri, 1919), the latter one being new to the fauna of Japan. Based on the recently collected specimens, detailed documentation of the variability of certain morphological characters has become possible. Since the type material of some species is lost and no other specimen is known to exist in natural history museum collections (e.g. *Mecistocephalus multidentatus* Takakuwa, 1936), our specimens offer excellent records for a better taxonomical understanding of the Mecistocephalidae. Two species new for science (from the genera *Mecistocephalus* and *Arrup*) have been found and will be described later.

Considering Mecistocephalidae as the best documented taxon with the highest diversity in the Ryukyu archipelago, the performance of the logarithmic species-area relationship for the 31 islands Ryukyu islands shows a significant positive correlation between the number of species and area ($p < 0.05$). However, the relatively low coefficient of variation ($R^2 = 0.18$) indicates the inability of area to explain most of the total variance in species richness.

LECTURE

The life cycle of *Ommatoiulus sabulosus aimatopodus* (Diplopoda, Julida: Julidae) in southern France

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Ommatoiulus sabulosus aimatopodus is a Mediterranean form with gonopods typical of the species *O. sabulosus* but a very different body coloration in the adult. Although the timing of male maturation and the succession of copulatory and intercalary males were studied in great detail in *O. sabulosus aimatopodus,* the growth, development and age at maturity of females remain poorly known. These important aspects of the life cycle are being studied in an abundant population living in a Mediterranean shrubland near Marseille. The stadial growth and development of several generations were followed in samples collected at different times of the year, and millipedes were reared in the laboratory under seasonal conditions to confirm a number of field observations.

The results show that new generations appear in autumn as stadium II (1 RO), which is the first active stadium. Growth is rapid in the young and continues during the winter. Juveniles of stadia III and IV have one more apodous ring than in northern populations, which results in consistently higher numbers of podous rings in the Mediterranean form. Sexual dimorphism is apparent from stadium VI onwards, which is reached in early spring. In autumn, one-year-old millipedes are in stadia VII and VIII, and all are still immature. Only two moults occur during the second year of growth – one during the period of inactivity in winter and one in spring – and two-year-old millipedes are in stadia IX and X in autumn. A few males reach maturity at stadium X and may reproduce at two years of age. However, the presence of many immature males in stadia X and XI indicates that most males mature for the first time at stadium XI or XII. These stadia cannot be reached before the age of three, even assuming that all individuals undergo two moults each year. Intercalary males, which are present from stadium XI onwards, are produced during the winter moult; they are most common in spring but virtually absent in autumn. The smallest females carrying full-sized eggs in autumn belong to stadium XI, which cannot be reached before the age of three. Ovigerous females have also been found in stadia XII and XIII, but it is still unclear whether females are semelparous (breeding only once when 3- or 4-year-old) or iteroparous (breeding several times in different years).

It is concluded that life-cycle duration in the *O. sabulosus aimatopodus* population from Marseille is not so different from that of *O. sabulosus* in Great Britain. However, there is a shift in the seasons of reproduction and growth, so that young Mediterranean millipedes of stadia II to VI are not confronted with harsh environmental conditions during the summer. One interesting feature is that all age classes moult once during the overwintering period.

LECTURE

Revision of the family Androgonathidae in Southeast Asia (Diplopoda: Platydesmida) with descriptions of six new species

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Platydesmids are a group of ancient millipedes with Laurasian distribution. Members of this order, like other colobognathans, have simple gonopods and discrimination of species and higher taxa is in most cases restricted to other morphological characters. Thus platydesmids are not attractive for many myriapodologists and were neglected for many decades, especially in Southeast Asia. Nine species of platydesmids are therefore known from Laos, Vietnam, Indonesia (Sumatra), Malaysia (Peninsular Malaysia, Borneo) in Southeast Asia, mainly synomized under the genus *Pseudodesmus* Pocock, 1887. Distinction and identification of *Pseudodesmus* and the similar North American and East Asian genus *Brachycybe* Wood, 1864 were discussed by some authors before without clear recommendations. The present research focuses on the systematics and distribution of the platydesmids in Southeast Asia. Types and new material of platydesmids from several museum collections was revised and compared to North American members of the genus *Brachycybe*. Due to the similarity and the mosaic like pattern of morphological characters sharing with *Brachycybe*, all Southeast Asian members of Androgonathidae were placed under *Brachycybe* and initially classified into four subgroups. Six species are redescribed and six new species are described from Vietnam, Thailand, Laos, Indonesia (Singkep Island) and Malaysia (Borneo).

POSTER

Some important taxonomical characters in the Australian genus *Pogonosternum* (Diplopoda: Polydesmida: Paradoxosomatidae)

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The most important characters for distinguishing, identifying and describing species in the order Polydesmida are those of the male gonopods. In most families of Polydesmida, obvious non-gonopodal characters or a combination of gonopodal and non-gonopodal characters can be used to assign species to higher taxonomic levels, such as genus or subfamily. This is often not possible in the speciose family Paradoxosomatidae, where differences in obvious characters, e.g. tergite structure, are small. Previous studies on little-used taxonomic characters in Polydesmida, e.g. the structure and ultrastructure of the spiracles, male leg setae, spinnerets, prozonite cuticle and limbus, indicate that these characters can be useful at species, genus and higher taxonomic levels. In this study the spiracles, color pattern, male leg brushes and female leg coxae were studied using light microscopy and SEM in 10 species (4 described, 6 undescribed) in the Australian paradoxosomatid genus *Pogonosternum*, which is native to Victoria, New South Wales and Tasmania.

The preliminary results indicate that within *Pogonosternum* several types of spiracles exist. Male leg brushes are restricted to a limited number of anterior legs in each species, ranging in *Pogonosternum* to leg pairs seven to eleven. Further, the females of some species bear a cone-shaped process ventrally on the leg two coxa, and more or less obvious differences in the color pattern can be observed. These non-gonopodal characters are being used, together with gonopod details, to distinguish and describe or distinguish species of *Pogonosternum*. Futhermore the ultrastructure of the prozonite cuticle, limbus and spinnerets was studied for its relevance as a useful character.

POSTER

A molecular-based study on *Stenotaenia* species diversity and relationships in the Italian region

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Among the geophilomorph centipede lineages of the Western Palearctic, *Stenotaenia* exhibits high interspecific variation in the number of legs and body size; this is in contrast to a great uniformity of most of its fine-morphology characters. The genus includes dwarf species (e.g., *S. romana,* with only about 40-50 leg pairs and an adult body length of 1 cm), as well as the giant *S. sturanyi* (with more than 100 pairs of legs and a body length up to 12 cm).

In the Italian region, which includes the territory of the homonymous country plus Corsica and Istria, no more than four *Stenotaenia* species can be distinguished on the basis of the sole morphology. Here we present the result of a first attempt to use genetic markers to clarify the actual species diversity and infer phylogenetic relationships.

We sampled 11 Italian populations from throughout the whole range of the genus, and estimated COI genetic distances. We found evidence of the presence of at least five species only partially overlapping with previously recognized species. We also performed a maximum-likelihood phylogenetic analysis based on COI and 28S gene sequences. We found that oligopodous and polypodous species belong to distinct clades. Moreover, specimens hitherto identified as *S. linearis* resulted belonging to two not strictly related species. Our analyses prove that COI and 28S are effective markers to infer phylogeny within *Stenotaenia.*

LECTURE

Type specimens of centipedes (Myriapoda: Chilopoda) in the National Museum, Prague (Czech Republic)

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The National Museum in Prague (NMP) hosts a collection of myriapods – centipedes (mostly spirit and partly dry material), millipedes (mostly spirit material) and pauropods (microscopical slides). The collection of centipedes is perfectly organized and catalogued thanks to Dr. Luděk J. Dobroruka who works in the NMP as a curator of Invertebrates in 1956. In the second half of 1970s, he also published catalogues of Bulgarian, Greek and Brazilian centipedes deposited in the NMP.

Dr. Luděk Jindřich Dobroruka (20 October 1933 – 4 July 2004) was born in Prague. He studied at the Charles University and later also at the University of Agriculture in Prague, and worked at the zoological gardens in Prague and Dvůr Králové nad Labem. Beside his main work with mammals, educational activities and interpretations, he published 37 papers and one monograph about centipedes. During his life, Luděk J. Dobroruka described, either alone (44 taxa) or with Božena Folkmanová (12 taxa), four new genera, 36 new species, 12 new subspecies and created four *nomina nova* of centipedes. One centipede species bears Dobroruka's name: *Lithobius dobrorukai* DÁNYI & TUF, 2012 (*nomen novum* of *Lithobius mongolicus* DOBRORUKA, 1960).

The centipede collection in NMP contains type material of 15 taxa (13 species and two subspecies), of which 14 were described by Luděk J. Dobroruka and one by Karl W. Verhoeff: *Allothereua wilsonae* DOBRORUKA, 1979; *Lithobius corrigendus* DOBRORUKA, 1988; *Lithobius creticus* DOBRORUKA, 1977; *Lithobius erythrocephalus mohelensis* DOBRORUKA, 1959; *Lithobius evae* DOBRORUKA, 1958; *Lithobius magurensis* DOBRORUKA, 1971; *Lithobius purkynei* DOBRORUKA, 1957; *Lithobius tatricus* DOBRORUKA, 1958; *Lithobius tatricus monounguis* DOBRORUKA, 1958; *Monotarsobius homolaci* DOBRORUKA, 1971; *Monotarsobius krali* DOBRORUKA, 1979; *Pachymerium dilottiae* DOBRORUKA, 1976; *Pachymerium hanzaki* DOBRORUKA, 1976; *Scolopendra aztecorum* VERHOEFF, 1934 and *Strigamia olympica* DOBRORUKA, 1977. Of these 15 taxa, five were described from the Czech Republic, three from Slovakia and seven from other countries (Greece, Iraq, Kyrgyzstan, Mexico, Nepal and Uzbekistan). The eight taxa described from the Czech and Slovak Republics are now considered as junior synonyms but the seven taxa described from the other countries are still valid.

The type material of centipedes was deposited to the NMP in three distinct periods: 1930–1935, 1975–1978 and 2012–2014. The type specimens are taxonomically extremely important because new species were described according to them and they thus bear the scientific names of the taxa. Therefore, a precise attention and care are given to the maintenance of the type specimens whose scientific value is incalculable.

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LECTURE

Diplopod subterranean biodiversity – a case from Croatian part of Dinaric Karst

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Cave systems in the Dinaric karst are the global hotspot of subterranean biodiversity. To date, more than 900 aquatic and terrestrial obligate subterranean species is recorded. Also, in caves and pits diverse diplopod fauna is found. Diplopods vary in degrees of adaptation to underground conditions: from accidental, trogloxenic representatives to highly specialized troglobitic and endemic taxa.

Most common diplopods from caves and pits belong to the order Polydesmida, as they are preadapt to such habitats. Diversity of the genus *Brachydesmus* is well known for Balkan Peninsula and even today a new species of this genus are described from the Dinaric karst and broader. Explorations of deep and complex cave objects enabled quality biospeleological analysis of these habitats, which caused findings of highly specialized polydesmid taxa. Their location within the higher systematic categories is one of the questions that need to be answered.

Order Chordeumatida is also extremely diverse and relatively common in underground habitats. For example, species *Haasia stenopodium* (Strasser, 1966) was recorded in the Lukina jama –Trojama Cave System at the depth of 1300 m. Furthermore, new findings indicate broader distribution area for monotypic family Biokoviellidae and it is necessary to establish the species status of these new specimens. Also, in caves of west Croatia troglobitic genus *Verhoeffeuma* was found. In order to determine the species level of this speciment it is necessary to collect males and to continue detailed biospeleological research of this area.

Troglobitic and epigean diplopod fauna from karst areas in Croatia are still insufficiently explored, which is indicated by numerous new species that have been described in the last decade and by presented preliminary results.

POSTER

Species delimitation and phylogeography of *Newportia* (Scolopendromorpha) in the Mesoamerican region and implications for widespread morphospecies

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The genus *Newportia* Gervais, 1847, includes more than 50 species distributed in the Caribbean, Antilles, and from Mexico to central South America. Modern keys to nominal species are available (Schileyko, 2013: *ZooKeys*), greatly facilitating species identification, but many species are based on few specimens and have incomplete documentation of taxonomically-informative characters. In order to explore genetic variability and evolutionary relationships within geographically-widespread morphospecies, specimens of *Newportia stolli* (Pocock, 1896) and *N. divergens* Chamberlin, 1922, two nominal species distinguished by differences in suture patterns on T1, were sequenced for mitochondrial 16S rRNA and cytochrome *c* oxidase subunit I (COI) from populations from southern Mexico, Guatemala, Honduras, Colombia and Brazil. *N. stolli* is paraphyletic with respect to *N. divergens* within a clade from Guatemala, Honduras, and Chiapas (Mexico), consistent with a single loss of a connection between the anterior transverse suture on T1, whereas specimens of "*N. stolli*" from Brazil are not closely allied to those from the Mesomerican type area. The widespread morphospecies *N. monticola* Pocock, 1890, was sequenced for the same loci from populations in Nicaragua, Costa Rica and Brazil, finding that specimens from the three areas do not unite as a monophyletic group. In contrast, samples of *N. oreina* Chamberlin, 1915, from different parts of Mexico (Tamaulipas and Oaxaca) form geographic clusters that resolve as each other's closest relatives. These results suggest that some widespread species of *Newportia* may be taxa of convenience rather than natural groups. Molecular identification is possible for specimens that are missing taxonomically informative morphological characters, notably damaged specimens that lack the ultimate leg pair, a protocol that should also apply to other taxonomically difficult genera that are prone to damage (such as *Cryptops*).

LECTURE

Ectoparasitic fungi (Laboulbeniales) on millipedes

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Labuolbeniales are an order of tiny ascomycete fungi which are all ectoparasites on arthropods. Insects, especially beetles are hosts of the majority of these fungi, but eight species have been described from millipedes, and several additional millipede parasites are under study. Most of the known species are from Juliformia, especially European species of the family Julidae, but Laboulbeniales are also known from Callipodida and Sphaerotheriida.

Some of the species on millipedes are very site-specific, i.e., they grow only on particular body parts which come into contact during courtship and copulation, suggesting a 'venereal' mode of transfer.

LECTURE

The millipede genus *Strongylosoma* Brandt, 1833 in the Caucasus (Diplopoda, Polydesmida, Paradoxosomatidae)

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Only two species of *Strongylosoma* inhabit the Caucasus: *S. kordylamythrum* Attems, 1898 and *S. lenkoranum* Attems, 1898. Both are quite distinct morphologically, their main diagnostic features being described and illustrated. The former species occurs over most of the Caucasus except for the region's eastern parts where only the latter species in encountered. Parapatry is observed only in Mountainous Karabakh and Hyrcania (within both southeastern Azerbaijan and northwestern Iran), but even there these species remain strictly allopatric, never being found together. Their distributions are refined and mapped, based both on the literature records and abundant new samples.

POSTER

Building biodiversity in Paris area (France): Green roofs and vegetated facades as habitats for myriapod and woodlice communities (Chilopoda, Diplopoda, Isopoda)

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Urbanization leads to profound changes in the biosphere. Urban matrix – mainly consisting of roads and buildings – grows sometimes with hostility, destroying and fragmenting ecosystems, contributing to global change and biodiversity loss. For two decades in France, buildings have been covered with greening systems (i.e. voluntary introduction of plants on suitable media on the building envelopes). These systems provide benefits to humans at local, urban landscape and global scale. They also reduce the urban matrix impact, and make it more welcoming and permeable to wildlife, even if different types of vegetation do not appear to be equivalent in terms of biodiversity. An ecological typology of green roof is based on six vegetation structures: naked, ballasted, muscinal, herbaceous, arbustive, and arboreous. The plant diversity and structure are influenced by the substrate depth and therefore influence urban arthropod biodiversity.

We analyzed the myriapod and isopod communities using the different types of greening systems as potential habitats on vegetated buildings and vegetated facades within the urban landscape. Samples were taken from soil-sampling, yellow traps and succion sampling. The importance of different variables are highlighted, such as the substrate depth and the structural complexity of vegetation. Heterogeneous habitats host more abundant and diverse communities in general (including wild plants, arthropods and birds). The different systems host distinct communities comprising generalist species that are part of ordinary biodiversity but also specialist species from dry or wet environments.

Preliminary results show that most centipedes, millipedes and woodlice represented in the samples are native species and belong to ordinary regional macroarthropod communities. Alien species potentially invasive and introduced with planted vegetation seem absent.

These analysis, to be compared with those obtained for spiders, beetles, true bugs and hymenopterans, offer perspectives for the development of innovative greenings, towards a new approach of urban ecosystems mixing conservation and services.

In accordance with an ecological typology for green roofs referred to as stratum classification, based on the vegetal structures living and colonizing such anthropo-ecosystems, wild roofs and facades adapted to receive spontaneous species could play an interesting role in urban biodiversity dynamics if they are developed at large scales in cities. They will certainly become an interesting tool to conciliate the greening of cities with ecological services.

LECTURE

Modelling and predicting centipede species distribution in Norway

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Our aim is to generate species distribution modelling (SDM) to study biogeographic patterns of centipedes and predict potential biodiversity hotspots in Norway (58–71° N, 4–32° E). To generate SDM we used the maximum entropy technique (MAXENT), a machine learning method for analyzing presence-only data and predicting the distribution of a target group from a sample of observed presences and a set of environmental data. The study is based on ca. 1700 georeferenced occurrence records provided mainly by the Norwegian Biodiversity Center. All samples are housed in natural history museum collections (i.e. University Museum of Bergen, Tromsø University Museum). 25 centipede species and a set of 19 BioClim variables downloaded from the WorldClim database for ecological modelling were included in the study. All bioclimatic variables were used at a resolution of nearly 1 × 1, 5 × 5 and 10 × 10 km grid covering Norway. Generalized linear model (GLM) and collinearity diagnostic factor (VIF) were used to identify the bioclimatic variables that best accounted for the species' recorded distributions. We omitted from the analyses seven species (*Cryptops hortensis*, *C. parisi*, *Geophilus carpophagus*, *Lithobius calcaratus*, *L. lapidicola*, *Stigmatogaster subterraneus*, *Strigamia crassipes*) with a poor coverage of records. A total of 18 species (*Geophilus electricus, G. flavus, G. insculptus, G. proximus, G. truncorum, Lamyctes emarginatus, Lithobius borealis, L. crassipes, L. curtipes, L. erythrocephalus, L. forficatus, L. macilentus, L. melanops, L. microps, L. tenebrosus, Pachymerium ferrugineum, Schendyla nemorensis, Strigamia maritima*) with more than 10 digitized and georeferenced records in Norway were finally incorporated in the analyses. Results show a highly significant latitudinal gradient towards an increased number of species richness in southern grids. Temperature and precipitation related variables (e.g. mean annual temperature, mean diurnal range, isothermality, precipitation of warmest quarter) are major contributors to the explanation of the potential distributions of the majority of the species. Species richness prediction derived from MAXENT produce higher species richness values compared to actual values, in grids at all of the resolution used. Species with restricted latitudinal range and southernmost distribution center had higher AUC values while species with broad latitudinal range and northernmost distribution center had lower AUC values. This shows that the range of distribution of species with high bioclimatic specificity (e.g. *G. truncorum*, *S. maritima*) can be modelled with higher accuracy than that of species with broad bioclimatic preferences (e.g. *G. proximus, L. emarginatus, L. erythrocephalus, L. forficatus*). Predictive modelling analyses revealed that southeastern Norway (including the urban and suburban region of Oslo) and western Norway (inclusive of the inner part of Hardangerfjord, Nordfjord and Sognefjord) are considered as local biodiversity hotspots with regard to high predictive species co-occurrence.

