European Congress on Orthoptera Conservation (ECOCIII)

1-2 April 2022

Leiden (The Netherlands)

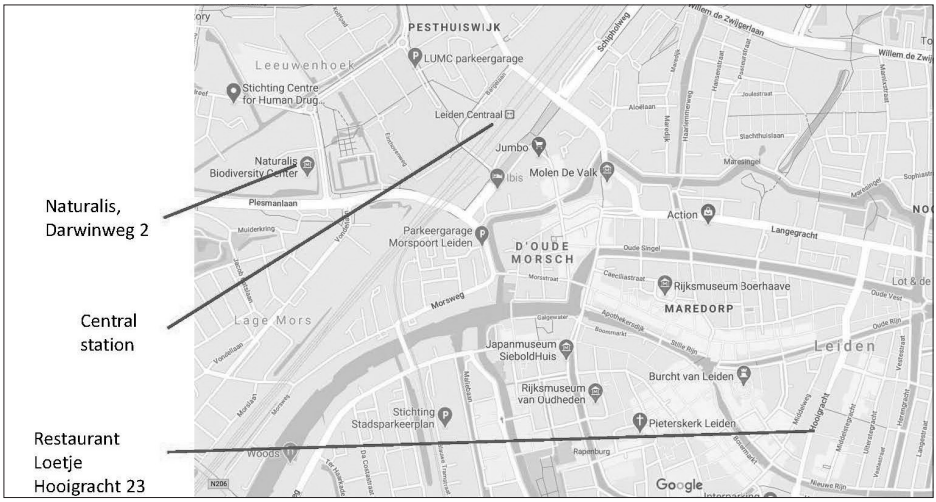
Program

Naturalis Biodiversity Center

kenniscentrum insecten en andere ongewervelden EIS

UYTTENBOOGAART -ELIASEN STICHTING

GSG



Dear participants,

It is a great pleasure to welcome you to the Third European Congress on Orthoptera Conservation and the 16th meeting of the Deutsche Gesellschaft für Orthopterologie (DGfO), at Naturalis Biodiversity Center in Leiden (the Netherlands).

Altogether 138 participants from 31 countries registered for this meeting, about half of them attending in person the other half following it online. Naturalis is honoured to welcome all of you in its brand new building which after three years of opened its doors again in September 2019. Besides the new building, Naturalis celebrated its 200th anniversary in 2020. Naturalis is not only a museum but also a research institute. The research carried out in Naturalis is linked to a collection which currently holds 42 million objects. The Orthoptera collection is large and especially rich for the European and Asian fauna.

The program for this meeting includes talks and posters on a wide variety of subjects involving grasshoppers. On behalf of the Deutsche Gesellschaft für Orthopterologie, the IUCN Grasshopper Specialist Group, Naturalis and EIS Kenniscentrum Insecten who are organising and supporting the event we wish you a very inspiring meeting and a pleasant stay in Leiden and the Netherlands.

Luc Willemse, Roy Kleukers, Baudewijn Odé & Rob Felix

Venue
The congress will be hosted by Naturalis Biodiversity Center (Darwinweg 2, Leiden). The meeting will be held in the Auditorium hall in Naturalis Biodiversity Center. Naturalis is a 10 minute walk from Leiden Central Station (Leiden CS, exit west hospital LUMC). The front entrance of Naturalis is closed until 10 AM so in the early morning you have to use the back entrance.

Parking at Naturalis is free for participants. Parking coins for leaving the parking will be provided by the organisation.

You have free access to the exhibitions of Naturalis, showing your badge.
The evening program (drinks, diner) both on 31st March and 1st April will be held at Restaurant Loetje, Hooigracht 23, Leiden, a 20 minute walk from Leiden Central Station.

Travel
For those arriving by plane at Schiphol Airport, the best way to travel to Leiden is by train. There are regular trains leaving from platform 5 or 6 at Schiphol to Leiden Central Station.

Covid
All Covid restrictions have been lifted in the Netherlands. However, the number of infections is still high and you can still get infected. We therefore recommend to stay careful during the congress. If you have medical complaints, take a self test (you will find one in your welcome bag) and if you are positive, do not come to the venue.

Program
The program of the congress has been fixed and is published in this booklet. For current information see the congress website on www.ortheur.org. The congress is organized as a hybrid meeting, allowing for both physical as online presentations. The meeting will be live streamed on the youtube channel of EIS Kenniscentrum Insecten. A specific link to the live stream will be mailed to all participants in the days before the congress. The presentations will be recorded and made available on youtube channel of EIS Kenniscentrum Insecten.

Sign up
Those attending the meeting in person can sign up upon arrival at the icebreaker at Restaurant Loetje on March 31 or upon arrival at Naturalis, in April 1 and 2. During sign up you'll receive a name badge and welcome bag including the booklet with the program and abstracts.

Book tables
There will be some tables in the auditorium for selling books or sharing free publications and flyers. In case you intend to make use of this option it helps if you could let the organisation know beforehand by sending a mail to ecociii@naturalis.nl.

Booklet
In 2020 the booklet 'Grasshopper Conservation in Europe' was prepared. The pdf can be found and downloaded from the congress website on www.ortheur.org. Participants who have not yet received a hardcopy can obtain one when signing up for the congress.

Collection tour
During lunch break (13.15-13.45) on April 1 and 2 there will be an opportunity to visit the Orthoptera collection of Naturalis. Due to logistical reasons we can only accommodate 10 people in a single tour. Registration for a tour on first come, first serve basis will be possible upon signing up in Leiden.

Contact
In case you have questions please do not hesitate to contact us via mail (ecocIII@naturalis.nl).