LECTURE

Millipedes (Diplopoda) and centipedes (Chilopoda) from the city of Bucharest, Romania: An introduction study

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Although the urban ecosystems represent a complex mosaic of relict natural, semi-natural and various man-made sites, abandoned ruderal areas, parks, lawns and cemeteries, and contain an interesting mixture of natural and synanthropic fauna, they have been relatively little studied in the context of the ecological research. Millipedes and centipedes are among the dominant groups of the arthropod decomposers and predatory communities of soil part of many habitats and as such are key systemic regulators of the ecosystem functions. Although first data about these soil invertebrates of some city parks of Bucharest are already known, millipedes and centipedes are still among the least investigated arthropod groups of this large conurbation.

Our sampling sites represented 4 urban parks in different areas of Bucharest, namely Herăstrău Park, National Stadium "Lia Manoliu", Tineretului Park and "A. I. Cuza" Park. The sampling took place between April 2005 and August 2010. Within the studied sites up to the present time, 6 species of millipedes and 8 species of centipedes were found. The family Julidae is represented by 4 species: *Megaphyllum unilineatum*, *Megaphyllum transsylvanicum*, *Cylindroiulus boleti* and *Cylindroiulus arborum*. The two other families, Anthroleucosomatidae and Polydesmidae are represented by only one species: *Bulgardicus bucarestensis* and *Brachydesmus superus*, respectively. The recorded centipedes belong to 5 families: Dignathodontidae with the species *Henia illyrica*, Geophilidae with two species, *Clinopodes flavidus* and *Geophilus flavus*, Lithobiidae represented by *Lithobius parietum*, *L. nigripalpis* and *L. forficatus*, Cryptopidae with *Cryptops hortensis* and Scutigeridae with *Scutigera coleoptrata*.

The differences in the species spectrum found in the investigated parks will be present in detail.

POSTER

The cave Diplopoda of southern China with reference to millipede diversity in Southeast Asia

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The diversity of Diplopoda in caves of southern China is remarkably high, often 5–6 species per cave, consisting mostly of local endemics and presumed troglobionts. These are evidently biased to just a few lineages, mainly members of the orders Chordeumatida and Callipodida, the families Cambalopsidae (Spirostreptida) and Haplodesmidae (Polydesmida) or the genera *Pacidesmus*, *Epanerchodus* and *Glenniea* (all Polydesmida, Polydesmidae), *Trichopeltis* (Polydesmida, Cryptodesmidae), *Hyleoglomeris* (Glomerida, Glomeridae) and *Dexmoxytes* (Polydesmida, Paradoxosomatidae). All these taxa, especially the Paradoxosomatidae and Cambalopsidae (usually amounting to about 60% and 10% of the total species diversity in the Oriental fauna, respectively), are moderately to highly speciose across Southeast Asia, being largely epigean. However, the epigean Diplopoda of southern China are yet badly understudied, since much if not most of the collecting and taxonomic exploration efforts still focus on cavernicoles. The Oriental Region is the only biogeographic realm globally that harbours all 16 orders of Diplopoda, of which 14 have already been encountered in China and/or the immediately adjacent parts of Indochina. Thus, China may actually prove to support no less than 1,000 millipede species of various origins, mainly Oriental and Palaearctic.

LECTURE

The millipede fauna of the Carboniferous (Stephanian) locality of Montceau-les-Mines, France

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Two taxa have been previously described from the famous Carboniferous locality of Montceau-les-Mines, France: *Blanziulus parriati* Langiaux and Sotty, 1976, and *Amynilyspes fatimae* Racheboeuf, Hannibal, and Vannier, 2004. The most common taxon found at this locality is *B. parriati*; newly identified specimens allow for a redescription of this taxon, previously known from only one partial specimen. This species has more than 70 body segments (almost twice the originally described number), an elongate head, a medium-sized collum that is subtriangular in lateral view, pleurotergites marked with subhorizontal striae, narrow sternites, closely spaced coxae, a strongly tapering posterior, and a small terminal segment. Additional specimens generally similar to *B. parriati* are also present as is a small oniscomorph having 12-14 segments, wrinkled dorsal ornamentation, and pleurites bearing transverse ridges on the posterior of their dorsal sides. The oniscomorph, which lacks spines, is represented by a single specimen. These taxa have body types that are similar to forms known from other Carboniferous sites such as Mazon Creek in Illinois, USA, and the Gaskohle of the Czech Republic. Euphoberiids, which are prominent at the latter two sites, are so far absent from Montceau-les-Mines.

LECTURE

The tracheal systems of three species of Notostigmophora (Chilopoda): Notes on interaction of tracheae with epidermal glands

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Based on their special tracheal systems, the Notostigmophora (= Scutigeromorpha) own a distinct position within Chilopoda: In contrast to all other centipedes, possessing pleural, paired spiracles, representatives of this taxon possess dorsal, unpaired spiracles localized at the tergites. Beside the anatomical description of the tracheal systems of *Scutigera coleoptrata, Parascutigera festiva,* and *Allotheria maculata*, we describe new aspects of the fine structure of the tracheal tubules of *S. coleoptrata* and their anchoring to the specialized epithelium of the pericardial septum.

The tracheal system of Notostigmophora consists of an unpaired, not closable spiracle that opens into a wide atrium. From this atrium, hundreds of tracheal tubules originate and extend into the pericardial sinus. The tracheal tubules of the three investigated species differ with regards to their shape and the tubular branching. The length of the tracheal tubules is about 50-100 µm in *A. maculata*, 80-150 µm in *P. festiva,* and 150-200 µm in *S. coleoptrata*. The diameter of the tracheal tubules is 2-3 µm in *S. coleoptrata*, 2.5 µm in *A. maculata*, and 3-4.5 µm in *P. festiva*. In *S. coleoptrata* the flat, single-layered epithelium of the tracheal tubuli is extremely thin (approximately 30 nm in height). The cuticle consists of a very small endocuticle covered by helically arranged chitin-fibrils.

Formerly, investigators described the tracheal tubules as blind ending and to float free in the hemolymph space that is surrounded by the pericardial septum. Here, we describe for the first time the anchorage of the tracheal tubules to the epithelium of the pericardial septum. This specialized epithelium comprises numerous epidermal glands and the endings of the tracheal tubuli stick into it. Thus, the glands come into contact to the tracheal tubules and secrete substances into them. Therefore, the blind endings of the tracheal tubules are filled by mucus substances. Furthermore, the cuticle of the tracheal tubules is covered by a more or less dense layer of mucoid substances. This mucoid layer might support the gas exchange through the epithelium of the tubuli into the hemolymph which is enriched with respiratory pigments (hemocyanin).

POSTER

Description of a new species of penicillate millipede from the genus *Monographis* (Diplopoda: Polyxenidae) found in Vietnam

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A new species of penicillate millipede, from genus *Monographis* (Diplopoda: Polyxenidae), was collected from Trang Bom and Dinh Quan, Dong Nai province, southern Vietnam. The taxonomic characteristics of genus *Monographis* Attems 1907 were used to formally describe this new species. *Monographis* sp. n. has been placed in a group with *M. tamoyoensis, M. yunnanesis and M. queenslandicus,* which have sensilla forming a triangular shape on the 6th antennal article. *Monographis* sp. n. is distinct from members of this group based on the number of sensilla found on the 6th antennal article. Claw structures were also compared in species from this group. Based on the large number of sensilla present on the 6th antennal article and its distinctive claw structure, *Monographis* sp. n. is confirmed as the ninth member of genus *Monographis* and named *Monographis dongnaiensis* as this species was collected from Dong Nai province, Vietnam.

LECTURE

Segmentation and leg development in penicillate millipedes (Diplopoda: Polyxenida)

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Segmentation in millipedes remains a controversial topic; many researchers have tried to solve the segmentation puzzle using a variety of approaches. Manton (1961) used the muscle and nerve attachments of a segment in her study of penicillate millipedes to solve the problem of segmentation. Bondi (1970) used the idea of the development of anterior body segments in a study of spirobolid millipedes to work out how segments and leg arrangements developed. Jansen et al. (2006) used germ bands in a study of embryonic development in pill millipedes to see how dorsal and ventral segments were associated. Gene expression was used to study of segmentation by Damen et al. (2009).

The aim of this study was to investigate the development of tergites and in relation to leg distribution in penicillate millipedes based on 3 schemes proposed by Dohle (2006): Scheme 1: Nguyen Duy-Jackquemin (2006), Scheme 2: Shot & Huynh (2006) and Scheme 3: Dohle (2006).

The segmentation and leg pattern observed in postembryonic stages of *Monographis queenslandicus* (Polyxenidae) has led to the formulation of a new approach in which stadium II, 4 pairs of legs, may be considered an important link in the development of all sub-sequential tergites and leg pairs seen in pencillate millipedes. The idea of shifting half a segment and the independent formation of tergites and sternites also made an important contribution to the formulation of this new explanation.

LECTURE

Sexual body size and shape dimorphism in *Apfelbeckia insculpta* (L. Koch, 1867) (Diplopoda: Callipodida: Schizopetalidae)

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Males and females of many organisms exhibit differences in secondary sexual characteristics (sexual dimorphism, SD) in size (sexual size dimorphism, SSD) and shape of the body (sexual shape dimorphism, SShD). Differences in body size and shape between genders have been explained by different evolutionary forces – natural, intra- and intersexual, fecundity and ecological selections.

To our knowledge, there are no published reports concerning SD in order Callipodida. For this reason, we used as a model-organism in our study *Apfelbeckia insculpta* (L. Koch, 1867). *A. insculpta* is one of the largest European millipedes and inhabits caves and other underground habitats in Serbia, Montenegro, Bosnia and Hercegovina, Croatia, Albania, and Greece. We studied 88 adult males and 90 adult females from five localities (four in Serbia and one in Montenegro).

Males and females differed in head length ($F = 32{,}136$; $p = 0{,}000$) and head width ($F = 19{,}443$; $p = 0{,}000$) (both values were significantly higher in females). Genders also differed in trunk dimensions, with females being significantly longer than males ($F = 68{,}298$; $p = 0{,}000$) and significantly higher ($F = 107{,}149$; $p = 0{,}000$) and wider ($F = 57{,}103$; $p = 0{,}000$) than males. Similarly, males and females differed in length ($F = 39{,}638$; $p = 0{,}000$) and width ($F = 27{,}097$; $p = 0{,}000$) of gnathochilarium (both dimensions have higher values in females), length of the leg 1 ($F = 19{,}533$; $p = 0{,}000$) (longer in females), length of the leg 2 ($F = 18{,}358$; $p = 0{,}000$) (longer in females), length of the leg 4 ($F = 22{,}085$; $p = 0{,}000$) (longer in females). Also, body mass was greater in females than in males ($F = 51{,}419$; $p = 0{,}000$). However, there were no significant differences in the length of antennae ($F = 1{,}147$; $p = 0{,}286$) and the length of the leg 24 ($F = 2{,}503$; $p = 0{,}115$).

Our results highlight the presence of female-biased SSD in *A. insculpta*. The distinct morphological characteristics of female *A. insculpta* are presumably the result of fecundity selection while male morphology is supposed to be under sexual selection.

LECTURE

Direct and indirect effects of climate change on decomposition activity of diplopods

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Due to the expected climatic change in Central Europe, including higher frequencies of hot and dry summers, Mediterranean drought-resistant oak species are being evaluated as future forest trees in dry forest sites in Germany. Planting foreign tree species will result in changing leaf litter composition and, hence, in altered nutrient resources for litter-decomposing soil arthropods. This may affect primary decomposition processes, which play a major role in nutrient cycling. Changing abiotic climatic conditions such as increasing temperatures and reduced soil humidity may furthermore directly influence the decomposition ability of saprophagous macroarthropods. Thus, laboratory feeding experiments with native diplopods assessed their feeding rates on introduced compared to native leaf litter. Further experiments tested the influence of temperature and soil moisture on the decomposition activity of native and Mediterranean diplopod species with native (*Quercus robur*) and introduced leaf litter (*Quercus frainetto*). Decomposition of native leaf litter (*Fagus sylvatica, Quercus robur*) and Mediterranean leaf litter (*Quercus ilex, Quercus frainetto, Quercus pubescens*) in the field was studied in litter-bag experiments. The feeding experiments revealed that Mediterranean leaf litter is readily accepted and partly even preferred by Central European litter decomposers. Correspondingly, in the litter bag studies, litter of introduced tree species decomposed at faster rates than that of native trees. Diplopod feeding activity increased with increasing temperature, although this effect is not species-specific. At higher temperatures, diplopods consumed foreign leaf litter at the same rate as native leaf litter. The results of the study indicate that the introduction of Mediterranean oak species in Central European forests does not negatively affect the decomposition function of native diplopods even under different climatic conditions.

POSTER

Compounds of defensive secretion in millipede species of Julida (Diplopoda)

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The defensive secretions of julid species, *Cylindroiulus caeruleocinctus*, *Ommatoiulus sabulosus*, *Cylindroiulus latestriatus* and *Choneiulus palmatus* were characterized by GC/MS analyses. Secrete mixtures contains 9 compounds of quinones. A characteristic mixture of benzoquinones of Julida, such as 2-methoxy-3-methyl-1,4-benzoquinone, 2-methyl-1,4-benzoquinone, 2,3-dimethoxy-1,4-benzoquinone and 2,3-dimethoxy-5-methyl-1,4-benzoquinone were identified from defensive exudates, together with trace amounts of 1,4-benzoquinone. The major compounds in julid species are 2-methoxy-3-methyl-1,4-benzoquinone and 2-methyl-1,4-benzoquinone. The defensive secretion of *C. latestriatus* showed highest content of 2-methyl-3,4-methylenedioxyphenol (50.16%) in comparison to that of *O. sabulosus* (1.52%). The major compound in the secretions of *O. sabulosus* and *C. caeruleocinctus* was 2-methoxy-3-methyl-1,4-benzoquinone 53.79% and 44.47%, respectively.

LECTURE

Changes of centipede communities on abandoned agriculture land in »Zgornja kolpska dolina« (Osilnica, Slovenia)

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The following study examines the impact of land use on the centipede communities. Different requirements for environmental conditions, different hunting strategies and behavior allow coexistence up to 35 centipede species in the dinaric beech-fir forest. In the decidious forests ground their abundance and biodiversity is the highest among different ecosystems. Developmental age and horizontal structure of the forest and consequently the temperature and humidity in the soil have large effect on centipede communities. Most of the temperate forest was changed by humans use land for agriculture. Same of such agriculture land was abandoned in last few decades and forest regeneration is occurred. By changing land use the centipedes' communities should also be change. The area of "the Upper Kolpa valley" in southern Slovenia is biogeographically important region because it is a Pleistocene refuge and it is located in crossroad of Alpine – Nordic and Pannonian – Illyrian – Sub-mediterranean floristic elements.

Five sites with different land use were selected near villages of Padovo and Osilnica: a beech – fir forest, a termophilic forest, an overgrown meadow, a forest meadow and an extensive meadow. Using two sampling methods 291 centipedes were collected and have been classified in 36 species, representing 36.7% of the currently registered centipede species in Slovenia. 29 species were obtained with square soil sampling method and 7 other species with hand collecting method. We found species with mid-european and southeast-european distribution and as well as palaearctic, Illyrian, Alpine- Carpathian, Mediterranean and species endemic for Slovenia, southeastern Alps and northern Dinarides.

Highest species diversity was 25 species in the beech forest. Species diversity at other sampling sites was much lower, only from 10 to 14 species. Only one species was found in the extensive meadow. Species present in most locations were *Crytops parisi, Lithobius* (*Sigibius*) *burzenlandicus carinthiacus, Strigamia transsilvanica, L. mutabilis, L. pusillus pusillifrater* and *Geophilus flavus* however with varoius abundance. Species with the highest density was *Lithobius* (*Monotarsobius*) *aeruginosus* with 181.5 ind/m^2 found in beech forest. The highest average density of centipedes was 387.7 ind/m^2 in the beech forest on schist claystone and sandstone, followed by thermophilic forest on limestone and dolomite with 239.2 ind/m^2 and overgrown lawn in the schist claystone and sandstone with 152.6 ind/m^2.

The Shannon- Wiener index (H') value was between 1.6 and 2.2. On the overgrown meadow, the maximum species diversity was also evaluated. The highest similarity determined by Rekonnen number was between the overgrown meadow and forest – meadow (59.6%). The results confirm that the presence of certain species and their density is affected as well by land type and its use probably due to age and vertical structure of the stand. Further research with seasonal sampling is recommended in order to give additional insight into process of regeneration of forest communities.

POSTER

Millipedes (Diplopoda) of Prague (Central Bohemia)

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In course of years 1997-2005 millipede fauna in the Czech Republic´s capital Prague was studied. In Prague there are natural, semi-natural and man-made (artificial) habitats. Special attention was paid to forests, a forest steppe, a rock steppe, rock debris, river surrowdings, parks, greenhouses, a garden centre, game parks, seedbeds and city greenery. At present, 51 species of millipedes occur here. Therefore, the Czech Republic´s capital is the area with the highest number of millipedes in the country. For example, the Křivoklátsko PLA and BR, a comparable natural area rich in millipede species, currently harbours 44 species of millipedes. A total number of millipedes species in the Czech Republic is 76. Thus 67% of millipedes species inhabit Prague. During the research, 20 millipedes species new for the Prague area were found, particulary those preferring man-made habitats. The species richness of introdused millipede species in Prague is the highest among all of the areas having been studied in this respect in the Czech Republic. The millipedes species rich site in Prague is the Zoological Garden in Troja, hosts 26 species. The most common millipede species in Prague include *Cylindroiulus caeruleocinctus*, *Ophyiulus pilosus*, *Julus scandinavius*, *Choneiulus palmatus*, *Blaniulus guttulatus* and *Cylindroiulus britannicus*. On the other hand, the rare relic species that has been found in Prague are: *Trachysphaera costata*, *Mastigophorophyllon saxonicum*, *Haploporatia eremita*, *Cylindroiulus luridus*, *Cylindroiulus arborum* and *Polydesmus germanicus*. For the Czech Republic, rare synanthropic species found in Prague are: *Cylindroiulus vulnerarius*, *Cylindroiulus punctatus* and *Amphitomeus attemsii*. The East European species *Polyzonium germanicum* and *Rossiulus vilnensis* reach in regional distribution limit in Prague. The four millipede species occuring in Prague, namely *Trachysphaera costata*, *Cylindroiulus luridus*, *Polydesmus germanicus* and *Rossiulus vilnensis* are included in the Red List of threatened invertebrate species in the Czech Republic. In 2014 increase the number of millipede species in Prague for 52 species (new was found species *Haasea germanica*) and total number of millipede in the Czech Republic rise for 77 species.

LECTURE

Polyxenus lagurus – the usefulness and beauty in detail

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We studied the external morphology of the bristly millipede *Polyxenus lagurus* (Linnaeus, 1758) by the use of a scanning electron microscope and present some peculiar details. From the human point of view, the arrangement and tidiness of the body parts of the bristle millipede observed with SEM represent a high functionality one hand and splendid and admirable beauty on the other hand.

In this contribution we present mainly the details of the head with trichobothriae and ocelli, bands of the dorsal setae, sensillae on the palp of the gnathochilarium, the molar plate with teeth reminding the surface of radula of land snails, legs with claws and silk glands and long brushes with croocks on the telson.