Program of the third European Congress on Orthoptera Conservation / 16th DGfO biannual meeting

Thursday 31 March

18.00-22.00: Icebreaker - registration, drinks and diner at
Restaurant Loetje, Hooigracht 23, 2312 KM Leiden; 071-5122444

[Legend - ⌂: offline; @: online; underscored name: presenter]

Friday 1 April (morning)

08.00: registration
09.00: Welcome by the Organizing committee: Luc Willemse

Chairman: Luc Willemse

09.10 ⌂ Thomas Fartmann: Orthoptera conservation in times of global change – a Central European perspective.
09.45 ⌂ Roy Kleukers: History of Orthoptera study in the Netherlands.
10.00 ⌂ Sophie Ogan: Population status and trends of Orthoptera in Rhineland Palatinate.
10.15 ⌂ Jeroen van Leeuwen & Rob Felix: The Western Saddle Bush-cricket (*Ephippiger diurnus*) in the Netherlands: occurence, decline and recovery

10.30 Coffee break

11.00 ⌂ Szymon Czyżewski, Przemysław Żurawlew, Ryszard Orzechowski, Seweryn Grobelny, Michał Brodacki, Marcin Kutera, Paweł Radzikowski: The Orthoptera distribution atlas of Poland, achievements and perspectives
11.15 ⌂ Giacomo Ortis , Cavaletto G., Marini L. & Mazzon L.: Increasing temperatures affect multi-year life cycle of the outbreak bush-cricket *Barbitistes vicetinus* (Orthoptera, Tettigoniidae)
11.30 ⌂ Paweł Radzikowski & Jarosław Stalenga: How the Common Agricultural Policy (CAP) affects Orthoptera diversity in Poland
11.45 ⌂ Nefeli Kotitsa, Apostolos Trichas & Moisis Mylonas: The Orthopteran fauna of Crete: new data and a preliminary biogeographical analysis
12.00 ⌂ Oliver Hawlitschek, Edgardo Ortiz Valencia & Ricardo Pereira: Phylogenomics of Acrididae (Insecta: Orthoptera): more genes, more resolution?
12.15 ⌂ Jaap Bouwman: Using DNA metabarcoding in unraveling grasshopper diet

12.30 Group photo

12.45 Lunch break

Friday 1 April (afternoon)

Chairman: Axel Hochkirch

14.00 ⌂ Anton Krištín, Ľudmila Černecká & Benjamin Jarčuška: Review of distribution of two expansive *Phaneroptera* species (Orthoptera, Tettigoniidae) with case study from Slovakia
14.15 ⌂ Soňa Nuhlíčková, Ján Svetlík, Anton Krištín, Benjamín Jarčuška, Ľudmila Černecká, Peter Kaňuch, Mária Šibíková, Jozef Šibík, Ivan Jarolímek, Milan Valachovič & Róbert Šuvada: Distribution and ecology of the endemic bush-cricket *Isophya beybienkoi*: preliminary results
14.30 ⌂ Lisbeth Zechner, Claire Pernollet & Axel Wolff: LIFE SOS Crau Grasshopper: adaptive habitat management, breeding and reintroduction programme
14.45 ⌂ Gergely Szövényi & Barnabás Nagy (†): Balkan pincer grasshopper (*Paracaloptenus caloptenoides*) in Hungary - history, conservation status and future prospects
15.00 ⌂ Filippo Maria Buzzetti: The conservation of *Zeuneriana marmorata* in Italy: past, present and future
15.15 ⌂ Luc Willemse: Greek Orthoptera: species richness and discovery rate
15.30 Coffee Break
16.00 ⌂ Axel Hochkirch: Rediscovery of two 'Possibly Extinct' Orthoptera species on Gran Canaria
16.15 ⌂ Landmann Armin: Grasshoppers on dynamic riverbanks of the Alps: actual status, threats and conservation prospects
16.30 ⌂ Florian Rech, Nijat Narimanov, Tobias Bauer & Jens Schirmel: Urbanisation effects on morphological and behavioral traits of a common grasshopper
16.45 ⌂ Sebastian König: Biotic homogenization of Orthoptera assemblages in the Hassberge and resource specialisation along a temperature gradient

17.00-18.30: general assembly of the DGfO

19.00-22.30: drinks, dinner and pubquiz at:
Restaurant Loetje, Hooigracht 23, 2312 KM Leiden; 071-5122444

Saturday 2 April (morning)

08.00: registration

Chairman: Baudewijn Odé

09.00 ⌂ Vasiliki Kati: Orthoptera under the context of European nature conservation policy: the case of *Chorthippus lacustris*
09.30 ⌂ Dragan Petrov Chobanov, Ionuț Ștefan Iorgu, Slobodan Ivković & Simeon Borissov: Genetic diversity of model steppe species in the Balkans: ecological adaptations and recent expansion of the *Poecilimon brunneri* complex
09.45 ⌂ Thomas Zuna-Kratky, Thomas Holzer & Georg Bieringer: Evaluation of the Austrian agri-environmental scheme using grasshoppers as indicators
10.00 @ Michelle Lemonnier-Darcemont: Strategic conservation plan for the Albanian species, *Peripodisma ceraunii*
10.15 ⌂ Simeon B. Borissov & Dragan Petrov Chobanov: New records of Orthoptera from Bulgaria with focus on the steppe inhabitants

10.30 Coffee break

11.00 @ Rowan Edwards: Field Cricket & Wartbiter in the UK
11.15 @ Ionut Stefan Iorgu, Thomas Stalling, Dragan Chobanov, Gellért Puskás, Gergely Szövényi, Elena Iulia Iorgu: Crickets and their secrets: *Myrmecophilus acervorum* is not always parthenogenetic
11.30 @ Lara-Sophie Dey: Not only climate change - decline and extinction of the Speckled Buzzing Grasshopper (*Bryodemella tuberculata*) in Central Europe
11.45 @ Karim Vahed, Holly Turner, Rose Poston-Saynor & Jon Hudson: Monitoring the Atlantic beach-cricket, *Pseudomogoplistes vicentae*, populations in the UK
12.00 @ Matthias Dolek: A governmentally funded grasshopper monitoring scheme in Baden-Württemberg – methods, perspectives and first results
12.15 @ Philipp Kirschner, Karim Vahed & Petra Kranebitter: Diversification dynamics in the alpine bushcricket genus *Anonconotus* Camerano, 1878

12.30 Lunch break

Saturday 2 April (afternoon)

chairman: Roy Kleukers

14.00 ⌂ Baudewijn Odé: Grasshopper sounds on Xeno-Canto
14.15 ⌂ Dan Stowell: Orthopteran species sound classification using deep learning with small data

14.30 ⌂ David Bennett: Effect of landscape structure on the presence of Orthoptera in Schleswig Holstein, Germany : bioacoustic surveying with Audiomoth and machine learning classification
14.45 @ Josip Skejo, Antun Jelinčić, Karmela Adžić, Maks Deranja, Marko Pavlović, Maja Mihaljević, Amira Aquilah Muhammad & Fran Rebrina: Biogeography of the Adriatic Orthoptera

15.00 Coffee break

15.30 ⌂ Apostolis Stefanidis: Orthoptera diversity patterns on Mitsikeli Mountain
15.45 @ Özgül Yahyaoğlu, Onur Uluar & Battal Çıplak: Conserving one of the 100 amazing species: The Beydaglari bushcricket *Psorodonotus ebneri*
16.00 @ Fran Rebrina, Marko Pavlović, Karmela Adžić, Maks Deranja, Nikola Tvrtković, Josip Skejo: Towards the Red Book of Croatian grasshoppers and crickets
16.15 @ Klaus Riede: European collections and their significance for global Orthoptera taxonomy and conservation
16.30 closing remarks

Posters

1 @ Altanchimeg Dorjsuren: Grasshoppers (Acridoidea) in Mongolia
2 ⌂ Máté Borbás, Gellért Puskás & Gergely Szövényi: Orthoptera fauna of Southwest Herzegovina and its conservational evaluation
3 ⌂ Inge Illich & Thomas Zuna-Kratky: Population dynamics of an alpine grasshopper (Orthoptera) community in the Hohe Tauern (Central Alps, Austria) over 30 years and the effects of climate warming and grazing
4 ⌂ Márk László, Júlia Somogyi & Gergely Szövényi: Population size and habitat use of the Large Banded Grasshopper (*Arcyptera fusca*) in Hungary – first steps of a regional conservation project
5 ⌂ Varvara Noutsou, Konstantina Nasiou, Apostolos Stefanidis, Panagiotis Nitas, Katerina Chiotelli, Olga Tzortzakaki & Vassiliki Kati: Saving the last dance: conservation actions for the Epirus grasshopper *Chorthippus lacustris*
6 @ Marko Pavlović, Lara Božičević, Karmela Adžić, Maks Deranja, Damjan Franjević & Josip Skejo: Threatened Tetrigids online: Assessing pygmy rainforests before they are gone
7 ⌂ Gellért Puskás, Márk László & Gergely Szövényi: Horticulture spread Mediterranean insects in Hungary (Orthoptera, Mantodea, Blattodea)
8 ⌂ Paweł Radzikowski & Jarosław Stalenga: Effect of agroforestry on diversity of insects in organic arable crops
9 ⌂ Paweł Radzikowski & Jarosław Stalenga: Abundance and diversity of Orthoptera in organic arable crops
10 Lisa Reiss & Axel Hochkirch: Hidden in forests: A new project on habitat management for Barbitistes serricauda
11 @ Howon Rhee: The ugly duckling in the laboratory: A high percentage of brown colour *Tettigonia viridissima* when reared in the laboratory
12 @ Michael Sergeev: Patterns of rare orthopteran species over Eurasian steppes

Abstracts

Orthoptera conservation in times of global change – a Central European perspective.

Thomas Fartmann

Department of Biodiversity and Landscape Ecology, Osnabrück University, t.fartmann@uos.de

Orthoptera are important bioindicators of the effects of global change. Moreover, they are of high functional importance in open and nutrient-poor terrestrial ecosystems, e.g., as a crucial food resource for many vertebrate species. However, these formerly widespread habitats are nowadays, due to land-use intensification or abandonment in most parts of Europe, often restricted to small and isolated remnants. Recently, climate change has become an additional factor that influences Orthoptera habitats and the distribution of the species.
The aim of this plenary talk is to disentangle the effects of current land-use and climate change on the long-term persistence of Orthoptera in Central European landscapes. Based on extensive field and laboratory studies ranging from the microhabitat and habitat to the landscape level, the most important drivers are highlighted. A special focus will be on the effects of habitat quality, habitat heterogeneity, patch size and landscape connectivity on Orthoptera diversity and dispersal. The presented examples cover research from semi-natural grasslands, heathlands and floodplains. Based on the current knowledge I will give recommendations for the management of species-rich Orthoptera habitats in times of global change.

History of Orthoptera study in the Netherlands

Roy Kleukers

EIS Kenniscentrum Insecten en andere ongewervelden, roy.kleukers@naturalis.nl

In 1983 Thijs Duijm and Gideon Kruseman published the first book on Dutch Orthoptera, and Leo Beukeboom (1986) provided a field key. This greatly encouraged naturalists to start collecting distribution data and led to two atlas projects (1990-1995, 2006-2014) and two red lists (1999, 2012). Local orthopterists are supported with posters, keys (traditional and multi-entry) and up-to-date distribution data on Waarneming.nl, where grasshoppers are also included in the image recognition system. Grasshoppers have found a place in Dutch nature conservation, together with butterflies and dragonflies. Several species protection plans are

in place, e.g., Common Wart-biter *Decticus verrucivorus*, Steppe Spiny Bush-cricket *Gampsocleis glabra*, White-clubbed Grasshopper *Gomphocerippus rufus* and Western Saddle Bush-cricket *Ephippiger diurnus*.

Population status and trends of Orthoptera in Rhineland Palatinate

Sophie Ogan

Department of Biogeography, Trier University, ogan@uni-trier.de

The rapid decline of species is a global problem of modern humanity. Recent studies show that the the abundance of insects has declined massively in recent decades. A fundamental phenomenon in the context of this decline is the lack of data on the spread and abundance of most insect species. Therefore, declining and increasing trends in populations are often unnoticed until it reaches a drastic dimension in either way. Nevertheless, this data is of enormous importance for red list assessments and thus for the initiation and implementation of conservation measures. Orthoptera are considered as valuable bioindicators to e.g., the intensity of land use. In 2011, a new atlas and in 2019, a new red list was published for this species group in Rhineland-Palatinate. However, the creation of the red list also showed that there are considerable gaps in knowledge about the population trends of Orthoptera species in this region. In summer 2018 and 2019, we re-surveyed 166 study sides in south-west Germany (Rhineland-Palatinate) to fill the gap of solid data on the population trends of Orthoptera. First results show that a higher degree of shrub encroachment seems to be the main driver of a reduction in the number of species. However, the outcome is much more complex and both, winners and losers of climate change and habitat modification were identified.