POSTER

Feeding mechanisms in myriapods: The evolution of tentorial mobility revisited

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Structural details of the cephalic tentorium and its functional role in mandibular movements are traditionally considered as the most compelling morphological evidence for myriapod monophyly. Ambiguity remained, however, about whether or not the mobility (‘swing’) of the tentorium is an ancestral feature of myriapods, because the transfer of its movements onto the mandibles is achieved differently in centipedes and millipedes and may even be absent. New insights inferred from electron microscopy and anatomical 3D-reconstructions based on histology allow readdressing this question. Evidence is presented against the previous view that the tentorium of geophilomorph centipedes is immobile. Although the feeding habits of Geophilomorpha are exceptional among centipedes in being predominantly suctorial, the muscular equipment of their tentorium in representatives of both Placodesmata and Adesmata reveals three-dimensional mobility and an unexpected coupling of the tentorial and mandibular movements with movements of the hypopharynx. The mandibular articulation with the tentorium in Symphyla is revised; its unique state among myriapods corroborates the view that the symphylan tentorium lacks the skeletal component that in centipedes and millipedes provides the rotation axis for the tentorial swing. Among millipedes the exceptional articulation between the mandibular gnathal lobe and the head capsule in representatives of the Pentazonia proved to be uncoupled from the tentorium; as in other millipedes movements of the tentorium enhance abduction of the mandibular gnathal lobe mainly via the hypopharyngeal suspensorium and are coupled with movements of the gnathochilarium. Current results favour the view that the differences in the tentorial mobility in pleurostigmophoran centipedes, symphylans, and millipedes are variations of a common pattern and derived from an originally mobile tentorium. This view is presently questioned only by the presence of an apparently immobile tentorium in scutigeromorph centipedes.

LECTURE

Diplopod feeding activity in relation to habitat choice in eastern Georgia, Caucasus

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Regional ecological and faunistic studies on individual animal groups which play significant roles in ecosystem functioning are of great importance for biodiversity conservation. One such group of soil-litter invertebrates is the class Diplopoda, or millipedes. The parts the millipedes take as primary decomposers of dead plant residues in soil-formation processes, as well as matter and energy flows in nature are long known to be very considerable (Ganin, 1989, 1997; Gilyarov, 1957; Gilyarov & Striganova, 1978; Striganova, 1969, 1974).

Our study aimed at investigating the intraspecific differences in diplopod feeding activity in three different habitats along an altitudinal gradient in eastern Georgia. *Megaphyllum brachyurum*, one of the most common, abundant and eurybathic millipede species distributed throughout the Caucasus, was chosen because it fully met the necessary requirements. The habitat types selected for sampling lay the along the Georgian Military Road, central Caucasus: (1) near Tskhneti which represents the deciduous forest belt (700 m a.s.l.), (2) at Stephantsminda (= Kazbegi) which supports low-grass subalpine meadows (1 800 m elevation), and (3) the Cross Pass lying in the alpine belt (2 395 m a.s.l.). In the forest population of the millipede, two weight categories were chosen: juveniles with a mean live body mass of 28 mg and adults on the average weighing ca 170 mg. Overwintered plant residues were used for feeding the millipedes in laboratory experiments.

Notable differences were observed in the feeding activity of *M. brachyurum* from the forest (juvenile group) and the subalpine belt. Millipedes with the same body weight from the forest consumed 10 times more compared to the subalpine population. Juveniles thus used the consumed energy not only for growth, but also for storing some reserves. The body mass of adult diplopods that inhabited the subalpine belt was significantly smaller, ranging between 20 and 36 mg per individual. The food consumption coefficient amounted there to some 38.8%, i.e. much lower in comparison with the same coefficient for the forest population (307.0% in the juveniles or 83.1% in the adults), but considerably higher than in Cross Pass animals (12.3%). The rates of consumed food amounted to 28.1 mg/ind./day (juv.) or 47.1 mg/ind./day (adults) at Tskhneti versus the subequal and much low rates both at Stephantsminda (3.8) and Cross Pass (ca 4.0).

The mean amount of consumed food averaged 20% per day per individual, regardless of both habitat and age/size. The highest rate of assimilation was observed in the juveniles, reaching 94.6%, versus 5-28.6% or 9.2%-24.5% in adults from the higher elevations.

Thus, the food consumption rates and life activity in *M. brachyurum* in the Caucasus seem to be closely related to the thermal regime of their habitats. High in the mountains, in the nival conditions subjected to warmth deficits, food consumption is reduced ca 7 times compared to the deciduous forest population, their daily diets likewise dropping from 72% to 8% per unit of live body weight.

POSTER

The millipedes of Palau

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The Republic of Palau is an independent state of Micronesia in the Pacific Ocean, composed of more than 200 small, mostly uninhabited islands. Its millipede fauna has first been studied by Yosioki Takakuwa (1873–1960) during the Japanese occupation, who described 4 new species from the capital island Koror: *Siphonophora spinosa*, *Trigoniulus palaoensis*, *Orthomorpha sekiguchii*, and *Platyrhacus macroporus*. Unfortunately, most of Takakuwa's type specimens have been destroyed in Japan during WW2. After careful tracking and with some luck, a small set of original specimens were discovered in February, 2012. These were collected by Teiso Esaki (1899-1957), a keen Japanese naturalist and expeditionist whose millipede material obtained in Micronesia between 1936-1940 have been preserved in the Entomological Collection of Kyushu University, Fukuoka, and proved to have been served as types for species descriptions by Takakuwa. One of them, *Platyrhacus macroporus* Takakuwa, 1942 (Polydesmida, Platyrhacidae), originated from Koror, Palau.

Together with subsequent literature records, 12 millipede species have ever been recorded in total from the Republic of Palau. During a field trip in January, 2012, to Koror and Babeldaob islands, 11 diplopod species were collected, including 4 undescribed ones (1 Polyxenida, 1 Glomeridesmida, 1 Polyzoniida: possibly *Rhinotus*, and 1 Polydesmida, Opisotretidae: possibly *Corypholophus*). Specimens of *Platyrhacus macroporus* were freshly found, and are herewith redescribed.

LECTURE

Male sexual organs as a new key feature in modern taxonomy within the genus *Scolopendra* (Chilopoda, Scolopendromorpha Scolopendridae)

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The male sexual organs of different *Scolopendra* species are shown and compared in shape and finer structures like setae as a possible new key feature for future centipede taxonomy.

The examinations are made with living specimens. They have been anaesthetised with carbon dioxide. During the anaesthesia and the resulting relaxation of the specimen, the specimen is brought into dorsal position and the sternite 20 is gently pressed with forceps, which causes the genital organs being released so that they can be examined.

A proposal is made to divide *Scolopendra* species into three groups according to the existence and shape of the male sexual organs. Group 1 consists of species which have a clearly visible penis and gonopods, group 2 consists of species which only have a penis but no visible gonopods and group 3 consists of species with no visible male sexual organs.

POSTER

On the function of the ultimate legs in some Scolopendridae (Chilopoda, Scolopendromorpha)

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The function of the variously shaped ultimate legs of Scolopendridae is briefly reviewed. Their function in different species like *Scolopendra heros, Scolopendra subspinipes, Ethmostigmus trigonopodus, Scolopendra morsitans, Scolopendra galapagoensis, Scolopendra hainanum* and others in which they are least specialised, has been investigated.

Specimens were tapped with forceps on different parts of the trunk to simulate the attack of a predator. When tapped on the first third of the trunk (near the head), the centipedes attacked the forceps with the forcipules. When tapped on the last third or the ultimate legs, they adopted a warning position, raising the ultimate legs to display the ventral and medial prefemoral spines as well as the spined coxopleural processes. In some cases the centipedes attacked the forceps with the claws of the ultimate legs by chopping down on them after lifting the legs high in the warning position. When tapped in the mid part of the trunk, the centipedes curled sideways to reach the forceps with its forcipules and ultimate legs simultaneously.

Scolopendra galapagoensis not only lifted the ultimate legs into the warning position but also the last 3-4 pairs of locomotory legs presenting their distodorsal prefemoral spines.

In addition to their function in warning behaviour, defensive stabbing, ritualised meeting reactions and during courtship behaviour, the ultimate legs may in addition act as hooks and perhaps be involved in species recognition.

No evidence was found that the ultimate legs are used to catch prey, nor of prey or predators being held between the prefemora.

LECTURE

Types of secretion in the midgut epithelium of millipedes (Myriapoda, Diplopoda)

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The midgut epithelium of myriapods is responsible for absorption, enzyme synthesis, secretion and storage of the reserve material (e.g. lipids, proteins, polysaccharides) or toxic substances (e.g. metals).

Three millipede species have been chosen for studies connected with the secretory functions of the midgut epithelium: *Polyxenus lagurus, Julus terrestris* and *Archirostreptus gigas*. The digestive cells of the midgut epithelium show distinct regionalization in organelles distribution. The reserve material, e.g. lipids or polisaccharides, together with numerous vesicles with accumulated material, gather in the cytoplasm. Substances produced and/or accumulated in the cytoplasm of the digestive cells are released into the midgut lumen due to apocrine secretion, microapocrine secretion and merocrine secretion. These three processes of secretion have been described with the use of the transmission electron microscopy (TEM). In addition, the midgut epithelium possesses the secretory cells, which occur between basal regions of the digestive and regenerative cells along the entire length of the midgut. Because of the fact that they do not contact the midgut lumen, they belong to the "closed type" of secretory/endocrine cells. They accumulate single mitochondria, cisterns of the rough and smooth endoplasmic reticulum, Golgi complexes, multivesicular bodies, together with numerous electron-dense granules. The precise structure and ultrastructure of the secretory cells have been also analyzed using the transmission electron microscope.

POSTER

Ultrastructure of the digestive cells in millipedes (Myriapoda, Diplopoda)

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The midgut of millipedes has been described as the tube-shaped structure which spreads along the entire length of the body. Among cells that form the midgut epithelium, they are present the digestive cells, secretory cells and regenerative cells.

The pseuostratified columnar epithelium of the midgut observed in the millipede species *Polyxenus lagurus, Archirostreptus gigas* and *Julus terrestris* lies on the non-cellular basal lamina and is composed of digestive, secretory and regenerative cells. The midgut epithelium is surrounded with two layers of visceral muscles: an inner layer of circular muscles, and an external layer of longitudinal muscles.

The cytoplasm of the digestive cells shows distinct regionalization in organelles distribution. Therefore, three regions can be distinguished: the basal, the perinuclear and the apical region. The differences in the ultrastructure of three cytoplasmic regions in all analyzed millipedes have been described with the use of the transmission electron microscope. We have described the distribution of mitochondria, cisterns of the rough and smooth endoplasmic reticulum, Golgi complexes, etc. Intercellular junctions such as smooth septate junction, septate junction, gap junction and spot desmosomes have been observed. The accumulation of the reserve material has been detected with the use of histochemical methods: bromophenol blue (detection of proteins), PAS method and alcian blue (detection of glycogen and polysaccharides) and Sudan Black B (detection of lipids).

POSTER

SEM image of the midgut epithelium of *Telodeinopus aoutii* (Myriapoda, Diplopoda)

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The digestive system of *Telodeinopus aoutii* is composed of three regions: the foregut, midgut and hindgut. While the surface of the fore- and hindgut is covered with the cuticle, the peritrophic membrane adheres the midgut surface, as has been described for other species of millipedes. The precise structure of the peritrophic membrane has been presented with the use of the scanning electron microscope (SEM). This membrane forms the characteristic pattern connected with the fact that it adheres the microvilli. The midgut of *T. aoutii* spreads along the middle region of the body. It is surrounded by two layers of visceral muscles: circular and longitudinal layers. SEM has enabled us to show the localization of the digestive, secretory and regenerative cells in the midgut epithelium. The structure and accumulation of microvilli, and the location of nucleus or cisterns of the endoplasmic reticulum have been demonstrated. The material for the studies has been cut transversally into small pieces after fixation in 2.5% glutaraldehyde in 0.1M phosphate buffer (pH 7.4) and 1% osmium tetroxide in 0.1M phosphate buffer. After dehydration in a graded concentration series of ethanol and acetone pieces were dried at critical point and coated with gold. The material was analyzed with a Hitachi SU 8010 scanning electron microscope.

POSTER

Centipede (Chilopoda) diversity in the Bug River Valley (E Poland)

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Habitats in valleys of European rivers are relatively poorly known in terms of species diversity, habitat selection and the dynamics of Chilopoda communities. In Poland, such studies have not been conducted so far.

The Bug River is one of the few rivers of such a size in Europe, which still remain almost unregulated. Its length in Poland amounts to 587 km. Two areas of Natura 2000 network were established in the valley of the river to protect endangered birds and habitats under the European Union law.

Research in the Bug River Valley was conducted at 26 sites in 2007-2008. The study sites were located in two regions differing in the shape of the valley and the presence of termophilous habitats and the size of riparian forests: (1) In the middle section of the river, as it meanders and cuts through glacial uplands at the depth of 30m creating a unique landscape in Europe, where the characteristic feature is the presence of termophilous habitas and well-preserved riparian forests; (2) In the lower course of the river, where the valley is much wider (it stretches up to several kilometers wide) with an overgrown flood terrace at its bottom. In this section, the Bug River slowly meanders and sometimes changes its course.

The study involved such habitats as riparian forests, rushes at oxbows, meadows of lower and upper flooded terraces, sandy grasslands, thermophilous grasslands and thermophilous brushwood.

Pitfall traps were used as a sampling method.

As a result, 444 specimens belonging to 12 centipede species of 2 orders – Geophilomorpha (4 species) and Lithobiomorpha (8 species) were caught. Of particular note is the species *Lithobius dudichi* (Loksa, 1947) found in Poland for the first time and previously known based on a single specimen. Our research provided first data on habitat preferences of this species.

2 to 10 Chilopoda species were found in each habitat under investigation. The greatest species diversity was found in thermophilous brushwoods (10 species), sandy grasslands (8), xerothermic grasslands (7) and fresh meadows (6). The fewest number of species was found in rushes of reed mannagrass (*Glyceria maxima*) and in an alluvial meadow (2 species at each location). We obtained several significant data on habitat preferences of individual species and the dynamics of Chilopoda communities.

POSTER

On the consistency of some taxonomic characters in the Scolopendromorpha and comments on two problematic genera (Myriapoda: Chilopoda)

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With the increase in taxonomic data it has become apparent that such characters as 21 vs 23 pairs of legs and presence or absence of spiracles on leg-bearing segment 7 are less reliable as phylogenetic and taxonomic characters than previously thought. Further exceptions to the norm are here discussed as well as two problematic genera.

New World species of *Scolopendra* plus an Old World species *S. valida* are a monophyletic group, usually with an anterior transverse sulcus (ring furrow) on T1. A subgroup of 12 species have 17 antennal articles, transverse coxosternal sutures and dorsodistal prefemoral spines on legs anterior to the ultimate pair two species lack the transverse sulcus. A second subgroup of six species have more than 17 antennal articles and lack the dorsodistal prefemoral spines on legs anterior to the ultimate pair. *Scolopendra valida* has the characters of the first subgroup except for the number of antennal articles which is 19–27. Other exceptions are discussed.

Some *Cryptops* (*Trigonocryptops*) lack the otherwise characteristic sternite trigonal sutures and *C*. (*Cryptops*) *anomalans* shows some of the morphological characters used to characterise *Trigonocryptops*.

Characters apparently linked to the presence of an anterior transverse suture on T1 in *Cryptops* (*Cryptops*) species, namely cephalic plate paramedian sutures, further sutures on T1 and head overlapping T1 are not always consistent.

It is suggested that the otostigmine genus *Alluropus* known from a single specimen is perhaps a *Rhysida* sp. with a regenerated ultimate leg.

It would appear from the rather incomplete data for *Kethops utahensis* (Scolopocryptopidae, Kethopinae) and the description of *Thalkethops grallatrix* that they may be characterised by the ultimate legs with rows of saw teeth on the prefemur (usually?) and on the femur and tibia, with a single saw tooth on tarsus 1. The arrangement of saw teeth in *K. atypus* viz.prefemur 0, femur 0, tibia 6 and tarsus 3 is typical of many *Cryptops* species. This and other characters suggest that *K. atypus* may be a *Cryptops* with 23 leg-bearing segments.

LECTURE

Taxonomy, distribution and conservation of millipedes in Thailand (Diplopoda)

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Thailand, which makes part of "Indo-Burma", is currently ranked as the eighth most important hotspot of biodiversity globally. The country supports one of the world's highest rates of biodiversity per unit area, considering both its terrestrial and aquatic habitats. As regards the class Diplopoda, since the latest checklist (Enghoff 2005) which contained 105 millipede species recorded by then from Thailand, progress has been very considerable. At the moment, already 171 millipede species (thus 66 added) belonging to 42 genera, 19 families and 9 orders are known to occur in Thailand. Among them, 139 (ca 81%) species seem to be endemic. However, there can be no doubt that the level of diplopod richness in the country is far greater, the actual number of species being at least twice as high. Regrettably, this impressive millipede diversity faces massive threats because of the combined effect of habitat destruction or fragmentation and overexploitation of natural resources. The growing human population renders an increasingly high pressure on biodiversity, including the endemic millipedes. To better understand the serious problems faced by millipedes in Thailand, cave species of *Glyphiulus* and *Plusioglyphiulus* will suffice to serve as examples. Both these genera are quite large (at the moment, 56 and 27 species, respectively), ranging from southern China in the north, through Indochina and Malay Peninsula, to Borneo Island in the east. Most of them have been found very locally in caves, usually a species per cave or cave cluster and feeding on bat guano. Since karst areas take up more than half of Thailand's national territory, the problems arise not only from deforestation due to limestone exploitation, especially cement industry and the heavy pollution it inevitably brings about, but also from Buddhist monks or abbots who "develop" caves in their own way. Although karst and caves abound in Thailand, the caves and grottos are increasingly often turned into preferred dhamma retreats for meditation which is believed to bring peace and quiet. Caves are thereby renovated and cleaned for a more comfortable stay and service, the bats and guano removed, and the habitats of millipedes and other cave animals destroyed. Knowledge of biodiversity and species distributions, including millipedes, thus becomes increasingly important for nature conservation as well.

LECTURE

Cocktails and pills: A COI primer cocktail for pill millipedes

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Pill millipedes (Glomerida) are an intricate order, which resulted in a taxonomical dataset of more than 400 mentioned variations, in up to date ~280 species described worldwide. This astonishing variability is an ideal set-up to test DNA-barcoding for its delimitation capability. Our study focuses on Austrian species, allowing for a pilot study within the upcoming initiative ABOL (*Austrian Barcode of Life*). Due to the status of diplopods, as notorious problem children in molecular studies, we introduced several methods. We avoid the probably inhibiting effect of defensive secretions, by only using the head for DNA-extraction. To preserve characters of taxonomic value even in this bodypart, we applied a Non-Destructive-Extraction method (NDE), which allows for retaining all cuticular structures. Only in *Trachysphaera*, a genus lacking defence glands, with minute species below 5mm body-length, entire specimens were used for NDE. To further optimize the protocol, a combination of primers was used for both the PCR and the sequencing reaction. The resulting primer-cocktail GlomF1/R1 gives satisfying results for all investigated species. No specific adjustments were necessary for species newly added to the data set. To validate our results we likewise sequenced a fragment of the nuclear 28S rRNA-gene (900bp), spanning both conserved and variable regions. The obtained sequences result in clusters fully congruent with our COI-tree.