The Western Saddle Bush-cricket (*Ephippiger diurnus*) in the Netherlands: occurence, decline and recovery

Jeroen van Leeuwen & Rob Felix

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Since the 80's, the number of populations of *Ephippiger diurnus*, inhabiting heathlands in the Netherlands, decreased from 16 to 6, and population size decreased in some of the remaining populations. The reason for decline is most likely related to a decrease in habitat quality, through decades of Nitrogen deposition and the resulting acidification and eutrophication in heathlands. Currently, we are preparing the recovery of heathlands, through application of soil amendments (grinded

rocks) to reinstate soil buffer capacity and nutrient balances, thereby bringing back wat has been lost over time. On the longer term this hopefully leads to recovery of the populations of the Western Saddle Bush-cricket (with help of re-introductions where needed).

The Orthoptera distribution atlas of Poland, achievements and perspectives

Szymon Czyżewski, Przemysław Żurawlew, Ryszard Orzechowski, Seweryn Grobelny, Michał Brodacki, Marcin Kutera & Paweł Radzikowski

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The Orthoptera distribution atlas of Poland, started in 2018, is the first Internet-based project in the country devoted to this insect group, collecting all the accessible data about Orthoptera distribution in a single place. The distribution maps for 86 grasshopper and cricket species recorded in Poland from 19th to 21st century are based on published records from studies of professional researchers and on unpublished observations of amateur naturalists and hobbyists, e.g., nature photographers, obtained directly and via various kind of social media and verified by the project team. The records are divided into two periods: historical (up to 1990) and contemporary (after 1991). The main aim of the project apart from distribution mapping is to popularize the knowledge about grasshoppers and encourage people to take an interest in them. While until now we already added over 52,000 records, a lot is still to be done, especially in some underexplored regions. Despite that, clear tendencies in distribution of some species over the last 20 years can be seen, like the fast expansion of the range of *Phaneroptera falcata*, increase in number of *Calliptamus italicus* populations or decline of *Psophus stridulus* and many other endangered species. The atlas is accessible online under the address https://orthoptera.entomo.pl, though it must be considered that the results are preliminary as the works are ongoing. The printed version of the atlas is planned to be issued in future.

Increasing temperatures affect multi-year life cycle of the outbreak bush-cricket *Barbitistes vicetinus* (Orthoptera, Tettigoniidae)

Giacomo Ortis, G. Cavaletto, Lorenzo Marini & Luca Mazzon
Department of Agronomy, Food, Natural resources, Animals and Environment (DAFNAE), University of Padova, Viale dell'Università 16, 35020 Legnaro (PD), Italy, giacomortis@gmail.com

Although outbreaks of rare species are unusual, several insect species have become emerging pests probably due to on-going environmental changes. *Barbitistes vice-*

tinus was first described in 1993 as an endemic bush-cricket of north-east Italy and was considered rare until 2008, when it becomes an established pest, causing severe damages to forests and neighbouring crops. The causes of this outbreak are unclear as the effect of environmental drivers on several key life-cycle stages. In this study, we explored the effect of summer temperature on egg diapause and the effect of winter temperature on egg survival. Field observations showed that the proportion of embryos that can complete development at the end of summer ranged from zero to nearly 90% depending on summer temperature. A substantial shift in rates of development from 20 to nearly 80% occurred in a thermal range of about only 1°C. On the contrary, overwinter egg survival was high and constant (90%) across a wide range of winter temperatures. Overall, the results suggest a potential key role of summer temperature warming on the outbreak propensity of this species, able to switch from a multi-year to an annual life cycle with just a 1-2° warming.

How the Common Agricultural Policy (CAP) affects Orthoptera diversity in Poland

Pawel Radzikowski & Jarosław Stalenga

Institute of Soil Science and Plant Cultivation, pradzikowski@iung.pulawy.pl

In Poland, as in the rest of Europe, most of the orthopteran species are associated with agricultural areas. The structure of land use in Poland is determined by historical reasons, among which the most recent is the accession to the EU whose a flagship programme is the Common Agricultural Policy (CAP). Since 2004, three editions of its key element, i.e. the Rural Development Program (RDP) (2004-2006, 2007-2013, and 2014-2020 - extended to 2022) have been implemented. Several monitoring surveys conducted in Poland have proven that certain CAP interventions can be of a great importance for the conservation of Orthoptera diversity. Under the 2014-2020 RDP edition, populations of grasshoppers occurring on organic arable fields and on the meadows under variants aimed at the protection of valuable natural habitats or habitats of farmland birds included in the agri-environmental scheme(AES) were studied. The new Strategic Plan for Agriculture in Poland (2023-2027) brings new interventions that have the potential to affect grasshopper populations, for instance: grazing on extensive grasslands, agroforestry practices or crop diversification on arable lands. We present the results of the Orthoptera monitoring performed in 2012-2016 and evaluate the selected CAP interventions with the potential to impact the Orthoptera diversity in near future.

The Orthopteran fauna of Crete: new data and a preliminary biogeographical analysis

Nefeli Kotitsa[1], Apostolos Trichas[2] & Moisis Mylonas[1,2]

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[2] Natural History Museum of Crete, University of Crete, Iraklion, Greece

Crete is the biggest island of Greece, situated in the south Aegean Sea. Until recently, 73 Orthopteran species were known from the island, of which 18 are endemic to Crete alone, and 4 are endemics to Crete and the south Aegean area. The aim of the present study lies in the faunistic and biogeographical analysis of the Cretan Orthopteran fauna, based on the specimens deposited in the Natural History Museum of Crete and all the literature data up-to 2020. Almost 20.000 specimens from the NHMC's 30-year old collection, originating from all dominant habitats of the island, were identified to the species level. As more than 90% of the specimens were collected by pitfall trapping, they are dominated by ground dwelling species, which are often overlooked by classical Orthopterological research. Consequently, the 66 identified taxa included: 5 species not previously recorded from Crete; 2 new species of endemic Ensifera; and both sexes of 5 endemic species previously described based on very few individuals of one sex. These data were combined with the existing literature in order to produce species distribution maps, zoogeographical patterns inside the island and the effect of altitude on the fauna. The orthopteran fauna of the lowlands is homogenous in the island, with the distinct exception of some local endemic species, whereas the mountains show a clear differentiation between east and west. Lastly, the increase of altitude leads to an exponential decrease in the number of Orthopteran species, as well as to the dominance of endemic species on higher altitudes.

Phylogenomics of Acrididae (Insecta: Orthoptera): more genes, more resolution?

Oliver Hawlitschek, Edgardo Ortiz Valencia & Ricardo Pereira

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Acrididae is a family of grasshoppers that has posed problems to phylogenetic reconstruction because of widespread incomplete lineage sorting, hybridization, pseudogenes (numts), and possibly Wolbachia infection. Nevertheless, earlier DNA barcoding and multigene phylogenies have already suggested that the current taxonomy needs revision. Especially, the current generic assignment of many species has to be revisited. We sequenced transcriptomes of a selection of Central Europe-

an species of the subfamily Gomphocerinae. Our results confirm the genus *Chorthippus* as polyphyletic, encompassing the genera *Stauroderus, Gomphocerus*, and *Gomphocerippus*. Our genomic data also appears to resolve species complexes, e.g., the *C. biguttulus* complex, that could not be resolved using DNA barcoding or mitochondrial genomes due to haplotype sharing. The position of some species, e.g., *C. apricarius* and *C. alticola*, differs significantly between mitogenomic and transcriptomic trees. Our goal is the detection of genomic markers that can be used for resolving the larger-scale phylogeny of this important but poorly studied group.

Using DNA metabarcoding in unravelling grasshopper diet

Jaap Bouwman[1], Kees van Bochove[2] & Hein van Kleef[3]

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In the past questions about grasshopper diets could be answered but were extremely time consuming or destructive. Researchers had to follow grasshoppers in the field or had to kill them and analyse the stomach content under a microscope. In 2019-2022 we performed a pilot study using DNA metabarcoding to analyse grasshoppers' scats of two endangered Dutch species of grasshoppers; *Ephippiger diurnus* and *Tetrix bipunctata*. Scats of *Ephippiger diurnus* were collected on different locations in the Netherlands and were divided in males, females, and juveniles. *Tetrix bipunctata* is present at just one location in the Netherlands. Therefore, additional scats were collected in a nature reserve in Germany. We show that DNA metabarcoding can provide interesting insights in the diet of grasshoppers, and they can give new direction to habitat preference. In this presentation we show what techniques were used in analysing the scats and we discuss the results. We think that DNA metabarcoding is a very promising technique in unravelling habitat preferences of different grasshopper species and could be used on a larger scale.

Review of distribution of two expansive *Phaneroptera* species (Orthoptera, Tettigoniidae) with case study from Slovakia

Anton Krištín, Ľudmila Černecká, Benjamin Jarčuška

Department of Evolutionary and Behavioural Ecology, Institute of Forest Ecology SAS, Štúrova 2, SK 96053 Zvolen, Slovakia, kristin@ife.sk

Two species of genus *Phaneroptera* are partially sympatric in Europe, but the synthesis of robust distributional data, the data on syntopic occurrence and environ-

mental factors explaining the distribution are missing. In the last decades, both species (*P. falcata*, *P. nana*) are considered spreading northwards throughout the Europe. We reviewed all available distributional data, and recently, *P. falcata* is widely distributed in Europe from Greece (~ 41°N) in the South to ~ 60°N latitude in NW Russia, while *P. nana* from N Africa (~ 30°N) only to 49–51°N. In 1996–2021, we checked 2327 sites (47.4% before 2010/ 52.6% after 2010) in Slovakia with the aim to find the distributional limits and syntopic occurrence of both species. *P. falcata* was found in 31.2% of sites (48.4/51.6 % before/after 2010), while *P. nana* only in 9.6 % (26.5/73.5 % before/after 2010) showing that number of *P. nana* sites (%) increased much more than in *P. falcata* after 2010. Both species co-occurred in 2.7% of all sites. *P. falcata* was found in wide altitudinal gradient up to 1450 masl (mean±SD = 405±204.5 masl), when *P. nana* only up to 530 masl (185.5±82 masl). Their syntopic occurrence was found higher (234±100.1 masl) than *P. nana* occurrence. *P. falcata* seems to prefer the forested areas, mostly with beech, while *P. nana* the riparian and synanthropic vegetation mostly with willow and poplar in Slovakia. Based on previous knowledge on distribution of both species in Europe, we mapped riparian vegetation of 12 south-north oriented Slovak rivers (120 sites) in 2018-2021, with aim to find the actual northern limits of their distribution. We found that *P. nana* is distributed mainly in southern and central part of the rivers, both species co-occur in central part and P. falcata occupies mostly northern sections. The species distributional patterns were discussed on the global scale.

Distribution and ecology of the endemic bush-cricket *Isophya beybienkoi*: preliminary results

Soňa Nuhlíčková[1], Ján Svetlík[1], Anton Krištín[2], Benjamín Jarčuška[2], Ľudmila Černecká[2], Peter Kaňuch[2], Mária Šibíková[3], Jozef Šibík[3], Ivan Jarolímek[3], Milan Valachovič[3] & Róbert Šuvada[4]

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Insect species with geographically restricted distributions are often poorly known and generally at higher risk of extinction. Therefore, information on distribution, ecological requirements and reproduction biology plays important role for conservation concerns in such species. Bei-Bienko's plump bush-cricket (*Isophya beybienkoi* Mařan, 1958) is an endemic species to the Slovak Karst (Slovakia, Central Europe). To improve the previous knowledge about the species distribution and

population size, the first systematic survey of all historical, recent and expected sites of the species occurrence was conducted. Distributional pattern was analysed according to microhabitat characteristics as each individual was assigned with GPS coordinates. Altogether, 21 transects (322 km) during 28 days of field work were walked to check all potential habitats of the bush-cricket. In total, 124 individuals (M=51%; F=49%) were recorded from June to July 2021. In comparison to previous data, new species records were found especially in the south-western part of the area. On the other hand, some historical records were not confirmed. Vegetation data indicated a strong link with dicot-herbs represented mainly by medium light demanding species in semi-humid habitats. This evidence was confirmed by two different geo-botanical approaches (Borhidi indicator scales for vascular plants and the Normalized difference vegetation index). The first results on phylogeography of the species suggest relatively high genetic variation and spatial differentiation of (at least three) lineages according to specific climate/habitat niche. Our novel information about species ecology and evolution will be an effective tool for predicting other suitable habitats as well as the first step in creation of conservation plan for this enigmatic species.