Up to now we generated 102 COI barcodes and 102 28S rRNA sequences of pill millipedes. Both markers separate Austrian Glomerida into 11 well defined clusters. In both trees distances are large among clusters, but small within each cluster. The recovered molecular clusters are congruent with currently accepted species. Obtained trees, especially of the 28S-fragment give surprising insight into relationships among species, for example indicating *G. undulata* and *G. transalpina* to represent young sistergroups. In some species molecular distances correlate well with geographical separation (*G. hexasticha* and *Trachysphaera gibbula*). Establishing our protocol for COI and 28S rRNA, we are eager to include the remaining Austrian species into the newly launched ABOL-Initiative.

LECTURE

Pachyiulus hungaricus (Karsch, 1881) (Myriapoda, Diplopoda, Julidae) – a model-system for semiochemical analysis and antimicrobial testing

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Pachyiulus hungaricus is one of the largest European millipedes, distributed mainly on the Balkan Peninsula. There are no records of chemical composition of defensive fluids within any members of the genus *Pachyiulus.* This species possess three lines of defense: aposematic coloration, hard calcified cuticle with possibility for spiral twisting, and chemical defense. Defense glands (ozadene) consist of three parts and belong to the juliform type. First part is spherical sac with probably glandular functions. Second part is efferent duct, connecting sac with ozopores. Apical part of the efferent duct has a caudal inflection with massive muscle inserting on the inflection. This part also contains closing mechanism for ozopore, consist of bung-like conical flange connecting with massive muscle. Third part is ozopore which is rounded by chitinous areole.

Analysis of the defensive secretion, using dichloromethane (DCM), showed presence of two groups of compounds: quinones, and non-quinones (pentyl and hexyl esters of saturated and unsaturated fatty acids with chain lengths from C_{14} to C_{20}, and long chain alkenes). Following quinones have been identified: 1,4-benzoquinone, 2-methyl-1,4-benzoquinone (toloquinone), 2-hydroxy-3-methyl-1,4-benzoquinone, 2-methoxy-3-methyl-1,4-benzoquinone, hydroquinone, 2-methyl-hydroquinone, 2,3-dimetoxy-hydroquinone, 2-methyl-3,4-methylenedioxyphenol, and 2-methoxy-3-methylhydroquinone. The relative abundances of quinones and non-quinones in the defensive fluids of *P. hungaricus* were 79.1% and 20.9%, respectively. Two dominant quinonic compounds, with 88.4% relative abundance in quinone fractions, were 2-methyl-1,4-benzoquinone, and 2-methoxy-3-methyl-1,4-benzoquinone.

Defense secretion (DCM extract) of *P. hungaricus* was evaluated for exploration of its antimicrobial activity against several certain Gram negative and Gram positive bacteria. The antibacterial potential of secret was evaluated according to his zone of inhibition against various pathogens and by using a dilution method. The results revealed that the defense secret is potent antibacterial agent which indicated that all tested strains differ slightly in it's sensitivity. The lowest concentration of secret was recorded against *Aeromonas hydrophila* and *Listeria monocytogenes*. In this range of concentrations was confirmed the sensitivity of MRSA, also. The DCM extract was not more effective in inhibiting the growth of bacteria than antibiotic (rifampicin), which was necessary in once or twice higher concentration.

Antifungal activity was tested using the eight fungi isolated from medicinal drugs. Results showed that defense secret of *P. hungaricus* exhibited a strong antifungal potential. The lowest concentration for inhibition of visible growth was necessary for *Fusarium equiseti*. A higher tolerance on this secret demonstrated the *Penicillium* sp. The results indicate that the fungi were more sensitive to the test compounds than bacteria. Furthermore, defensive secret of *P. hungaricus* was more effective in inhibiting the growth of pathogenic fungi than antibiotic (fluconazole) which was necessary to tenfold higher concentration to inhibit the growth of fungi.

LECTURE

Type locality assignation to *Rhinocricus duvernoyi* (Karsch, 1881) (Diplopoda: Spirobolida: Rhinocricidae)

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Millipedes are arthropods characterized by its trend to local endemism, therefore species with wide distribution are infrequent. Taxonomical stability of species within this group depends on the existence of type specimens with precise localities. This is lacking in the original description of *Rhinocricus duvernoyi*, just referred to Cuba. Based on evidences coming from literature and field research, a precise type locality is assigned to the species.

POSTER

Endemics in the millipede fauna of the Asian part of Russia (Diplopoda)

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At present, 114 species from 40 genera, 17 families, 5 orders and 2 subclasses of Diplopoda are known to occur in the Asian part of Russia. The fauna is highly original, being characterized by a high rate of endemism at different taxonomic levels. Thus, 74.6, 25 and 5.9% of the region's diplopod species, genera and families are endemic, respectively.

The number of endemic species drops from south to north. The distribution of endemic species within this territory is irregular. Most (76.4%) are continental, dominating in the south. Only three species reach up to about 60˚N.

Even though 11.8% of all species endemic to Asian part of Russia show insular patterns, they again occur only on the larger islands and archipelagos such as Sakhalin + Moneron Island and the Kuriles. Most of the insular endemics are restricted to the southern parts of their islands or archipelagos, with only two species extending considerably to the north and only one being endemic to northern Sakhalin. The millipede faunas of the smaller islands in the southern and southeastern parts of the Russian Far East which are known to have been formed as a result of sea-land oscillations appear to lack endemics altogether.

The considerable difference in the rate of endemism between the mainland and islands shows secondary roles played by insular isolation in the region's faunogenesis.

Only 11.8% of all regional endemic species of millipedes are common to the islands and mainland. Most of these species demonstrate rather limited distributions within the Primorsky Province, with only two species being more widespread.

The Russian Far East and Siberia differ in the number and faunistic composition of endemic Diplopoda. The greatest proportion of endemic taxa is recorded in the Far East: 55.3, 50 and 100% of species, genera and families, respectively. Most of the endemic species show a Manchurian distribution pattern which includes the Primorsky Province, the southern part of the Khabarovsky Province, the Amurskaya Area, northeastern China and Korea. A little more than half of the Siberian endemic species can be attributed to the Central Asian faunogenetic centre, i.e. the territory extended along the border between northern Mongolia and the southern part of Eastern Siberia. Only one endemic genus and one endemic species are common to Siberia and the Russian Far East.

To summarize, Asian part of Russia is a region showing a high level of endemism in the millipede fauna. Continental endemics, insular endemics and endemics common to the mainland and insular parts of the region can be distinguished. The former dominate. Neither integrity of nor a great degree of similarity between the endemic faunas of different territories of Asian part of Russia is observed. There are few endemic species common to the continental and insular parts of the region and there is only one genus and one species shared by the faunas of Siberia and the Russian Far East.

LECTURE

Parental care in centipedes (Myriapoda: Chilopoda): A phylogenetic perspective

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The last quarter of the 20th century was a time of unprecedented progress in animal phylogenetics, largely thanks to the rapidly increasing availability of DNA, RNA and protein sequences, and the development of increasingly powerful and critically sensitive techniques for their analysis. In the case of centipedes (Arthropoda: Myriapoda: Chilopoda) most phylogenetic studies, based on morphological, molecular or total evidence confirm the basal split between the Scutigeromorpha (Notostigmophora) and all remaining centipedes (Pleurostigmophora), as well as the sistergroup relationship between the Scolopendromorpha and the Geophilomorpha. The most conspicuous advance produced by combined analysis of morphological and molecular evidence was the recognition of two large chilopod clades supported by behavioral evidence, in addition to the morphological and molecular characters. One is the Phylactometria, grouping together all centipedes – the monogeneric Craterostigmomorpha and the Epimorpha, comprising Scolopendromorpha and Geophilomorpha – whose females provide extended parental care to their brood. The other is the Adesmata, which groups all those geophilomorphs where the brooding females coil their body around the brood in such a way to expose the ventral surface with glands that produce defensive exudates.

In the present study we describe the cases of the brooding female of the following centipede species: *Cryptops anomalans* Newport, 1844; *Cryptops parisi* Brolemann, 1920; *Geophilus flavus* (De Geer, 1778), *Henia illyrica* (Meinert, 1870), *Pleurogeophilus hercegovinensis (*Verhoeff, 1901), *Stenotaenia linearis* (C. L. Koch, 1835), and *Strigamia herzegowinensis* (Verhoeff, 1935). The position of mothers of all these species with respect to their clutch has not previously been described. In *C. anomalans* and C. *parisi* brooding females were observed with the ventral side against the offspring and the terga outward, and no case has been recorded with the female resting in an opposite position. On the other hand, in all geophilomorphs the ventral surface of the brooding female were exposed to the outside. The analysis of breeding behavior in these taxa supports the hypothesis that within the clade of centipedes with prolonged parental care (Craterostigmomorpha + Scolopendromorpha + Geophilomorpha), the female position with sterna outwards is an apomorphic state and probably a general feature of the whole Adesmata, i.e. the Geophilomorpha exclusive of the basal Mecistocephalidae.

LECTURE

Defensive secretion of proteinaceous glues by *Henia* (*Henia*) *illyrica* (Meinert, 1870) (Chilopoda, Geophilomorpha)

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Analyses of sternal gland contents of the geophilomorph centipede *Henia (Henia) illyrica* (Meinert, 1870) by gas chromatography − mass spectrometry (GC-MS) and electrophoresis revealed that its chemistry is similar to that reported from the other representative of the same genus [*H. vesuviana* (Newport, 1844)]. The analyzed centipedes secrete copious amounts of proteinaceous glue in responce to attack from potential predators. When a leg of a live specimen is stimulated, the segment to which it is attached momentarily shrinks in size, and a droplet of glue appears on the ventral surface. The glue-secreting glands of *Henia illyrica* are highly effective at repelling attacks from soil-dwelling predatory arthropods.

LECTURE

The centipedes (Chilopoda) of Serbia (including Kosovo and Metohija)

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Published and unpublished data on the centipedes of Serbia (including Kosovo and Metohija) is summarised and critically reviewed in this study. Sixty-one species (1 Scutigeromorpha, 31 Lithobiomorpha, 5 Scolopendromorpha, and 24 Geophilomorpha) are listed and discussed, 18 of wich are new to Serbia.

POSTER

Ján Gulička (1925–2009) – famous and almost forgotten Slovak (Czechoslovak) myriapodologist

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Ján Gulička was one of the leading specialists for soil macrofauna in the Central Europe during the second half of the 20th Century. He was born in the modest family living in the Ružomberok Town, Central Slovakia, and encircled by the Carpathian Mountains and karst massifs he was fascinated in his whole life by mountain landscape and caves. His studies were focused on soil zoology and biospeleology, and above all on millipedes. After graduation at the Faculty of Natural Sciences, Comenius University, Bratislava (1950), he gained the position in the Institute of Zoology of this Faculty and worked there until retirement. Soon he wrote two large manuscripts as doctor and PhD theses (1951 Progoneata a Chilopoda Slovenska – Progoneata and Chilopoda of Slovakia; 1961 Diplopoda Slovenska – Diplopoda of Slovakia). Both works, based on thorough study of literature, extensive field work and precise determination represented solid local synthesis of the contemporary knowledge especially in millipedes. Soon he recognized peculiarities of the Hercynian and Carpathian faunas. Unfortunately, both manuscripts were not published and they were hidden before other colleagues directly by the author himself. With time he became very suspicious. Partly it was due to hypocritical atmosphere in totalitarian regime in the former Czechoslovakia growing up even on the University premises.

He described new millipede taxa from the Czech and Slovak Republics, from the Balkan Peninsula as well as from the Russian Asia. His publication activity was culminated in the half of 80thies. He published in total 24 papers dealing with millipedes (taxonomy, ecology, faunistics) and centipedes (ecology and faunistic data from Slovakia). Since 1990, he was retired, he stood at home and his contacts with other scientists were rare and irregular. After he has died, all his scientific inheritance was given by his wife to his alma mater. Set of papers and manuscripts in this inheritance is not numerous, but it is important key to the collection of myriapod material, especially millipedes. Majority of the items in the collection is not identified, but it involves also type specimens, borrowed material for comparative studies and others. The samples collected by him come primarily from the territory of Slovakia, but quite numerous are items from other European countries (e.g. Czechia, former Yugoslavia, Albania, Bulgaria) and Asia Minor. The life, work and collection of Ján Gulička is worthy to be described and re-interpreted.

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POSTER

Hungarosoma bokori Verhoeff, 1928 (Diplopoda, Chordeumatida), a tiny and enigmatic millipede: Redescription and new light to its systematics, ecology and biogeography

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The millipede *Hungarosoma bokori* Verhoeff, 1928 was described based on the female specimens. For significant morphological characters already in that time it was included in a separate genus. This genus was considered to be monotypic and the species obligate cave and parthenogenetic inhabitant, stenoendemite and with uncertain systematics. Due to the studies undertaken by Loksa (1961) and Ceuca (1967, 1974), the knowledge on ecology, distribution and taxonomy was subsequently upgraded, other population of this species was found in the soil of non-karstic area in the Western Hungary and another one species was described from Romania.

Recently quite numerous isolated localities of this species were found in behind the northern limits of the Pannonian Lowland in limestone caves and in soils near the caves in the Western Carpathians and the Moravian Karst. 86 years after a long history of field searching and discussion of its systematic position, in April 2013 the series of nine specimens including one adult male of this small enigmatic species was collected in the type locality, the Abaliget Cave in Southern Hungary.

The recent Circum-Pannonian distribution corresponds with the hypothesis that it is a relict of the mega-block Tiszia from Tertiary period, recently slumped under sediments of the Pannonian Lowland. New findings motivated the study of its population genetics and phylogeography. Beside this, the description of male gonopods and other detailed morphological analysis of both sexes, important for other consideration of systematics of the species will be given. Species identity of separate "populations" is analysed based on morphological and molecular studies. Legitimacy of the opinion of existence of the stand-alone family Hungarosomidae Ceuca, 1974, ignored for a long time, will be discussed. The study was supported by the grant Vega 1/0199/14.

POSTER

The epidermal glands of Myriapoda: Ultrastructural diversity, function and phylogenetic resolving potentials

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The epidermis of myriapods is rich in multicellular exocrine glands (class-III glands) of various structural and remarkable functional complexity. These glands consist of three types of cells: (1) one or several secretory cell(s) involved in the production and primary release of secretion, (2) an intermediary cells processing the secretion and making connection to (3) one or several canal cell(s) that guide the secretion onto the surface of the cuticle via a cuticularized duct. This talk focuses on the structural diversity and phylogenetic significance of these multicellular epidermal glands. These glands may be scattered throughout the integument (solitary glands) or become locally adjoined to form units in large and complex, deeply internalized glands with (compound glands) or without (aggregated glands) acinar compartments. One example for an aggregated formation is the venom gland of centipedes, whereas e.g. the scutigeromorph maxillary I gland or accessory sex glands of lithobiids pose an example for compound glands. In recent years, a new terminology was introduced to resolve more comprehensively the (functional) morphology and evolution of glandular units in myriapod multicellular glands. Depending on pore structures, diversity, arrangement of constituting cell types, and most importantly, the appearance of the canal cell with a duct system, either flexo-canal or recto-canal epidermal glands are present in the myriapod epidermis. In this talk, an overview is provided of major essentials of our TEM investigations we conducted in the past 12 years regarding representatives of all major chilopod subgroups as well as of penicillate, glomerid and julid millipedes. Based on the distribution of character states, we draw possible pathways of gland evolution along the stem lineages of Progoneata and Chilopoda. As flexo- and recto-canal epidermal glands are also found in other arthropod subtaxa, we also evaluate if gland characters may help to unravel the still heavily disputed arthropod interrelationships.

LECTURE

The shaft organ of *Scutigera coleoptrata*: The long-sought hygroreceptor of scutigeromorph centipedes?

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Concerning their integumental anatomy/morphology, myriapods are still widely understudied, especially on the ultrastructural level. Although much progress was achieved the past 20 years with respect to sense organs, as for instance eyes or antennal sensilla, there are still remarkable gaps of knowledge. One in particular is the shaft organ, single sensory pits that are located on the scape of the antennae. There was only histological data available from the early 1920ies provided by the German zoologist Heinrich Fuhrmann. He noticed the occurrence of several minute sensory cones inside a cuticular cavity bulging in from a dome-like dorsomedian projection of the scape. Since its first discovery, the shaft organ has been assumed to be sensitive to olfactory cues. We provide first insights from the shaft organ of the House Centipede *Scutigera coleoptrata* (Linnaeus, 1758). We describe the ultrastructure of the sensory cavity, the sensory cones and the entire surprisingly complex apparatus of receptor and sheath cells. Our survey includes SEM and TEM.

Each shaft organ is equipped with 15-20 sensory cones, each housing three biciliated receptor cells and three sheath cells. Along with the entire internal surface of the sensory cavity, the sensory cones are covered by a thick, electron-dense and amorphous mucus structure. This covering layer most probably represents secretion produced by approximately 20 solitary recto-canal epidermal glands associated with the shaft organ. Two receptor cells extend long outer dendritic segments that project into the sensory cone. The outer dendritic segments of the third receptor cell are much shorter and terminate in inside depressions of the thickened dendritic sheath deeply below the sensory cone. Each sensory cone bears a terminal pore that continues into a central canal reaching deeply into the cone. This canal is filled with the same amorphous substance covering the cone. Constituting a plug pin-like structure, it presses the truncated tips of four dendritic outer segments. This configuration is highly similar to insect hygroreceptors. Water vapour pressure beyond a certain threshold may lead to swelling and subsequent elongation of the plug pin, thus causing stimulation of the dendrites. Therefore, the two receptor cells with long outer dendritic segments are considered hygrosensitive. In contrast, the thickened part of the dendritic sheath accommodating the tubular bodies of the third receptor cell is connected to a scolopale-like structure passing through proximal sheath cell via numerous microfilaments. This scolopale-like structure in *S. coleoptrata* strongly resembles that found in scolopale cells of hexapod and crustacean scolopidia, except for the absent connection to an overlying cuticular cap. This is the first observation of scolopidia-like sensilla in myriapods. The definite function of these components is yet unknown, but they may be linked to thermoreception. Accordingly, the shaft organ may play a crucial role in sensory biology of *S. coleoptrata* by allowing the animal to find suitably humid and cold places in the soil.

POSTER

Searching for the ancestral motion-detecting circuit of Mandibulata

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As opposed to other Mandibulata (except Branchiopoda!), scutigeromorph centipedes possess optic lobes with just two neuropils: a distal lamina and a proximal visual tectum. The thin plate-like visual tectum accommodates large tangentially arranged relay neurons, the axons of which project into the frontolateral edge of the brain. To name this second optic neuropil the visual tectum appears appropriate given the close resemblance to the lobula plate of Hexapoda. Hence, neither a medulla nor a lobula is present in scutigeromorph centipedes. If both the tecta and lobula plates are homologues, the ability of scutigeromorphs to perceive directional motion has to be assumed. However, as yet very little is known of the visual behavioral physiology of these animals or their optic lobe neuroanatomy. In addition, our understanding of the fine-scale wiring of relay neurons in the lamina as well as in the visual tectum is at best vague, especially with regard to synaptic circuitry.

This poster presents preliminary data on reconstructions of specific neuronal patterns in the optic ganglia of the House Centipede *Scutigera coleoptrata* (Linnaeus, 1758). Transmission electron microscopy is used to resolve retinula cell axons and second order neurons and their synaptic interconnections to higher order relays. The research addresses the fundamental question as to whether motion computation can be achieved by an arthropod possessing exquisite compound eyes but having a visual system that is far simpler than that of any insect. One focus of this study is to test the robustness of circuits that are supposed to mediate motion computation thereby resolving the ground pattern of neurons mediating the detection of visual motion across the retina.