LIFE SOS Crau Grasshopper: adaptive habitat management, breeding and reintroduction programme

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The 'coussoul' in southern France is a unique dry grassland of the Crau plain renowned for its biodiversity. Transhumant, extensive sheep grazing remains the dominant practice, and contributes to preserve biodiversity. The Coussouls de Crau National Nature Reserve (7 411 ha) is a strictly protected area. It is also part of the Natura 2000 network.
The Crau Plain Grasshopper *Prionotropis rhodanica* is endemic to the coussoul. It is listed as Critically Endangered on the global IUCN Red List (Hochkirch and Tatin 2016). In 2014, a strategy for its conservation was elaborated by the IUCN SSC Grasshopper Specialist Group and the Conservatoire d'espaces naturels Provence Alpes Côte d'Azur CEN PACA (Hochkirch et al. 2014).
Based on this strategy, the LIFE project (2021-2025) coordinated by CEN PACA aims to improve the conservation status of the highly threatened species. The main long-term objective is to strengthen the remaining sub-populations by increasing population size and range.

The LIFE project is based on 4 key objectives:
- Increase favourable habitat through adaptive grazing management
- Reduce predation by colonial insectivorous bird species
- Improve breeding success in captivity and start reintroduction programme
- Communicating, education and raising awareness among local stakeholders, the general public and institutions.

The methods used and developed for population monitoring and breeding of *P. rhodanica* can also be applied to other *Prionotropis* and orthopteran species. In cooperation with a network of European experts and the IUCN SSC Grasshopper Specialist Group, a transfer strategy for the further use of the project's techniques and methods will be developed. A first application of population monitoring methods (detection dogs) will be carried out in 2022, in the framework of *P. azami* conservation actions in Southern France, led by CEN PACA. International videoconferences allow the exchange of knowledge on orthopteran conservation strategies and habitat management experiences between experts, which will contribute to the exchange and replication of methods. The preparation of an international project on the conservation of *Prionotropis* species and their habitats is being considered within this framework.

Balkan pincer grasshopper (*Paracaloptenus caloptenoides*) in Hungary – history, conservation status and future prospects

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The Balkan pincer grasshopper occurs on the Balkan Peninsula and its surroundings penetrating into the Carpatho-Pannonian region in north. In the northern range margin only very localised and mostly small and isolated populations are known to be exist. Its Hungarian occurrence has been published first already in the 19th century. According to all published and other available data the species seems to be extinct from most of its former Transdanubian occurrences (Vértes Hills, Bakony Mountain, Buda Hills) and there still occurs only in Visegrád Mountain, while in North Hungarian Mountains is present in several locations in Börzsöny Mountain, Cserhát Hills, Mátra Mountain, Bükk Mountain and Aggtelek Mountain. There are known altogether 50 recent occurrences in Hungary mostly in forest clearings, as a result of a systematic field research done in the past decade. The considerable increase in the number of known populations suggests an increasing or at least stable trend, but, unfortunately, it is a false picture. It seems, that the real situation is rather a decreasing tendency on average with harsh regional differences. Most of the populations are found in protected areas in for-

ested landscapes, but are very small on average. The main problems are the secondary succession and the high pressure of game (wild boar, red deer, moufflon) on the grassland habitats. Therefore the future of the species in Hungary depends practically on the appropriate management of the habitats, which are often contrary to the forest management objectives there.

The conservation of *Zeuneriana marmorata* in Italy: past, present and future

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Zeuneriana marmorata (Fieber, 1853) is listed as EN (Endangered) by IUCN in the Red List of European Orthoptera. Current populations are in NE Adriatic coast in Italy, inland in Slovenia and one recently discovered in Italian inland. These are assumed to be remnant sub-populations of a larger metapopulation living in the wet habitats of the plains around the North Adriatic Sea. Causes of range fragmentation are supposed and current threats outlined. Regarding Italian populations, study (bioacoustic) or conservation (translocation, area management) actions applied to date and planned for the future are explained.

Greek Orthoptera: species richness and discovery rate

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Greece harbours a very rich Orthoptera fauna, the most recent overview reporting 378 species (Willemse et al. 2018). Factors that contributed to this richnes are briefly described and exemplified. Although Greece has been explored regularly during the last decades, new species are still being reported up to this very day, the overall total approaching 400 species now. Factors that contribute to species remaining undiscovered are listed, examples of recently discovered species are listed and one species will be presented in more detail.

Rediscovery of two 'Possibly Extinct' Orthoptera species on Gran Canaria

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Our knowledge on the distribution and status of European Orthoptera species is better than in many other regions of the planet, but still incomplete. For this reason, none of the European species has been assessed as Extinct on the IUCN Red List so far. However, seven species were flagged as 'Possibly Extinct' in the Critically Endangered Category. Two of these species are endemic to Gran Canaria (Canary Islands, Spain). The Gran Canaria Crested Grasshopper (*Dericorys minutus*) was only known from the holotype, which had been collected at Maspalomas beach in 1949. In 2016, a photo of this species was found by Heriberto López on Flickr, which was taken at the coast near Puerto de Sardina in the Northwest of the island. A first search in this area by Anja Danielczak was unsuccessful, but she discovered a second population in a nature reserve near Arinaga in the Southeast of the island. In 2017, the population near Puerto de Sardina was confirmed by Anne Michaeli and Jacob Andreä. As the southwestern population is quite large and occurs in a protected area, Dericorys minutus can probably be downlisted to Endangered or Vulnerable. It appears to be specialized in its diet on *Suaeda vermiculata* and *Bassia tomentosa*. A second lost species on Gran Canaria was the Gran Canaria bush-cricket (*Evergoderes cabrerai*). This species had not been found since the 1960s despite searches. The only known locality was the Barranco de Agaete in the Northwest of the island. In 2018, it was finally rediscovered by Lisa Mahla, Lukas Knob and Jann Kolmsee. As a consequence of a press release on this finding, a naturalist submitted a photo from another locality near La Aldea de San Nicolas de Tolentino in the West of the island taken in 2018. Another record from 2006 appeared on the Citizen Science platform iNaturalist and a dead individual was found in Telde – in the east of the island. Two further records were documented in 2021 and 2022 in the West and Centre of Gran Canaria. All populations appear to be very small and the insect is difficult to find as it prefers steep rocky slopes as habitat and is nocturnal. Based upon the new findings, a downlisting of the red list status to Endangered is likely. These rediscoveries illustrate that the search for lost species is not useless. Rediscoveries can foster conservation action for such rare species.

Grasshoppers on dynamic riverbanks of the Alps: Actual status, threats and conservation prospects

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According to the WWF European Alpine Program 2014 the pan-Alpine river network consists of more than 10.500 river units with a total length of about 57.000 km. In particular, stretches of braided floodplains with high seasonal and year to year hydrological and morphological dynamics, for thousands of years have been keystone ecosystems in all parts of the Alps and served as refuge and hotspot for highly specialised, mainly semiaquatic or hygrophilous plants and animals. The banks of such rivers are dominated by extensive gravel fields with sparse vegetation and are characterised by a high small-scale variability in soil structures, micro-topography and micro-climates. Therefore, these dynamic habitats traditionally have also been refuges for xerophilic and geophilic grasshoppers and a few bush crickets. Overall, more than a dozen Caelifera species originally have been or still are typical for bare ground habitats along alpine rivers. However, most of these species also inhabit other habitats dominated by raw soils and even artificial environments like, e.g., gravel pits. On the contrary, in particular four species, namely *Tetrix tuerki, Epacromius tergestinus ponticus, Bryodemella tuberculata* and *Chorthippus pullus* in the Alps are more or less exclusively bound to dynamic habitats along wild rivers. Given this close association the notion is alarming that only less than 5% or less than 500 km of the river network length of larger rivers (with catchments over 500 km²) have been assessed to still show a high ecological status by the WWF in 2014. Accordingly, all specialised river dwelling Caelifera mentioned, nowadays are listed in higher threat categories of the Red Lists of the countries which have part in the Alpine Arc, and even are regarded as 'Regionally Extinct' in several states. What is more, all four species overall still show decreasing population trends in the Alps and most regional populations are severely fragmented and isolated now and continue to decline due to habitat deteriorations caused by ongoing river regulation programs, hydropower use or gravel-mining. Conservation measures therefore are urgently needed in order to preserve the last remaining alpine populations of these species. The talk first gives a short overview about the current population and threat status of the species in the Alpine Arc and about conservation activities which have been implemented so far. In particular an actual river-restoration program funded by the EU-LIFE scheme (Dynamic River System LIFE Lech 2016-2021) at the Lech River (Tyrol, Austria) is presented. Amongst others, riverbank grasshoppers have been selected there as target and flagship species, and the local distribution, population status and habitat requirements of three species which still occur at the Lech river are monitored.

Urbanisation effects on morphological and behavioral traits of a common grasshopper

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Urbanization has a major impact on biodiversity. For many organisms, the urbanization process means environmental stress caused by, e.g., the urban heat island effect, and atmospheric, soil, light, and noise pollution. Such environmental stress can influence both the morphology and behavior of animals. Hence, individuals might be selected for survival-facilitating traits under high ecological pressures in urban areas. The influence of urbanization on the ecology of insects has already been intensively investigated while the specific impact of urbanization on insect behavior is still largely unexplored. Here we studied the impact of urbanization on one of the most common grasshopper species in Germany, *Chorthippus biguttulus*, by comparing morphological and behavioral traits of grasshoppers sampled from meadows with low, medium, and high urbanization levels. We first investigated whether urbanization as a stressor affects the body size and the fluctuating asymmetry in the locomotor organs. Next, we examined whether urbanization induced changes in the individuals' boldness and walking activity. Our results showed that the fluctuating asymmetry of grasshoppers' locomotory organs was more expressed in individuals from the meadows with high urbanization levels than their counterparts from the less urbanized areas. Further, the boldness and walking activity of individuals increased from the areas with low toward high urbanization levels. The results indicate that urbanization can strongly affect morphological and behavioral traits of insects. The individual trait adaptions further indicate a high phenotypic plasticity in *C. biguttulus*, probably explaining its success in urban environments.

Biotic homogenization of Orthoptera assemblages in the Hassberge and resource specialisation along a temperature gradient

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The degradation of natural habitats is causing ongoing declines in terrestrial insect biodiversity. This decline is particularly strong in agricultural landscapes and often accompanied by a homogenization of biological communities. Even for grasslands, which rank among the most species-rich ecosystems worldwide, the main-

tenance of diversity is a key challenge in times of global change. However, the reactions of species to recent warming and environmental changes differ. Therefore, the consideration of species trait clines in hand with assemblage compositional rearrangements over time can be a useful tool to disentangle effects of environmental change on communities. One approach to study ecosystem responses to climate change is to regularly monitor the presence of species on selected sites. Therefore, we surveyed Orthoptera on appr. 200 grassland sites of different habitat types in central Europe (Hassberge), which had originally been probed by Othmar Fischer-Leipold in 1985. The study sites were revisited in 2004 by Jürgen Thein and Julia Gombert. Finally, Simon Thorn, Jürgen Thein, Julia Gombert, Josline Griese and Sebastian König repeated the same methodology in 2019. First results show a biological homogenization of the different habitats, as facilitated by a spread of thermophilic, mobile species and a parallel decrease of wet grassland associated species which is likely associated with microclimatic shifts in the respective habitats.

Climate can also influence the strength of biotic interactions. Insect herbivores differ in their degree of specialisation with broad consequences for the diversity and composition of plant communities. The composition and richness of herbivore consumers and plant resources change along climatic gradients, but knowledge about associated shifts in specialisation is scarce. We adapted a non-invasive, standardized metabarcoding approach to reconstruct dietary relationships of Orthoptera species as a major insect herbivore taxon and their plant resources along a temperature gradient in southern Germany. Based on orthopteran surveys, collection of faecal pellets of >3000 individuals of 347 populations and 54 species, and parallel vegetation surveys on 41 grassland sites, we quantified resource availability and use to estimate specialisation. Herbivore assemblages were more species rich and dense at sites with high summer temperatures, while plant richness peaked at intermediate temperatures. The corresponding interaction networks were more specialised in warm habitats. When considering phylogenetic relationships of plant resources and their cover, however, the specialisation pattern peaked at intermediate temperatures, mediated by herbivores feeding on a narrow range of related resources. Our results suggest increased generalist feeding at both ends of the sampled gradient, questioning the assumed causal relationship of insect herbivore diet breadth and temperature. Thus, we demand more experimental research to understand how species assemble their diets in response to changes in climatic conditions.