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POSTER

Fine structure of trimodal beak-shaped sensilla of *Scutigera coleoptrata* (Chilopoda: Scutigeromorpha)

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The antennal sensillar equipment of Scutigeromorpha has never been examined in detail. However, a recent comprehensive SEM survey revealed the existence of thousands of beak-like sensilla sitting on the antennomeres as well as on the (prae-) tarsomeres of the trunk appendages of the House Centipede *Scutigera coleoptrata* (Linnaeus, 1758). On the antennae, these beak-like sensilla are arranged in circles at the distal end of every second antennomere, whereas they are aligned along the dorsal and lateral aspect of the walking and terminal legs. The slightly curved, flattened and robust sensillar shaft measures up to 50 µm in length and displays a terminal pore. The (sub-) cellular anatomy of beak-like sensilla was explored utilizing standard 2D-TEM as well as SEM and serial-block-face-imaging (with Gatan 3view). With the latter method we gained a gap-less series of images which provides a basis for 3D reconstruction of the sensory cells and sheath cells down to the fine structural level. Both chemical- and cryo-fixed (high-pressure freezing) antenna were compared with regard to their practicability and applicability for 3D-EM. 14-22 bipolar, uniciliated receptor cells are found in each beak-shaped sensillum, encompassed by three sheath cells. One of these receptor cells bears a short outer dendritic segment which terminates in a tubular body attached to the socket apparatus. This configuration is typical for mechanoreceptive receptor cells found in numerous arthropod sensilla. The outer dendritic segments of remaining receptor cells are much longer and project into the hair shaft, a part of them terminates slightly below the terminal pore indicating gustatory function. Within the hair shaft, all outer dendritic segments remain in a peripheral position in close vicinity to an extracellular structure surrounding the receptor lymph space, called the dendritic sheath and a specialized, non-lamellated cuticle. This non-lamellated cuticle is continuous with the bottom of deep spiral furrows incising the shaft cuticle. Combined with secretion produced by numerous recto- and/or flexo-canal epidermal glands in the integument, this specialized cuticle is thought to be semi-permeable for volatile odors. Hence, this configuration indicates that at least a part of chemoreceptive cells in beak-shaped sensilla has specialized in olfaction. Trimodal sensilla integrating olfactory, gustatory and mechanoreceptive functions are unique among arthropods. It would be most parsimonious to assume that beak-shaped sensilla evolved secondarily by modification of the shaft cuticle of an ancestral bimodal contact-chemoreceptor. Our morphological data as well as behavioural observations show that olfaction certainly does matter in the life of a scutigeromorph.

POSTER

Fauna and ecology of millipedes (Diplopoda) in the Tigirek State Nature Reserve, Russian Altai

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The Tigirek State Nature Biosphere Reserve, being the only one reserve in the Altai Province, situated in the south-west part of the region and encompasses 3 sites, namely Khankhara, Tigirek and Beloretsk sites. The dark-coniferous taiga is the main land cover of the Tigirek Mt. Range. Aspen and fir forests predominate in the most territory of the Reserve. In the river valleys there are pure fir forests whilst pine and fir forests occupy mountain taiga area. Prior to undertaking the research about two species of Diplopoda had been known to inhabit the Tigirek Sate Nature Biosphere Reserve: *Julus ghilarovi ghilarovi* (Gulička, 1963) and *Schizoturanius clavatipes* (Stuxberg, 1876) (Mikhaljova & Nefediev, 2003). We have researched 20 localities both in the low-mountain and mid-mountain vegetation belts at a height up to 900 m and ranging from 900 to 1400 m above sea level, respectively, and further to the upper forest line, being formed by pine and fir sparse growth with some areas of subalpine tall grass meadows. In low-mountain terrain large areas of meadow steppes and shrub thickets have been also researched.

The species diversity of Diplopoda in the Tigirek State Nature Biosphere Reserve is represented by at least 7 species: *Megaphyllum sjaelandicum* (Meinert, 1868), *Orinisobates sibiricus* (Gulička, 1963), *J. ghilarovi ghilarovi*, *S. clavatipes*, Polydesmidae gen. sp., Diplomaragnidae gen. sp. and undescribed species of Julidae. The julidan millipedes, *M. sjaelandicum* and undescribed species of Julidae, appear to be the most widespread, whereas the former predominates in light coniferous forests (up to 95% of the total abundance) and the latter in shrub thickets and dark-coniferous forests (up to 74% in both types of biotopes). The polydesmid millipede, *S. clavatipes* predominates in birch forests amount to 83%. The species of the family Diplomaragnidae and the julid *O. sibiricus* appear to be quite rare. Thus, the highest millipede species wealth has been found in forest ecosystems, inhabited by no less than 4-5 species. In meadow steppes and shrub thickets the species wealth includes no more than 1-2 species.

The character of vertical distribution shows that the maximum abundance of millipedes can be observed in low-mountain forests and shrub thickets, wherein their total density ranges from 11.5 to 32.5 ind./m^2. In mid-mountain areas diplopods are quite rare to find, wherein their numbers are less than 1.5 ind./m^2. The highest locomotor activity of millipedes has been found in low-mountain forests, ranging from 4 to 30 ind./100 trap-days. In low-mountain shrub thickets the dynamic density of diplopods ranges from 4 to10 ind./100 trap-days.

Juveniles predominate in the sex-age structure of dominant species, such as *M. sjaelandicum*, *S. clavatipes* and undescribed species of Julidae.

POSTER

A review of the anthropochore fauna of Asian Russia, with new records from the Altai Province, Siberia (Diplopoda)

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The anthropochore millipede fauna of Asian Russia is reviewed, based on the available literature records, as well as new samples from the Altai Province and only partly published, freshly revised material (Nefediev & Nefedieva, 2006, 2011). The first anthropochorous diplopod reported from the Asian part of Russia seems to be *Oxidus gracilis*, encountered in Sakhalin Island (Chamberlin & Wang, 1953). In the mainland of Asian Russia, this species has hitherto been recorded in Khabarovsk, Russian Far East (Mikhaljova, 1993), as well as in Tomsk, southwestern Siberia (Mikhaljova & Nefediev, 2003). Now it has also been found introduced to hothouses of the South Siberian Botanical Garden (= SSBG) in Barnaul, Altai Province. The julidan millipede, *Nopoiulus kochii* has heretofore been reported from the Russian Far East in Vladivostok (Lokšina & Golovatch, 1979; Golovatch & Enghoff, 1990; Mikhaljova, 1993, 1998a, b) and from Elena Island, off the coast near that city (Mikhaljova, 2009a). In Siberia, this species has been recorded in Tomsk (Mikhaljova & Nefediev, 2003), now also found introduced to hothouses of SSBG and to some parks of Barnaul, as well as to open hand-made grounds in the Pervomaiskii District, Altai Province. The species *Cylindroiulus latestriatus* having been introduced to Kunashir Island, Kuriles (Mikhaljova, 1998). In southwestern Siberia, *C. latestriatus* has only been recorded very recently (Nefediev *et al*., 2013), collected on open hand-made grounds in the Pervomaiskii District, Altai Province. Both *C. britannicus* and *C. truncorum* have also been reported from southwestern Siberia only very recently (Nefediev *et al*., 2013). The former species has been taken in some anthropogenous habitats in two cities in the Altai Province (Barnaul and Biysk), as well as in Tomsk, Tomsk Area, whereas the latter species in Barnaul and Tomsk. The polydesmid millipede, *Polydesmus denticulatus* has hitherto been recorded by Mikhaljova and Nefediev (2003) in Siberia in a city park of Tomsk.

New samples from the Altai Province appear to add several new taxa to the millipede list of Asian Russia. Thus, the julid genus *Brachyiulus* as well as the species *B. jawlowskii* are new to the millipede fauna of the Asian part of Russia, currently recorded in several anthropogenous habitats in Barnaul and Biysk, as well as on open hand-made grounds in the Pervomaiskii District, Altai Province. Similarly, both the polydesmid genus *Brachydesmus* and the species *B. superus* are reported from Asian Russia for the first time, having been introduced to hothouses of SSBG and to open hand-made grounds in the environs of Barnaul. The genus *Poratia* and the widespread *P. digitata*, as well as the family Pyrgodesmidae they belong to, are formally new to the millipede fauna of Russia. This species is now found introduced to a hothouse of SSBG.

At present, 9 species from 7 genera, 5 families and two orders of Diplopoda are known to occur in Siberia and the Russian Far East as anthropochore introductions.

LECTURE

Distribution of millipedes (Diplopoda) along an altitudinal gradient in the south of Lake Teletskoye, Altai Mts

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Since 1998 the Altai State Nature Biosphere Reserve and a buffer zone around Lake Teletskoye are inscribed as one of three separate areas of UNESCO World Natural Heritage Site under the name "Golden Mountains of Altai". Lake Teletskoye, being the deepest and largest body of freshwater in southwest Siberia, exerts the great warming influence on local climate, in its southern part especially. Situated at a height of 435 m above sea level, the lake lies between the mountain ridges of Altyntu and Korbu, and the Chulyshman river highlands in the south. In 1959-1961 in the south of Lake Teletskoye in the territory of watershed of the Kyga and Bayas rivers was laid 22 numbered sites at different altitudes (= Kyga Biogeocenosis Profile), comprising a relic *Pinus sibirica* forest from the Tertiary period. The vertical vegetation zonation here is characterizes by the presence of forest and high-mountain belts. There are widespread dark coniferous forests with *Betula pendula* and *Populus tremula*, also called chern taiga, and sparse growths of *Pinus sibirica* in the former belt, whereas alpine meadows does not occur almost at all in the latter. Above the timberline at a height of 2100 m above sea level, all hilltops are occupied by shrub, moss-lichen and rocky tundras. The distribution of millipedes along an altitudinal gradient in the south of Lake Teletskoye, based on new samples from Kyga Profile sites, as well as on partly published and freshly revised material (Mikhaljova *et al*. 2007, 2008, Nefedieva & Nefediev 2008, Nefediev & Nefedieva 2013), is established.

Thus, the millipede diversity in the south of Lake Teletskoye is estimated to be at least 13 species and 2 subspecies from 10 genera, 6 families and three orders: *Julus ghilarovi ghilarovi*, *J. insolitus*, *Orinisobates sibiricus*, *Pacifiiulus amurensis*, *Sibiriulus altaicus*, *Ghilarovia kygae*, *Kirkayakus pallidus* (synonym of *Altajella pallida*), *Teleckophoron montanum*, *Altajosoma bakurovi bakurovi*, *A. deplanatum*, *A. katunicum*, *A. kemerovo*, *Shearia teletskaya*, *Schizoturanius clavatipes* and *S. tabescens*. The bulk of species diversity is confined both to low- and mid-mountain chern taiga forests and high-mountain shrub tundras with *Betula rotundifolia* and *Salix glauca*, whereas mid-mountain sparse growths of *Pinus sibirica* are characterized by the lowest millipede diversity.

The numbers of diplopods range from 5 to 65 ind./m² in the subzone of low- and mid-mountain chern taiga forests, and from 5.5 to 8 ind./m² in high-mountain shrub tundras. Despite of the lowest species diversity in the mid-mountain sparse growths of *P. sibirica*, they show the highest numbers, reaching up to 130 ind./m², evidently caused by the abundance of plant debris of dwarf vegetation that appear to be more suitable for feeding of millipedes.

POSTER

The phylogeny of the pill millipedes (Diplopoda, Glomerida): First insights and a basic framework

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The pill-millipedes of the order Glomerida (Myriapoda, Diplopoda) are small enigmatic animals, occurring in the holarctic ecozone, which can roll up into a perfectly closed ball when threatened. The relationships of the genera within the Glomerida are still up to debate, as the current system is typological and based on a single character, namely the male telopods. To test the current system and explore the morphological diversity of the pill-millipedes, using an unprecedented taxon sampling, two nuclear and two mitochondrial marker genes were analyzed and 2355 high resolution SEM images of 17 separate structures were recorded and examined. Here we show that the current system of the order Glomerida does not provide a subdivision in monophyletic units. The molecular phylogenetic analyses failed to recover any of the currently proposed groups above genus level, such as the suborder Glomeridelloidea or the family Protoglomeridae. Problems could be found even on genus level, as *Haploglomeris multistriata,* which belongs to the sub-family Haploglomerinae was recovered within the genus *Glomeris* of the sub-family Glomerinae. Additionally, based on two exemplary morphological character systems, it is shown that the morphological diversity of the pill-millipedes is highly underrated and that numerous potentially phylogenetically informative characters can still be found by studying the external morphology with SEM-microscopy. Furthermore, it is shown that Europe is the most likely origin of the current distribution of the order and that the hitherto hypothesized close relationship between the American and Asian genera is unlikely. The results clearly demonstrate that there is still much work to be done to establish a robust phylogenetic system for the order and that the current focus on the male telopods needs to be shifted to include a wider spectrum of characters.

LECTURE

The evolutionary history of the rediscovered Austrian population of the giant centipede *Scolopendra cingulata* Latreille, 1829 (Chilopoda, Scolopendromorpha)

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The thermophilous giant centipede *Scolopendra cingulata* is a voracious terrestrial predator, which uses its modified first leg pair and potent venom to capture prey. The highly variable species is the most common of the genus in Europe, occurring from Portugal in the west to Iran in the east. The northern-most occurrences can be found in Hungary and Romania, where it abides in small isolated fringe populations. We report the rediscovery of an isolated Austrian population of *Scolopendra cingulata* with the first explicit specimen records since more than 80 years and provide insights into the evolutionary history of the northern-most populations utilizing fragments of two mitochondrial genes, COI and 16S, comprising of 1155 basepairs. The classical speciation by distance scenario, which argued for a simple range expansion of the species from the south, via Romania, Hungary and finally to Austria, was falsified based on a comprehensive taxon sampling from seven countries, including the first European mainland samples. We argue that more complex patterns must have shaped the current distribution of *S. cingulata* and that the Austrian population should be viewed as an important biogeographical relict in a possible microrefugium. The unique haplotype of the Austrian population constitutes an important part of the species genetic diversity and, because microrefugia are likely to host further rare thermophilous species, we hope that this discovery will initiate protective measures not only for *S. cingulata*, but also for its habitat. Furthermore, we take advantage of the unprecedented sampling to provide first basic insights into the suitability of the COI fragment as a species identifying barcode within the centipede genus *Scolopendra*.

POSTER

Centipede assemblages along an urbanization gradient in the city of Heraklion (Crete, Greece)

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Global urbanization is a major force that causes alteration and loss of natural habitats. Urban ecosystems are strongly affected by humans and there is a continuum of decreasing human influence along city centers to natural habitats. To study ecological changes along this continuum, researchers introduced the urban-rural gradient approach. The responses of centipedes to an urbanization gradient (urban-suburban-rural areas) were studied using pitfall traps in and near the city of Heraklion, in the island of Crete, Greece, from November 2010 to November 2011. In general, habitat loss and habitat fragmentation reduce species richness in many animal groups because of the impoverished flora, leading to isolated populations. However, the present study failed to indicate negative urbanization effect on centipede species richness and diversity. Our results support the intermediate disturbance hypothesis, in which suburban areas located in the transitional zone between urban and rural habitats show high environmental heterogeneity. Also, the structure of centipede assemblages differed along the urban-rural gradient with great similarity in centipede diversity between rural and suburban sites.

LECTURE

A phylogenetic framework of the family Chelodesmidae Cook, 1895 (Polydesmida)

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With close to 800 described species, the Chelodesmidae constitute the second largest family in Polydesmida; its members occurring in South America (subfamily Chelodesminae) and western Africa (subfamily Prepodesminae). Hoffman, examining and illustrating numerous characters in his extensive work on the family, proposed numerous tribes, mainly in the Chelodesminae. Employing morphological characters, the monophyly and the interelationship of the 16 chelodesmine tribes are tested, with the exception of the tribes Pandirodesmini and Trachelodesmini, which have not been sampled yet. Currently, the data matrix contains 45 species (terminals) and 58 characters with a total of 132 states. In the current data set, the majority of the proposed tribes are monophyletic; exceptions are the Caraibodesmini, Strongylomorphini and Trichomorphini. The paraphyly of the Macrocoxodesmini is confirmed here. The most parsimonious tree (316 steps) shows Chelodesminae as paraphyletic. The South American tribes Batodesmini, Cornalatini and Trichomorphini form a clade with the western African Prepodesminae. The relationship between those tribes and the Prepodesminae can be used as a model to hypothesize the ancestral group occupying Gondwana prior to the separation of South America and Africa. Thus, the Chelodesminae *sensu stricto* is composed of the monophyletic tribes Arthrosolaenomeridini, Chelodesmini, Chondrodesmini, Dibolosthetini, Gonorygmatini, Leptodesmini, Lepturodesmini, Platynodesmini, Priodesmini, Sandalodesmini and Telonychopodini, and is restricted to South America. The position of the recently revised chelodesmine genus *Odontopeltis* is tested here. It still forms a close relationship with its sistergroup *Rondonaria,* a clade which could be interpreted as a new tribe.

LECTURE

Systematics of the millipede family Pachybolidae, with emphasis on the Southeast Asiatic fauna

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The cylindrical millipedes, the superorder Juliformia, are one of the most diverse millipede groups in SE Asia. Recently the gigantic millipedes of the order Spirostreptida, family Harpagophoridae were partly revised. In contrast, the order Spirobolida, another highly diverse group of cylindrical millipedes, has received little attention in SE Asia, and is particularly poorly known in Thailand. Indeed, currently only three families, with six genera and eight species of Spirobolida are known from Thailand. Yet, our own recent field surveys, observations and sampling campaigns convincingly suggest that these figures vastly underestimate the actual spirobolidan diversity in Thailand. Until now, based on gonopodal characters and COI sequence divergences, ten new taxa have been recognised from Thailand, as well as three taxa from Malaysia and Viet-Nam. Species of the family Pachybolidae are medium-sized to gigantic millipedes occurring in tropical Asia, Madagascar, Africa, Australia, and with one single genus living in South America. Against this background, the family Pachybolidae is an interesting and challenging model taxon for investigating the evolutionary dynamics of a highly diverse group. The phylogenetic relationships between the SE Asian pachybolids and the African, Malagasy and South American pachybolids and also some other families of Spirobolida, based on two partial mitochondrial genes (COI and 16S) and nuclear (28S) genes will be discussed.

LECTURE

The Chilopods of the Khentey-Mountain Range, Northern Mongolia: Communities from different forest-types under a varying fire regime

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The Khentey-Mountain Range is a part of the central Asian watershed and stretches from the Mongolian capital Ulaanbaatar in north-eastern direction towards the Russian border and beyond. The Khentey Mountains are a "hotspot" of Biodiversity in Mongolia, due to a double border situation: The sibirian Taiga meets the central Asian – Daurian Steppe region, and forms a special type of forest, the forest-steppe. In addition, the Khentey Mountains were located, were the central Siberian dark taiga borders to the light taiga in the east.

The field studies were performed in three locations in the West, South and East Khentey. Altogether, we sampled 99 plots, each consisted of a transect of five pitfall traps and a soil and litter sampling.

We were able to establish the occurrence of nine species of Chilopoda in the Khentey-Mountain region. The Lithobiomorpha *Lithobius (Ezembius) giganteus, Lithobius (E.) sibiricus, Lithobius (E.) ostiacorum, Lithobius (E.) rapax, Lithobius (Monotarsobius) alticus, Lithobius (M.) crassus* and *Hessebius styliferus* and the Geophilomorpha *Pachymerium ferrugineum* and *Strigamia acuminata*. Among these, *L. giganteus* and *L. alticus* were by far the most widespread species. While the distribution of L. alticus was evenly in both, traps and soil samplings, L. giganteus was found nearly exclusively in the traps.

The Chilopoda-communities in the West were more species-rich than those in the South and East, which is caused by the higher precipitation and hence resulting higher diversity of the forest. Even within the Western and Southern Khentey, we found a simultaneously increase in the richness of Chilopoda and tree species. Generally, we found the highest diversity of Chilopoda in the higher altitudes, which corresponds with the increasing precipitation, and, exclusively for the Lithobiomorpha, in the floodplain forests . Geophilomorpha were absent in the alluvial forests and were only found in the hill forests.

Regarding the influence of fire, the situation is more complex. The two most common species are indiscriminately found on burned and unburned areas, while significantly less common species such as *L. sibiricus* or *H. styliferus* have their peak of abundance in burnt areas. The soil-dwelling Geophilomorpha showed no clear differences with regard to the fire influence.

Overall, we detected a slightly positive effect of wild fires on the species richness and density of Chilopoda, while our results demonstrate that the differences of chilopod communities in burned and unburned forests decline with increasing tree species diversity.

POSTER

Beyond benzoquinones: Chemical diversity of defensive secretions in the Julida (Diplopoda)

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Chemical defense is widespread among arthropods but is particularly pronounced in millipedes (Diplopoda). Most diplopods possess serially-arranged defensive glands that are known to produce a variety of noxious secretion compounds, including unique alkaloids (Glomerida), terpenes (Polyzonida), hydrogen cyanid and cyanogenetic compounds (Polydesmida), phenols (Polydesmida, Callipodida), and – most conspicuously – benzoquinones (Juliformia). For the latter group, the Juliformia (i.e. Spirobolida, Spirostreptida, and Julida), the term "quinone millipedes" was introduced and is meanwhile well established, even in general texts on millipede ecology.

Based on our own studies and on literature data, we here summarize growing evidence that particularly the defensive chemistry in the order Julida is much more diversified, and that several classes of non-quinonic compounds accompany or replace the typical juliform benzoquinones in a number of taxa. In detail, a diverse array of aliphatic alcohols, aldehydes, esters, phenols as well as a large bulk of hitherto unknown components appears to be present in addition to a frequently highly modified benzoquinone matrix. In order to gain a first overall-picture on julidan chemistry in an evolutionary context, we here provide a hypothesis on the evolutionary history of the secretion chemistry of julidans using a modified approach of ancestral character state reconstruction. As a result, 1) the patchy taxonomic occurrence of phenols in julidan secretions may be considered the remains of an ancient phenolic chemistry, as still predominating in putative juliformian outgroups such as Callipodia and some Polydesmida; 2) the non-aromatic fractions, by contrast, appear to be newly evolved chemical classes of julidans, being taxon-specific and being considered a pool of phylogenetically important characters for julidan internal systematics and phylogeny.

We believe that the conspicuous, but hitherto neglected chemical diversity of julidan secretions has the potential to revive julidan chemosystematics and to fundamentally change the traditional view on the chemical ecology of the "quinone millipedes".

LECTURE

Overview of current state of research on centipede (Chilopoda) in Slovenia

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It is generally known that Slovenia has a very high biodiversity. However the knowledge level varies significantly with respect to various animal groups. There are only few animal groups that are well known and investigated. Among them certainly are centipedes. Within present research all available data about centipedes in Slovenia collected during different investigations from year 1921 to 2009 was gathered. All the data was put into a general electronic database called "CHILLOBIO", which was created for in order to have an easy overview of Slovenian centipede fauna and to be able to input and interpret further new data gained during future research. Using this database and geographic information system (GIS) tools it has been studied what was the investigation level of centipede fauna in Slovenia. In the period from year 1921 to 2009, 108 centipede species were found in Slovenia. Those species were found in 323 different locations. From 236 UTM quadrants 10x10 km which are covering Slovenian area, the centipedes were found in 105 of them. Data overview had shown the absence of centipede data mostly for the south-eastern, eastern and north-eastern part of Slovenia. On the other hand the southern-central part is the best investigated. The highest number of centipede species (43) was recorded for quadrant VL68 near Iška valley. In 54% of investigated quadrants less than 10 species were recorded. On only one locality were found 8 species. For most of them only one or two specimens were caught. Among all species found in Slovenia, 17 species until now were known only from Dinaric region, 4 only from Prealpine-subpannonian region and 7 only from Primorska. In present research we also investigated in how many different habitat types in Slovenia the centipedes were found. They were caught in 19 habitat types, but the larger number of species was found in beech forest stands, possibly due to the fact that during past research the sampling was most often done in this habitat type.

LECTURE

Loboglomeris rugifera – an example of color polymorphism in Glomerida

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Color polymorphism is quite common in the animal kingdom. Well known are the red and the black morphs of the Two-spotted ladybird beetle (*Adalia bipunctata* (Linnaeus, 1758)) or the dark and the light morphs of the Peppered moth (*Biston betularia* (Linnaeus, 1758)). Within diplopoda, leg polymorphism is described of the julid millipede, *Anaulaciulus inaequipes* Enghoff, 1986 and paraterga polymorphism of the polydesmid millipede *Epanerchodus polymorphus* Mikhaljova & Golovatch, 1981. In this presentation the color pattern polymorphism of the glomerid millipede *Loboglomeris rugifera* (Verhoeff, 1906) is discussed.

L. rugifera known from Northern Spain is not only impressive by its size but also by the rare ability to stridulate. The *L. rugifera* is a light brown glomerid with a lot of speckles from dark brown to black all over the dorsal side of the body and therefore resembles a supersized *Glomeris undulata* C. L. Koch, 1844. After an extensive collection Haacker added to that species a second subspecies *L. r. mauriesi* Haacker, 1969. *L. r. mauriesi* has a single row of black big spots at the middle of the tergits forming a long black dorsal band during the unrolled posture. On the first view these two subspecies are clearly distinctable by their drawing pattern.

2009, during an international excursion to the southern part of the Bask region (Navarra, Alava and Guipuzkoa) there was a chance to collect a lot of that interesting glomerids. Most of the specimens could be sorted to either one of the two subspecies, but there were also several intermediary forms between the two mentioned drawing patterns. By comparison, the morphology, especially of the telepodes, could not reveal any differences between *L. r. rugifera and L. r. mauriesi*. Furthermore, a clear regional separation between these two subspecies could not be detected. In 2013 and 2014 there was a chance to compare the COI coding region of the mDNA between the two subspecies. The DNA-analysis has shown that *L. r. rugifera and L. r. mauriesi* did not form two separate groups with a barcoding gap but were mixed in the phylogenetic tree.

This leads to the conclusion that *L. rugifera* does not consist of two separable subspecies, but of two distinctable color morphs. *L. r. mauriesi* is a new synonym of *L. rugifera*.

LECTURE

Diversity and spatiotemporal dynamics of myriapods in forested talus deposit (Slovakia, the Western Carpathians)

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Forested talus deposits represent a specific type of subterranean habitat characterized by close contact to soil surface, minimal seasonal fluctuations of microclimate and better availability of organic matter. All named characteristics are a prerequisite for the presence of rare hypogean and relict fauna. The study was conducted in a small karstic valley in eastern Slovakia (the Western Carpathians), on the forested talus deposit with *Tilieto-Aceretum* forest association at the altitude 530 m a.s.l. The specimens were collected by series of subterranean traps consisting of a set of plastic containers filled with preservative, inserted into the depths 5-95 cm through perforated plastic tube. Two kinds of preservatives were used: 4% formaldehyde (October 2008 to November 2009) and 50% ethylene glycol (November 2009 to July 2010). A total of 2 individuals of Symphyla, 4 individuals of Pauropoda, 979 individuals of Diplopoda belonging to 13 species and 123 individuals of Chilopoda belonging to 11 species were captured. Three distinct myriapods assemblages were distinguished within investigated depth gradient. The "subsurface" assemblage inhabiting uppermost levels was represented in particular by millipedes *Julus curvicornis*, *Leptoiulus mariae*, *Polydesmus complanatus* and centipedes *Harpolithobius anodus*, *Lithobius lucifugus*, *Strigamia acuminata*. The second assemblage was formed by species abundant at -5 cm but also occurring deeper in small numbers. Two species, millipede *Trachysphaera acutula* and centipede *Lithobius forficatus* belonged to this group. The "underground" assemblage with apparently stronger affinity to deeper levels was composed mainly of millipedes *Mecogonopodium carpathicum* and *Polydesmus denticulatus*. Diplopoda were the most numerous at the depth of 35 cm. This was due to one-off mass trap of juvenile of *Polydesmus denticulatus* (417 inds.). Apart from this extreme value, millipedes had relatively uniform distribution. The specimen number gradually decline with depth, except -65 and -95 cm where the slight increase was observed. Chilopoda were the most abundant at the depth of 5 cm. Deeper, the specimen number declined sharply. In winter period, the seasonal activity of Myriapoda dropped to a minimum in all depths. Vertical migration of individuals from sub-surface to deeper parts of the gradient was not detected. The capture efficiency of formaldehyde and ethylene glycol varied. The most significant contrast was evident in the number of trapped millipedes. Compared to formaldehyde traps (installed for 13 months), the traps filled with ethylene glycol (installed for 7 months) captured by 78.9% more individuals. On the contrary, the centipedes were more numerous in formaldehyde traps (by 27.8% more captured specimens). The study was supported by the grants Vega 1/0199/14 and VVGS-PF-2013-104.

POSTER

Microhabitat use by the millipede *Rhysodesmus byersi* (Polydesmida, Xystodesmidae) in an introduced pasture and a pine-oak forest in Mexico

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Many factors can influence where millipedes are found; among these, food preferences, resistance to desiccation, and temperature preferences have been shown to be important. In this study, we investigated whether these factors are related with millipede presence at a broad scale, as well as on a smaller scale. Specifically, we investigated refuge use by the millipede *Rhysodesmus byersi* (cow manure, stones, logs and leaf litter) in a pine-oak forest and adjacent grasslands, as well as the probable physicochemical factors involved (humidity, temperature, and food). We found that individuals of *R. byersi* prefer shelters that are in the grasslands, particularly cow manure. Our results show that ambient temperature within the pine-oak forest was significantly lower than in the grasslands, and too low for millipede locomotion. Temperature did not differ significantly among shelters in the grassland; however, cow manure presented a significantly higher humidity, compared to the other shelters. Based on these results, the choice of cow manure in grasslands by *R. byersi*, can be explained by: 1) it is present in sites with higher temperatures that allow millipede locomotion, 2) it has a higher moisture content, and 3) it is used as a food source by *R. byersi*, which could provide nutrients that are scarce in the environment, as well as easier digestion and assimilation, since a previous decomposition process is carried out in the intestine of the cow.

POSTER

Relationship between millipede body size and altitude, latitude, precipitation, and temperature (Polydesmida: Xystodemidae: *Rhysodesmus*)

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Body size is a complex and important trait in animals, since it can influence their physiology, biotic interactions, behavior, fitness, and geographic distribution, and this trait is generally different between sexes, individuals, populations, and species. Millipede body size varies enormously, however, little is known about the factors that may explain this variability. In this study, we examined the relationship between millipede body size and four variables that have often been associated with arthropod body size: altitude, latitude, precipitation, and ambient temperature. Specifically, we studied the relationship between these factors and body size in species of *Rhysodesmus* (Polydesmida: Xystodemidae), a genus in which growth ends when individuals reach adulthood. We measured body size of adult males of 24 species of *Rhysodesmus* obtained from biological collections from Mexico and U.S.A., and determined the relationship between average body size and altitude, latitude, precipitation, and ambient temperature from the sites in which individuals were collected. We found a significant and negative relationship between *Rhysodesmus* body size and altitude, but no significant relationship was found between size and latitude. We also found significant and positive relationships between *Rhysodesmus* body size and both ambient temperature and precipitation. Our results suggest that humidity and temperature have an important effect on body size in these millipedes.

POSTER

Diel activity of *Cylindroiulus caeroleocinctus*

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The data on the diel activity of millipedes are scarce. In the field experiment we studied the diel activity of ground beetles and other arthropods, including millipedes, active on the soil surface on four sites that differed with plant density, testing the hypothesis that the structure of vegetation can modulate the circadian rhythms of arthropods. Diurnal activity was monitored using time-sorting pitfall traps, which can split the daily capture into two-hour intervals. Field experiment was carried out during a total of six periods from June to September 2012, when traps were always run for four days, and was located in Praha-Ruzyně in experimental grounds of the Crop Research Institute. The data were then processed using the methods of circular statistics. The only abundant species of millipede was *Cylindroiulus caeruleocinctus*, which was abundant only late in the season on all sites. We found that this species was most active late at night and early morning, between 23:00 and 7:00, with the peak activity around 3:00. There was no difference in activity among the study sites.

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POSTER

Climatic factors and the ecological diversity of millipede communities in a latitudinal gradient

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The species diversity of millipedes, as of many other animal taxa, peaks in low latitudes. There is still no comprehensive understanding of mechanisms maintaining this diversity. The niche theory suggests that coexisting species must differ in the use of trophic and/or spatial resources. We compared potential niche partitioning mechanisms in Diplopoda communities of four deciduous forests in temperate (Central European Russia), Mediterranean (Caucasus), cold monsoon (Russian Far East) and tropical monsoon climate (southern Vietnam). To estimate the niche structure in local communities, we assessed the diversity of morphotypes (Golovatch, 1995) and their subdivisions; the trophic structure and trophic specialization using stable isotope analysis (SIA); and the diversity of microhabitats occupied. The diversity of the local millipede communities increased from 9 in the temperate to 39 species in the tropical forest. The morphological diversity was also at a maximum in the tropical forest. According to SIA results, no trophic differentiation was found in the community from Central Russia (species mean $\delta^{15}N$ values ranged less than 3‰). One core trophic group and a few outlying species were found in the Caucasus and Far East communities. Three well separated trophic groups were detected in the tropical community, with a total range of mean $\delta^{15}N$ values reaching 13‰. The intra-species variation in $\delta^{13}C$ and $\delta^{15}N$ values was used to estimate the width of trophic niches of individual species. The mean trophic niche width was correlated positively with the temperature of the coldest month and was at a maximum in the tropical forest, and at a minimum in the Far East community. The mean niche width did not correlate with the total number of species; both specialized and generalist species were abundant in the most species-rich tropical community. The number of microhabitats occupied correlate with the mean air humidity during the season of millipedes' activity. The number of microhabitats ranged from four in the temperate forest to twenty in the tropical forest. Ten microhabitats were colonized in the humid (though winter-cold) Far East forest, and only six in the warm but summer-dry Caucasian forest. All communities studied contain species with strict spatial preferences and with a wide set of preferred microhabitats.

We conclude that the ecological diversity of millipede communities is driven mainly by climatic factors. Cold winter and/or dry summer limit the number of micro-habitats and indirectly the number of food substrates available for diplopods. Communities that are less limited by temperature and humidity occupy the highest range of spatial niches and trophic resources; species tend to polarize into generalists and strict specialists.

LECTURE

Polyxenida of the Caucasian region

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A collection of Penicillate millipedes comprising more than 70 specimens from 47 sites in Crimea and the Caucasus has been examined. Specimens include those collected by MS Ghilarov in 1947 through to those collected in 2013 by Ivan Tuf, with the majority of collecting carried out from 1981-1985 by Sergei Golovatch.

The dominant species in the collection is a distinctive millipede in the genus *Propolyxenus* in the family Polyxenidae. This species appears to be very widespread having also been found in Croatia, Romania, Greece, Turkey, Israel and possibly Iran.

Millipedes in the genus *Lophoproctus* were also identified from Crimea and a limited number of sites along the eastern edge of the Black Sea.

The findings from this research are compared with Polyxenida described from the Caucasian region by Verhoeff, Brolemann and Lignau.

LECTURE

Biogeographical patterns in the distribution of European centipedes

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This study is based on a dataset of 585 centipede taxa and 56 European countries/regions. Our aim is to identify consistent biogeographical regions and examine spatial distribution patterns of centipede in Europe. Primarily, we compiled a presence–absence matrix (PAM) based on species occurrence records. A cluster analysis was used to identify biogeographical modules. We explored nestedness and centipede species structure within the modules. Geographic patterning of diversity was investigated for potential centers of origin for centipedes. Three main biogeographical modules, namely Eastern Mediterranean, Western Mediterranean and Eastern-Central-Northwestern Europe, were revealed. Results show that ratios of diversity were higher in the Mediterranean region and the Balkan peninsula. The compartmentalization of the centipede fauna is consistent with the geographical characteristics of Europe. All modules were significantly nested. Central and northwestern Europe share highly nested assemblages, while the high number of singletons and endemics decreases the degree of nestedness in southern Europe. Structure of centipedes shows a definite shift from high richness difference towards richness agreement. Great mountain ranges act as biological barriers limiting species overlap between modules. The ecological history of southeastern Europe (i.e. Pleistocene glacial refugia) render the Balkan Peninsula as the most probable center of diversity for centipedes in Europe.

LECTURE

First record of the scolopendrid centipede genus *Digitipes* Attems, 1930 from Myanmar

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The genus *Digitipes* Attems, 1930 is considered as a monophyletic group from molecular evidence. Its distribution was until now confined to fragments of the supercontinent Gondwana, with species known only from tropical Africa and peninsular India. The differences between *Digitipes* and *Otostigmus* Porat, 1876 have been debated over recent decades because few characters distinguish the two genera. However, molecular data and morphology-based taxonomic revision of Indian species of *Digitipes* resolved this argument in favour of it being a distinct genus based on genetic divergence and unique taxonomic characters. Moreover, the cryptic diversity among population in the Western Ghats of India shows high endemism. Recently the first record of *Digitipes* in Myanmar has been collected and analyzed, males possessing the distomedial process on the ultimate leg femur that is diagnostic of the genus. Distinguishing characters of Myanmar *Digitipes* from other members are the 2.5 to 2.7 dorsal glabrous antennal articles, absence of a lateral spine on the coxopleural process, and the lack of median and dorso-median spines on the ultimate leg prefemora. Molecular analyses of two markers (mitochondrial COI and 16S rRNA) were conducted to support the proposal of a new species from Myanmar. The phylogenetic tree of Myanmar-Indian *Digitipes* populations upholds the monophyletic status of *Digitipes*, though its members are closely related to other members of Otostigminae (*Otostigmus*, *Ethmostigmus* and *Rhysida*). Moreover, the genetic divergence of the Myanmar samples is congruent with diagnostic morphological characters that indicate a species distinct from those known from India.

POSTER

Morphological and molecular variation in the common large centipede *Scolopendra dehaani* Brandt, 1840 in Thailand

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The common large centipede *Scolopendra subspinipes* Leach, 1814 has been reported as widely distributed in many tropical parts of the world. However, recent revision of eight putative subspecies used in traditional classifications such as that of Attems (1930) suggested that three of these, including *S. dehaani*, merit recognition at the species level. Because of its abundance and distribution throughout Thailand and neighbouring countries, *Scolopendra dehaani* Brandt, 1840 presents itself as a worthy model for studies of intraspecific variation and biogeography. We have collected *Scolopendra dehaani* throughout Thailand, and critically analyzed all known morphological characters. A molecular analysis was conducted using three gene fragments in combination, the mitochondrial genes (COI and 16S rRNA) and nuclear ribosomal 28S rRNA. Three distinct body colouration forms are recognized, corresponding to geographic groups. The molecular results demonstrate genetic divergence in several populations that are specific to particular geographic regions, with specimens from Southern and Eastern populations being most closely related genetically. In addition, the sequence data for *S. subspinipes* were clearly distinct from *S. dehaani*, validating their species-level separation. A preliminary geometric-morphometric analysis based on landmark methods demonstrated shape variability in such morphological characters as the forcipular coxosternite, the cephalic plate, and the tergite and sternite of the ultimate leg-bearing segment, and morphometric clusters correspond well with molecular groupings. As regards geographic distributions, the Isthmus of Kra appears to be boundary between the three forms, which will be discussed.

LECTURE

Structure and distribution of antennal sensilla in centipedes

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Centipedes are remarkable predators that are able to retrieve and locate their prey in a variety of environments. With the help of their antennae that are equipped with numerous sensilla, they are supposed to detect possible food sources, conspecifics, potential mates, as well as essential environmental conditions. Scanning electron microscopic investigations of the antennae of ten species covering all five orders of centipedes revealed the presence of 12 different types of cuticular sensilla. Based on their fine structure and external morphological characters, these sensilla can be attributed to specific sensory modalities, as e.g., mechano- or hygroreception. In all species, typical contact-chemoreceptors (sensilla trichodea), which are characterized by a ribbed shaft, emanating from a movable base, and a terminal pore, are distributed numerously over all antennomeres. In contrast, there are several types of sensilla, e.g., beak-shaped sensilla of *Scutigera coleoptrata*, contorted sensilla of *Scolopendra oraniensis*, or tube-like sensilla of *Craterostigmus tasmanianus* that are exclusively found in these corresponding species. However, similarly to the distinct morphology of these sensilla, the number and distribution pattern is varying and often species specific. We present a comparative overview on sensillar types and suggest functional modalities using external features.

POSTER

Past and present – microCT analyses of extant and fossil myriapods

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Including fossil data to current evolutionary scenarios often improves our understanding of morphological transformations. Myriapod fossils in general, are rare and often only parts of them are well preserved. In fact, investigating these relict specimens is often challenging. However, those of which are amber-trapped fossils seem to cope most constraints, due to the more or less translucent character of the latter. Nevertheless, contortions, gas bubbles, as well as environmental contamination often complicate detailed analyses using light microscopy and light based macro photography. Non-destructive micro computed X-ray tomography (μCT) might overcome these limitations and has been shown to be a valuable tool in visualizing structural complexity in general, and internal anatomy especially. Moreover, this approach is highly promising for a variety of question where information on natural coherence is inevitable required. Based on comparative investigations, I will exemplified demonstrate the usability of this approach for answering developmental questions, as well as compare results of fossil samples, preserved in amber, to discuss specifications and limitations.

LECTURE

Notes on the life history and ecology of grassland millipedes

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Grasslands cover about 40% of land surface, globally. In these systems, millipedes are generally at lower diversity and abundance than in forests due to limited water availability. However, millipedes are still an important component of the grassland soil fauna, and may even be dominant. Grasslands face numerous threats, including development, conversion to agriculture, and woody plant encroachment. In order to effectively conserve grassland millipedes, we must better understand their biology. Little is known about millipede life history and ecology in general. This is especially true for the grassland fauna – less research occurs in these systems, likely because biodiversity is lower. I recently have begun establishing lab cultures to collect life history information and to conduct ecological studies on North American grassland species. I will present the goals of the research, methodology, and the challenges and successes to date. Included will be a summary of knowledge about millipede biodiversity in North American grasslands and life history of millipedes globally.

POSTER

At the end of the rope: *Geophilus hadesi* n. sp. – the world deepest cave-dwelling centipede (Chilopoda: Geophilomorpha: Geophilidae)

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The centipede order Geophilomorpha is known to encompass about 1,250 extant species distributed on all continents except for Antarctica. All species lack sight and have dorsoventrally flattened trunk, and are well adapted to underground way of life. The burrowing locomotion is typical for geophilomorps but species that creep on the surface or move in open spaces are also known in the group. Some 'extreme' habitat adaptations are demonstrated, for example, by species that inhabit surge zones of seashores, periodically inundated forests in Amazonia or deserts. Caves represent another unusual environment where geophilomorphs can rarely be found. Members of genus *Thracophilus* Verhoeff, 1926 (Himantariidae) are recorded from caves in Europe but none of the species exhibit troglomorphic traits. *Ityphilus cavernicolus* (Matic, Negrea & Fundora Martínez, 1977) (Ballophilidae) found in several caves in Cuba was speculatively presumed to be a troglobite or a regular troglophile. True troglobites were unknown for the order until 1999, when *Geophilus persephones* Foddai & Minelli, 1999, a species showing a hirsute body and strongly elongated antennae and legs, was described from cave Pierre Saint-Martin in France. Although the species was found in Salle de la Verna, a large hall located at 1073 meters of depth from the cave entrance, the collecting point is estimated to be at approximately 220 m distance from the surface.

Here, we describe the second troglomorphic geophilomorph centipede: *Geophilus hadesi* n. sp., showing traits commonly found in troglobites, such as relatively long antennae and legs and a pilose body. The new species differs from all congeners by a number of anatomical characters and especially by its exceptionally large claws. The origin of the name is from the Greek mythology, where Hades was the god of underground and husband of Persephone.

G. hadesi n. sp. was found by Croatian biospeleologists at a great depth in three vertical caves in the Velebit Mountain, Central Croatia, among which the 14th deepest cave in the world, Lukina jama – Trojama system (-1431 m). There it was collected in a large chamber at -980 m while moving slowly across a large boulder. It has also been observed at -1100 m, but unfortunately in a place inaccessible for collecting. The latter represents the world's deepest underground record of a centipede known up to date. In the other two caves, Muda labudova and Munižaba, the new species was found at -500 m, and -250 m, respectively. These different records prove that the species is well adapted to life underground.

LECTURE

Blowing the dust off the old publications: an enhanced cybertaxonomic checklist of *Eupolybothrus* Verhoeff, 1907 (Chilopoda: Lithobiomorpha: Lithobiidae)

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Taxonomy is a fundamental science with more than 250 years of history and a wide range of benefits to community. Its progress is largely depending on access to past works, but unfortunately a huge proportion of these and associated data is fragmented and isolated in paper-based books and articles – most of which remaining out of the reach of the scholars. A number of initiatives for digitization, extraction and mark up of the legacy and prospective biodiversity literature have been launched in the last decade (Biodiversity Heritage Library, Encyclopedia of Life, Plazi, etc). Their ultimate aim is to create a virtual pool of data, thus to prevent the loss of important taxonomic information, increase the value of taxonomy and allow new services, tools and knowledge to emerge. In parallel, the scholarly publishing environment has also changed significantly, responding to the increasing interest in opening biodiversity information and data.

Centipedes, and in particular species of the genus *Eupolybothrus* Verhoeff, 1907, have been a test group for a number of cybertaxonomic pilot projects. These include novel approaches in publishing semantically enhanced taxonomic content, interactive identification keys and advanced species descriptions using next generation molecular methods and novel computing and imaging technologies. Here, we present yet another cybertaxonomic pilot based on *Eupolybothrus* which demonstrates how taxon treatments (original descriptions, re-descriptions, synonymies and other nomenclatural and taxonomic acts) are extracted from legacy literature by applying optical character recognition (OCR) then tagged by using Golden Gate software, and integrated with other such treatments in a single treatment repository (Plazi). In addition, a checklist of all currently valid species is enhanced by linking the taxon names to the respective digitised species treatments in Plazi and to associated literature scans at BHL and Zenodo. We also describe a new species, *E. liburnicus* sp. n., found in caves in the Velebit Mountains, Central Croatia, which exhibits molecular (COI) and morphological differences from its closest congeners. The study is carried out in the framework of the EU FP7 project pro-iBiosphere.

LECTURE

Digestive enzymes in digestive tract of spirostreptid and spirobolid millipedes

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The giant tropical millipedes represent a suitable model for investigation of soil organic matter transformation in the invertebrate digestive tract and the animal-microbial interactions during this process. The functional importance of compartmentalisation of digestive processes in different sections of the digestive tract and between endo- and ectoperitrophic space delimited by peritrophic membrane was confirmed in insects. No such data are known from millipedes.

Two species of large tropical millipedes belonging to two different orders were investigated: *Archispirostreptus gigas* (Spirostreptida) and *Epibolus pulchripes* (Spirobolida). The mass-specific activities of digestive saccharidases and protease were measured in the gut content and gut wall in the both main sections of the digestive tract (midgut and hindgut). To obtain basic information about influence of pH on the enzyme activities, all assays were done at pH 4 as well as 7.

Enzyme activities attacking α-polysaccharides starch or laminarin type (about 10-50 U/g), followed by α-disaccharidases and some chitinases (activity about 0.5 U/g) prevailed in digestive tract of both species. Activities of other enzymes including cellulases, cellobiase (β-glucosidase) and saccharase lay between 0.05 and 0.18 U/g. Xylanolytic activity assays were negative.

Most of enzymes showed higher activity at pH 4 excepting trehalase and saccharase and general protease in *E. pulchripes*.

Digestive enzymes activities prevailed in midgut (MG) with exceptions of saccharase, microcrystalline cellulase, amylase in *A. gigas* and endochitinase in *E. pulchripes* having insignificant differences between the MG and HG activities.

Some enzymes were more active in the gut wall than in the content (some cellulases and chitinases) others were more active in the content, typically α-amylase, laminarinase or general protease.

LECTURE

Individual development of Spirostreptidae: Morphological observations and quantitative measurements

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Individual development of 38 laboratory reared individuals of the giant African millipedes *Archispirostreptus gigas* was monitored from egg to maturity at the constant temperature 25°C to define useful morphological and morphometrical marks of individual developmental stages for using in physiological measurements and experimental studies.

Changes in the number and arrangement of the body segments and ocelli in the ocular field, the body mass, body width and longevity were analysed at individual reared postembryonic stadia and completed at fixed individuals of the known age. Furthermore, metabolic rate (CO_2 production) of several individuals of subsequent postembryonic stadia was measured.The development of *A. gigas* was found to be hemianamorphic with eleven postembryonic stages taking about 750 days from the appearing of the pupoid to the beginning of the stage XI.

The number of body rings increased during the first ten stages. A certain number of apodous rings were added to the growing zone anteriorly to the telson at each stage, transforming to the same number of new podous segments in next stage. The variability in the number of new segments at each stage was analysed.

The ocular field grew very regularly forming a triangle adding one row of ocelli in each stage until the stage V. The number of ocelli in last row increased by one in comparison with the previous row. Consequently, the number of the rows of ocelli corresponded to the postembryonic stage. Starting from the stage VI, the numbers of ocelli in new rows become irregular and the triangular occular field transformed into an unequal half-moon.

From the egg to the adult stage the fresh body mass increased quickly in time, fitted by a three order-polynomial curve, whereas the longevity of the millipede body increased more linearly. The increase of the body mass during individual development followed the changes of body volume calculated according to measured mean body size. Consequently, the specific body weight seems to be stable during the whole postembryonic development.

Measurements of the mass-specific metabolic rate showed large individual variability and unsignificant differences between the postembryonic stages.

POSTER

The phylogenetic position of Symphyla and Pauropoda: A phylogenomic approach

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With more than a million described species worldwide, arthropods are the most diverse and most successful groups of Metazoa. Despite all the efforts, relationships among main subgroups still remain but poorly resolved, impeding more conclusive statements about the early evolution of arthropods. The contribution of phylogenomics is hampered by the paucity of data in key groups, like pauropods and symphylans among myriapods. Additionally, high support values in phylogenomics in many cases obscure conflicting signal present within data sets. Consequently, the contribution of phylogenomic data to some open questions currently is still restricted.

Main aim of our project (VieArt) thus is to provide and analyse transcriptomes, focussing on underrepresented myriapod groups. Various open questions of myriapod phylogeny will be tackled, including: (i) the phylogenetic position of Symphyla and Pauropoda, (ii) relationships among the four main lineages of myriapods, and (iii) the position of myriapods within Euarthropoda. To address these questions we will not only apply standard phylogenetic analyses (ML), but hypotheses of relationship will be addressed by specific hypothesis testing. Based on the Four-cluster Likelihood-Mapping approach the phylogenomic data set will be searched for ambiguous signal, to analyze the source for support of conflicting topologies.

POSTER

Long term changes in millipede assemblages (Diplopoda) in alpine habitats on granite and limestone bedrocks in the West Tatra Mts., Slovakia

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Recovery of alpine ecosystems from atmospheric acidification since the nineties of the past century and parallel effects of increasing temperature has been actually documented in the Tatra Mountains, Slovakia. Changes in soil mesofauna communities of alpine and subalpine habitats documented during the last two decades indicate possible impact of this recovery as well as global warming on soils of these specific habitats. The study on epigeic activity of millipedes in the given area in 1992–1993 showed significant differences between settlement of alpine habitats developed on granite and limestone. The repeated pitfall trapping in 1997–1998 and 2007–2008 periods showed changes in presence of both, the Carpathian endemic and cold tolerant species (e.g. *Chelogona carpathicum*, *Hylebainosoma tatranum*, *Polydesmus tatranus*, endemic species of the genus *Leptoiulus*) as well as the eurytopic representatives (*Leptoiulus trilobatus*, *Polydesmus complanatus*). Different trends in long term changes were recorded on granite and limestone bedrocks. Low and slightly decreasing activity of chordeumatid species was characteristic for habitats close to the timberline and in alpine zone on granite. Based on the repeated sampling of two alpine grasslands on limestone, besides different trends in total epigeic activity (an increase in one grassland and decrease in the other), a general decrease of the Carpathian mountain and alpine endemic species and a rising share of eurytopic *Leptoiulus trilobatus* were observed. Obtained results can suggest sensitivity of millipedes to acidification (recovery) and temperature changes. Possible effect of reduced acidic deposition and increasing temperature on millipede assemblages will be discussed.

POSTER

Climate and weather versus millipedes – A little story of *Cylindroiulus caeruleocinctus*

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The millipede *Cylindroiulus caeruleocinctus* is one of the largest representatives of the family Julidae in the Czech Republic. This species with West European distribution become during the last several decades more common in the Czech Republic, widely spreading above all throughout the synanthropic, urban and agricultural habitats, occasionally even in mass occurrence.

Within the field research in vineyards near the Mikulov Town in South Moravia, Czech Republic, a permanent population of this species was recorded. Repeated soil sampling and precise heat extraction of millipedes served an interesting and numerous material, which was elaborated for detail characterization of population structure, estimation of postembryonic development in the given vineyard and evaluation of other parameters of ecology of this species.

Analysis of material confirmed presence of 13 postembryonic stadia and two-year life cycle. In comparison with West European populations, the subadults and adults have a shorter body (lower numbers of body segments) and Moravian population apparently possesses a shorter development with adults one stage earlier with absence of males in the last stadium. Analysed data, indicating possible impact of more severe continental climate on given millipede population, will be presented and discussed.

Furthermore, the resampling of this species in 2009–2011 showed certain irregularities in population structure analysed in subsequent years. Comparison of specific weather conditions of the relevant years in the study area with obtained data offers an explanation of fluctuations recorded in population structure of this millipede species and supports the considerations about the influence of climate and weather and impact of global warming on soil invertebrates including the millipedes.

LECTURE

Annotated checklist of millipedes (Diplopoda) of the Czech Republic

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Since they were published the first faunistic records from the territory of the recent Czech Republic, the knowledge of the fauna of millipedes passed a long history of over 150 years, in close consequences with the research in surrounding Central European countries. Beside the first papers dealing with millipedes directly from our country, published in the end of the 19th century, many data from the territory of Czechia (i.e. Bohemia, Moravia and Silesia) are involved in historical monographs completed by Latzel and Haase. Repeatedly accelerated faunistic research in the thirties and fifties of the past century was connected namely with Lang, Folkmanová and Gulička. Three species of millipedes (*Choneiulus palmatus*, *Leptoiulus proximus* and *Listrocheiritium septentrionale*) were described form our territory. The millipede *L. septentrionale* is known only from the Czech Republic, and can be considered as endemic. Increasing faunistic research and monitoring within a row of regions of the present Czech Republic brought many new records and importantly contributed to the completion of our knowledge of millipede faunas. In contrast, revisions and synonymization of some species of millipedes resulted into the decrease of several taxa formerly listed for our country. Summarising, the most actual inventory involves 78 millipede species.

POSTER

Volvation of pill millipede *Glomeris pustulata*

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Volvation or conglobation is term for ability to take specific ball-like posture. Volvation is typical for different animals from non-related groups, as armadillos (Mammalia: Xenarthra), hedgehogs (Mammalia: Insectivora), mites (Acari: Oribatida), cuckoo wasps (Insecta: Hymenoptera), pillbugs (Crustacea: Isopoda) or millipedes (Diplopoda: Pentazonia). The main function of volvation is defence against predators.

We evaluated volvation of pill millipede *Glomeris pustulata* as a defensive behaviour against three types of stimuli: touch, squeeze and drop. Millipedes were kept separately in small plastic boxes and tested five times; altogether we tested 150 millipedes. Each experiment contained set of all three stimuli in alternated order. Each stimulus was repeated up to five times to induce volvation; length of volvation was measured up to the first sign of animal activity.

The longest volvation was induced by touch; nevertheless touch was necessary to apply more times than other stimuli. It means, millipedes did not conglobated after the first touch, but if we continued in touching them, they volved for really long time. As we changed order of stimuli, it was evident, that the longest reaction (volvation) was induced by the third stimulus – millipedes stayed conglobated for increasing period and it was not necessary to apply stimulus repeatedly. Relevance of this behaviour in real life of pill millipede is discussed.

POSTER

Bait traps for sampling of soil dwelling myriapods

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Hand collecting of centipedes (Chilopoda) and millipedes (Diplopoda) individually is very time consuming and it is hard to quantify the sampling effort. Moreover, assemblages of myriapods at almost all biotopes consist from two main groups: surface dwelling species (i.e. epigeic fauna) and soil dwelling species (i.e. euedaphic fauna). It is necessary to sample these two groups of species by different collecting methods.

Surface dwelling species are sampled usually using pitfall traps. Another possible method is to offer them shelters and check these shelters during inspections in field. Contrary to pitfall traps, shelters are not killing another species (it is positive); on the other hand quicker myriapods can escape from shelter even during inspection. Soil dwelling species are usually collected inside soil samples or samples of litter and upper layers of soil. Millipedes and centipedes are sorted from samples by hands or extracted using different types of extractors (e.g. Kempson apparatus, Winkler xereclector etc.). Soil samples of appropriate size are heavy and sampling is destructive to soil. Pits, as rest of taken samples, can be obtrusive for farmers mainly.

We tried to evaluate new methods for sampling myriapods – underground bait traps. Bait traps are created on basis of well known "litter bags". We tested in total 180 bait traps with hay installed in field, meadow and forest respectively. Bait traps were installed for one to twelve weeks to evaluate colonization of bait to find the best length of exposition for sampling effort. Animals were extracted from bait traps using Kempson apparatuses.

According our results, communities of myriapods sampled using bait traps are similar to communities extracted from soil samples. The richness communities were found in bait traps installed for two months and longer. Bait traps can be more useful method for quantitative sampling soil dwelling myriapods.

LECTURE

Annotated checklist of centipedes (Chilopoda) of the Czech Republic

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The history of knowledge of Czech centipedes goes back to the twenties of the XIXth century. The first valuable contribution summarising the data from our territory were the Latzel's "Die Myriopoden der Österreichisch-Ungarischen Monarchie" and two volumes of Haase's "Schlesiens Chilopoden". After the establishment of the independent Czechoslovakia, an increasing interest in national faunas was connected with Božena Folkmanová. Her activity resulted in monographs summarising the fauna of centipedes from the Bohemia (Western part of the Czech Republic) published in 1928. She documented the occurrence of 34 species of centipedes. This monographs and later on updated key of Czechoslovak centipedes led to higher popularity of these invertebrates among wider community of Czech zoologists. Beside Folkmanová published new records Borek, Hachler, Lang and Dobroruka. The revision of taxonomical status of some centipede species described directly from our country decreased the total number of species of national check list. Increasing faunistic research and monitoring of previously neglected regions of the present Czech Republic since the nineties of the past century brought new records and contributed to the completion of our knowledge of the Czech centipede fauna. The summarising list of species published in 2008 was completed in the last years by records of another four geophilomorph species. In sum the actual check list of the Czech centipedes contains 70 species.

POSTER

Centipede venom evolution: Casting light on a neglected group of venomous animals

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Centipedes are among the oldest extant groups of terrestrial venomous animals. However, despite their notoriously painful stings and ferocious predatory ecology, virtually nothing is known about their venoms. Using a multi-angled approach we have provided the first comprehensive insight into the composition and evolution of these ancient and unique venoms. This revealed a rich set of both novel and convergently recruited toxin types, but also substantial variation in toxin diversity between taxa. Surprisingly, despite lacking the formidable physical weaponry of scolopendrid centipedes, scutigeromorph venoms appear surprisingly non-complex. We suggest that the apparent differences in venom complexity between centipede orders are due to morphological restrictions of the venom gland, and that there may be a link between the morphological and biochemical complexity of this unique venom system. Our data add to the small but growing body of evidence that toxins are not uniformly expressed throughout venom glands, and that morphological adaptations may influence the evolution of functional venom strategies.

LECTURE

The value of some non-gonopodal sexual characters for the systematics and phylogeny of the family Julidae (Diplopoda: Julida)

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Of all morphological structures, the gonopods are by far the best studied and applied in the julid systematics. Being highly specialized, complex organs showing considerably little intraspecific variability, they usually provide reliable diagnostic characters at the species level. However, homologization of their various anatomical parts is not always possible, especially in a phylogenetic context. On the other hand, sexual structures, such as vulvae, penes and the male adhesive pads are much less known and only occasionally reported in the literature concerning Julidae. With a very few exceptions, comprehensive studies on the anatomy and variability of these organs across the major taxonomic groups within the family are generally lacking.

Here we present the results of a comparative anatomical study of penes, vulvae and male adhesive pads in different taxa of the millipede tribe Brachyiulini (Julidae), that reveal their systematic value. The examined characters add additional support to the so far questioned monophyly of tribe Brachyiulini. They also prove useful for separating sibling species that otherwise exhibit gonopod uniformity. The uncovering of several potential synapomorphies is an important step towards elucidation of the tribe's phylogenetic affinities, in terms of both in-group relations and position within Julidae. Based on the present research, as well as on the scattered data about other julid groups, it is expected that similar, comprehensive studies can be of much help in unravelling the taxonomic and phylogenetic problems in the family. This survey is a continuation of the authors' work on the taxonomy and phylogeny of the Brachyiulini.

LECTURE

First molecular data and the phylogenetic position of the peculiar Borneo centipede *Edentistoma octosulcatum* Tömösvary, 1882 (Chilopoda: Scolopendromorpha: Scolopendridae)

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Edentistoma octosulcatum Tömösváry, 1882, is a rare, superficially millipede-like centipede known only from Borneo and the Philippines. It is the only representative of the genus *Edentistoma* and unique within the order Scolopendromorpha for its slow gait, robust tergites, as well as highly modified gizzard and mandible morphology. Not much is known about the biology of the species but it has been speculated to be arboreal with a possibly vegetarian diet. Until now its phylogenetic position within the subfamily Otostigminae has been based only on morphological characters, being variably ranked as a monotypic tribe (Arrhabdotini) or classified with the Southeast Asian genus *Sterropristes* Attems, 1934. The first molecular data for *E. octosulcatum* sourced from a newly collected specimen from Sarawak were analyzed with and without morphology. Combined analysis of four molecular loci places *Edentistoma* in a sister-group relationship with two *Otostigmus* species (*O. astenus* and *O. angusticeps*), a clade that is resolved as sister to three Indo-Australian species of *Rhysida* (*R. nuda*, *R.* cf. *carinulata* and *R. polyacantha*). Combined analysis of both morphology and molecular data resolves *Edentistoma* as sister group to the same three *Rhysida* species, with this clade in turn grouping with *Ethmostigmus*. Although a position of *Edentistoma* within Otostigminae is consistently retrieved under different analytical conditions, support values within this subfamily remain low for most nodes, preventing a definitive systematic placement for *Edentistoma*. The species exhibits strong pushing behavior, which suggests it may have burrowing habits. Evidence against the suggested vegetarian diet is also proposed; *E. octosulcatum* has been observed eating a *Trachelomegalus* millipede.

LECTURE

Communities of myriapods (Diplopoda and Chilopoda) in mountain spruce forests after bark beetle outbreak with different subsequent management: Differences or similarities?

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Climatic changes like mild winters and warmer summers in combination with repeated storm events has promoted the development of large bark beetle populations in the mountain spruce forests along the mountain range in the Czech-German-Austrian border area, the Bavarian and Bohemian Forests, Central Europe. The subsequent large-scale dieback of Norway spruce since the 1990s was connected with searching of appropriate management, because large areas in this mountain range are situated in unmanaged areas of National Parks. Both preventive clearcuts and or leaving areas to spontaneous dieback with successive regeneration of spruce growths have been applied since the nineties in the Šumava National Park, the Czech part of this mountain area, reflecting different approaches from forestry management or nature protection points of view.

Given area is characteristic by specific species composition of both myriapod groups, with the predominating millipedes *Mycogona germanica*, *Haasea germanica* and *Haasea flavescens* and the centipedes *Strigamia acuminata*, *Geophilus oligopus*, *Lithobius tenebrosus*, *Lithobius piceus* and *Lithobius punctulatus*. Actually, approximately 15 years after the dieback of spruce forests, we tried to compare the community structures of millipedes and centipedes in the mosaic of both clearings and spontaneously regenerated forest plots. In total nine plots, three clearings, three disturbed and spontaneously regenerating forest plots and another three regenerating plots in more humid variant, were investigated in the years 2010–2013. According to data from soil sampling and pitfall trapping, previous management influenced differently both assemblages of millipedes and centipedes. Lower densities and activities of millipedes were found in clearcuts with previous salvage logging and timber removal. Higher community parameters of millipedes were characteristic for more humid waterlogged spruce growths under regeneration, but centipedes preferred drier stands before clearcuts and humid stands under spontaneous regeneration.

Generally, a longer time after the dieback of spruce forests, the different management practices did not result in dramatic changes and differentiation in millipede and centipede assemblages.

POSTER

Characteristics of centipede (Chilopoda) assemblies in some frost hollows in Slovenian Dinaric Karst

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In following study some characteristics of the centipede assemblies in frost hollows in Slovenian Dinarides are presented. Sampling took place in 24 different locations with two sampling methods. Altogether 2904 centipedes identified to 52 species were collected. 23 species were obtained only with square soil sampling method and 4 species were obtained only with hand collecting method under the dead wood plant material and stones. Most discovered species had Illyrian or Central European distribution. Twenty percent of collected species were endemic for Slovenia or/and in northern Dinarides. Another twenty percent of species had Paleartic distribution. The highest estimated average density was 1004.6 individuals/m^2 while the lowest was 41.72 ind. /m^2. In more than half of all locations the density was 300 ind./m^2 or higher, which is more than average density in most European deciduous forests but less than average density in Slovenian dinaric forests. Species that had high average density in the frost hollows and were until now found rarely and sparsely in Slovenia area were *Eurygeophilus pinguis*, *Geophilus* n.sp., *Lithobious tenebrous*, *Lithobius* (*Sigibius*) n.sp."anici", *Lithobius* (*Monotarsobius*) n.sp. and *Cryptops rucneri*. We presume that frost hollows presents suitable, even favorable environment for those species due to their specific microclimate. In 58% of all locations 18 or more species was found which is comparable to other centipede communities in non dinaric locations in Slovenia or communities in most deciduous forests in Europe. The average value of Shannon-Wiener diversity index was 2.03 and the average Evenness index was 0.80. The greatest similarity between communities was 0.74 (using Renkonnen number). Communities in the frost hollows were more similar to each other than to the communities from several other Slovenian sampling locations. Assumption that there is an active migration between centipede communities in the frost hollows and centipede communities in the surroundings remains unverified and should be investigated within future researches of frost hollows which should include seasonal sampling.

LECTURE

An annotated checklist of Sympyhla and Pauropoda (Myriapoda) of Germany

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The Symphyla and Pauropoda are the most neglected classes of Myriapoda worldwide, with sparse information on ecology and distribution on species level available. The few records of these taxa are scattered in literature, and many new species remain to be discovered even in Europe. For the first time a comprehensive checklist is provided for the Symphyla and Pauropoda of Germany based on literature review, database and collection queries. Information on distribution and ecology for both taxa so far available are given.

Currently 19 taxa of Symphyla and 36 taxa of Pauropoda are known for Germany. New species records from museum collections and new investigations are given, most of these concentrated on Baden-Württemberg, Bavaria, North Rhine-Westphalia, Rhineland-Palatinate, and Saxony according to the focus of investigations on these taxa during the last decades. *Trachypauropus cordatus* (Scheller, 1974) is newly assured as record for Germany.

We consider this checklist a basis and stimulant for further investigation on these taxa.

POSTER

Morphological adaptations of the Termitodesmidae, the only obligate insectophilous millipede family (Diplopoda, Glomeridesmida)

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The Glomeridesmida, one of the basal-most orders of chilognath millipedes, are still little-known, with only two described genera and 32 described species. The order is divided into two families, the Glomeridesmidae and the Termitodesmidae, the latter containing *Termitodesmus* Silvestri, 1911 with five described species from Sri Lanka, India and Vietnam. Despite the fact that the Termitodesmidae are the only known obligate insectophilous millipede family and have an unusual appearance which is easily distinguishable from any other millipede, the genus is very little known. All species are only known from their first descriptions, dating back to 1911, 1913 and 1938, with no species ever the subject of a redescription. The genus was apparently forgotten by most of the zoological community, with works on insectophilous and termitophilous organisms no longer mentioning the *Termitodesmus*, despite providing chapters on other millipedes. Fresh samples of *Termitodesmus* from Malaysia, as well as of *T. calvus* Attems from Vietnam, provided the impetus to re-study all available type specimens of the family. As illustrated here, *Termitodesmus* is shown to exhibit several unique morphological characters, potentially as an adaptation to life in insect nests.

POSTER

Steps towards a better supported phylogeny of the Diplopoda: Additional morphological characters via modern imaging techniques.

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The relationships among the 16 orders of the most species-rich class of the Myriapoda, the Diplopoda, are still little understood. The main reason is that the anatomy of millipedes remains poorly known, especially when compared to other arthropod groups. A 'new' phylogeny which incorporates the old German literature and an exemplary µCT scan of a member of the order Platydesmida was recently constructed. Although this analysis increased the number of phylogenetic characters utilized for classification to 64, compared to the centipedes (Chilopoda), for which more than 200 morphological characters contribute to a well-supported phylogeny, this number is still low. A further problem is that the analysis coded whole orders, not real taxa. Additionally, many character states were taken from the literature and should be checked again. Despite these shortcomings, the study illustrated that the advent of µCT techniques has made it possible to overcome the character impediment quickly as scans of more than 30 species can be conducted in less than 24 hours. A µCT study incorporating real taxa, preferably two for each order so that the numerous unique characters of each order can be incorporated, would pave the way for a well-resolved phylogeny and a much better understanding of the morphology of the Diplopoda. The two main obstacles for such a study are (1) the availability of determined specimens conserved in Bouin solution, and (2) the time consuming work of analyzing the µCT scans.

LECTURE

The GBOL – Myriapoda project: Insights and shortcomings in the Barcoding of myriapods

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The German 'Barcode of Life' (GBOL) project aims at creating a genetic library of all species of animals, plants and funghi occurring in Germany. The Myriapoda are jointly managed by Museum Koenig in Bonn and the Bavarian State Collection in Munich (Jörg Spelda), in association with the Senckenberg Museum Görlitz (Karin Voigtländer and Peter Decker). The project aims to collect, determine and sequence the COI gene of at least 10 specimens for all German myriapod taxa. A key to the success of this goal are voluntary 'faunal experts' who are reimbursed for their efforts with 5-10 € per specimen. Each specimen is photographed and stored in a natural history collection as a voucher under a unique collection code before a fragment of the COI gene is sequenced. After almost three years, most German millipede and centipede species could be obtained, but the COI standard primer sets (HCO/LCO, HCOoutout/LCO, Nancy/LCO) only amplify the gene in 60% of the geophilid centipede and many millipede taxa, often because of genus- or species-specific mutations in the primer regions. First results are promising, with Diplopoda and Chilopoda species being generally well-distinguishable based on high differences of the COI. On the other hand, surprisingly high intraspecific variation could be observed in the Lithobiida and Geophilida orders of the Chilopoda, as well as in a few julid (e.g. *Ommatoiulus sabulosus*) and pill millipede species. Specimens of *Lithobius tricuspis* and *L. erythrocephalus* are surprisingly intermingled, while very low genetic variation can be found between species of the Chordeumatida genera *Rhymogona*, *Craspedosoma*, or *Listrocheiritium*. Morphological studies or nuclear genes are now necessary to evaluate the observed genetic discrepancies and find potential cryptic species or synonyms. The COI study, especially of the widespread centipede and millipede species, should be expanded to populations all across Europe in order to gain further insights into the evolutionary history which shaped the current distribution of European myriapod taxa.

LECTURE

Postembryonic development of the giant pill-millipede *Zephronia siamensis* Hirst, 1907 (Sphaerotheriida: Zephroniidae)

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The *Zephornia siamensis* Hirst, 1907 is the first species of giant pill-millipede from Thailand. The specific type locality of them has been reported from Sichang Island in eastern Thailand. This species is one of colorful millipedes and has highest activity above soil surface during rainy season in their natural habitat. Comparing to other millipede groups, a few postembryonic development data of giant pill-millipedes has been presented. Therefore, the postembryonic development of *Z. siamensis* was focused in this study. Specimens were collected from Sichang Island. The morphology and some histological studies of the giant pill-millipede were investigated. The details of these studies are presented here.

LECTURE

Do patches of alder bog forest enhance the myriapod diversity in the Cartpathians?

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Fertile Carpathian beech forest (*Dentario glandulosae-Fagetum*) covers the largest area in the lower montane range in the Babia Góra Massif lying in the flysch section on the western Carpathian Mountains. Perfectly preserved primeval Carpathian forest contains the patches of alder bog forest (*Caltho laetae-Alnetum*) in local dips and places of exudation of water situated on northern slopes with small inclination. Centipede and millipede assemblages were studied in the both forest habitats to reveal importance of alder bog patches for diversity of present fauna. The myriapods were collected using pitfall trapping and soil sampling in three stands of each type of habitats – the beech and alder forests in the Babiogórski National Park. Two groups of myriapods represent different direction of changes. Centipedes reduce their richness, diversity, abundance and activity in alder bog forests while millipedes increase these parameters in comparison with the surrounding beech forests. The importance of local habitat factors were considered and discussed.

POSTER

Cellular immune reactions in Myriapoda: Hemocytic encapsulation *in vitro*

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Encapsulation of xenografts by hemocytes has been proven to represent a typical immune reactions in arthropods. To induce and study encapsulation processes various xenografts were incubated *in vitro* with hemocytes of various Diplopoda and Chilopoda. A specific dynamic incubation apparatus was used to simulate the *in vivo* conditions within the hemocoel. Hemocyte reactions and capsule formation was investigated using light and transmission electron microscopy.

The intensity of these reactions depended on the material implemented:

Reaction was most intensive using cotton threads attracting a large number of different hemocytes after 15 minutes which attached to the thread surface. Within 1 h a hemocyte capsule was formed (of hemocytes surrounding the xenograft) and within 3 hours a multilayered hemocyte sheath (consisting of hundreds of hemocytes starting to flatten).

Latex particles were surrounded by a thin layer of hemocytes within 1 h and hemocytes started to aggregate the latex particles. So after 4 h conglomerates occurred that consisted of 10 to 20 beads. The majority of latex particles, however, were not encapsulated within the first 3–4 hours.

Reactions of hemocytes to cytodex beads were quite low. Only a few beads were surrounded by a multilayered capsule whereas most beads were free of any hemocytes after 60 to 70 minutes. Conglomerates of more than 2 beads were infrequently found.

In contrast to other arthropods there was little or no melanization between the hemocytes of the capsules. Melanin deposition on the xenografts was almost completely lacking. So the function of the capsule *in vivo* may be to separate the parasite from the nutrient source of the hemolymph and to eliminate it by release of hemocytic substances.

POSTER

Geophilomorpha (Chilopoda) of Iran

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An introduction to Geophilomorpha of Iran is presented, here, based on all previously published data as well as newly collected material from Alborz Mountains, Iran. Bibliography presented here consists of all researches dealing with this region and the validity of the species names and probable synonymies were checked using latest taxonomic reviews. The first publication on centipedes collected from Iran was carried by Pocock, (1900). During subsequent years the following researchers worked on materials collected from Iran: Brolemann 1921, Attems 1951, Matic 1969 and 1980, Eason 1981 and Zapparoli 1986. Together, those researchers recorded 38 species from this area, from which, seven (*Bothriogaster signata*, *Diporocyclus deserticola*, *Geophilus gigas*, *Henia bicarinata*, *Mesocanthus latisternus, Pachymerium ferrugineum, Pachymerium caucasicum*) belongs to two families of Geophilomorpha. New research on Alborz Mountains, north of Iran, revealed members of four new genera for Iranian fauna including *Mecistocephalus, Stenotaenia, Strigamia,* and *Clinopodes.* Challenges on reliable identification of the recent collected specimens at the species level are discussed here; also new localities are added for some of the previously known genera. Taxonomic status, and subsequently distribution, of some of the genera need revision. Also it should be stressed that the diversity and distribution of Centipedes in Iran is still poorly known and extremely underestimated.

LECTURE

Diversity and distribution of centipedes (Myriapoda: Chilopoda) in plain and mountain ecosystems of the Kola North

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Only four species of myriapods are known for the Kola North, 66-69° N 32-36° E. They all belong to the centipedes (Chilopoda) but occupy different ecological niches and have different occurrence and abundance. Eurytopic species *Monotarsobius curtipes* (Lithobiidae) is the most numerous and widespread from the Islands of the White Sea to the tundra zone at the Murmansk coast of the Barents Sea. In the Khibiny Mountain Massif this species inhabits all high-altitude belts including the polar deserts on the mountain plateau. Closely related larger-sized species *Lithobius forficatus* is known for the region only by two findings, although considered as synanthropic. Both geophilides species – *Geophilus proximus* and *Pachymerium ferrugineum* (Geophilidae) are very rare at the territory of the region. Apparently, distribution of geophilides is limited by the forest border as in the plains and in the mountains. Millipedes were not found in the native soils of the Kola North, although inhabit on the territory of the neighboring Karelia Republic. Poorness of regional fauna of myriapods is explained by a geographic position of the Kola North far 150 km from Northern Polar Circle. In results this litter- and soil-dwelling invertebrates are should develop in a condition of cool and humid climate and inhabit in acid podzol soils with low content of calcium.

LECTURE

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