Orthoptera under the context of European nature conservation policy: the case of *Chorthippus lacustris*

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An overview of the current European nature conservation policy is presented and the tools available to conserve those invertebrates not protected under the EU environmental legislation. Biodiversity is declining in the EU at alarming rates. Natura 2000 network of protected areas is the cornerstone of the EU policy for nature conservation, but EU legislation largely neglects arthropod conservation. However, the new European Biodiversity Strategy by 2030 can indirectly contribute to Orthoptera habitat conservation through a suite of key commitments for offering protection in 30% of EU land, and strictly protecting one-third of it, along with restoring nature. Even red-listed Orthoptera species not covered by the EU legislation can be included in monitoring schemes, in Environmental Assessment Studies, and considered in LIFE conservation projects. The conservation story of Chorthippus lacustris, a critically endangered steno-endemic species of Greece, is presented, to illustrate the conservation endeavor for an important species that is omitted from the Habitat's Directive and still struggles for survival.

Genetic diversity of model steppe species in the Balkans: ecological adaptations and recent expansion of the *Poecilimon brunneri* complex

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Steppes are among the most altered habitats by anthropogenic activity. Dry and cold steppes covered most of Eurasia during the Last Glacial period. The rapid transition to interglacial conditions and the extensive land use during the Anthropocene resulted in the currently observed severe fragmentation of this habitat. Steppe communities are subjected to constant disturbance and diminish rapidly in Europe, therefore, monitoring the status of these communities is an important task for conservationists. Orthopterans are a suitable model group to study habitat

quality due to their strong association with certain habitat types. Genus *Poecilimon* is characterized by remarkably high diversity, that has recently been largely linked to the Pleistocene glacial cycles. In this study we focus on the *Poecilimon brunneri* species complex, which is among the very few *Poecilimon* groups adapted to live in xerophytic grasslands. We evaluate the genetic diversity and the phylogenetic relationships within the complex and use molecular dating to obtain a time frame of speciation events. Additionally, we apply ecological niche modelling techniques to study range shifts in response to climatic oscillations as well as to estimate differences between ecological requirements of different species.
This study was supported by grant KP-06-N31/13 of the National Science Fund of Bulgaria to Dragan Chobanov and by the National Research Program 'Young scientists and postdoctoral students' – grant to Simeon Borissov (both under the Ministry of Education and Science of Bulgaria).

Evaluation of the Austrian agri-environmental scheme using grasshoppers as indicators

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The agri-environmental scheme is the most powerful instrument to implement nature conservation in the cultured landscape in Austria. From 2014 to 2019 a total of 2620 Mio € was paid to farmers for the implementation of environmentally responsible measures in agriculture. A large proportion of the subsidies is reserved to measures supporting biodiversity, but so far there was no evaluation of the effectiveness of the measures on a national scale. In 2017-2018 we had the possibility to evaluate these measures with grasshoppers (and butterflies) as indicators. In a first step we tested coverage and effectiveness of the measures for the austrian populations of a group of 26 rare and endangered species (e.g., *Isophya costata*) and also a sample of seven widespread species typical for extensively used grassland (e.g., *Psophus stridulus*). In a second step we compared during a field survey in 72 areas in Austria the species-richness of arable fields resp. meadows without measures with up to ten proximate patches, where farmers received subsidies for different types of environmentally responsible measures. It turned out that even very rare species of agricultural habitats (like *Saga pedo*) can be reached by the agri-environmental scheme (on average 50-60% of the populations), but during the last 10 years significant proportions of farmland hosting these species fell out of the area where funds can be applied for. The most important land-use types for the preservation of endangered species were extensively used meadows (like litter meadows or mountain-meadows). The only effective measures enhancing biodiversity applied on large scale turned out to be the creation of set-aside on

fields (regardless if funded by 'greening' in the first pillar of the CAP or in the frame of the Austrian scheme), the implementation of the measure 'Naturschutz' ('nature conservation', esp. in extensively used habitats) and the preservation of landscape elements like hedges or grass-strips. These effective measures cover only 5% of the land with applied 'biodiversity-supporting' subsidies! Other promising measures like eco-farming, strips with delayed mowing in meadows or cultivation of rare or nitrogen-fixing crops showed no significant increase in species richness compared to adjacent patches without funding. This came mainly from too weak differences in the management of these funded 'biodiversity-friendly' fields compared to 'normal' agriculture. To improve the effectiveness of the agri-environmental scheme we propose to put a focus on the funding of the management of extensively used meadows, to strengthen the implementation of set-aside (at least for 8% of the arable land), to establish 'biodiversity-strips' in meadows (at least 5%) with delayed mowing (min. 8 weeks) or a 'mowing-window' (min. ten weeks) in summer, the extension of the specialist-based measure 'Naturschutz' and the exhaustive preservation and reestablishment of landscape elements.

Strategic conservation plan for the Albanian species, *Peripodisma ceraunii*

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The Cika mountain grasshopper (Peripodisma ceraunii) is a Critically Endangered species with a very restricted distribution, only known from the Cika Mountain in Vlore district of Albania. This species is threatened by domestic livestock grazing, particularly cattle grazing, resulting in a declining population trend. Due to its status and its extremely restricted distribution, it was of the utmost importance to rapidly implement some efficient conservation actions and to guarantee its sustainable management. In 2018, we published the results of a 3-year study: Effects of changing grazing systems on the threatened genus *Peripodisma* pointing out the importance of mastering pastoralism to manage the conservation of this species and biodiversity. In 2020, we got funds to launch a two years project with a highly motivated Albanian team, composed of a young conservationist in early career, living near the area and the Head of the Museum of Natural Science of Tirana. We increased our knowledge concerning its exact distribution on the Cika mountain and population densities, and concerning spatial data on grazing in that area (species, races, number of units, period, duration, grazing areas, etc.) while establishing good links with stakeholders. In 2021, we conducted a workshop to share a conservation strategy for the species with stakeholders (regional administration, herders, plant collectors, NGOs), then started implementation of the action plan. Public awareness was done through information panels and video film.

New records of Orthoptera from Bulgaria with focus on the steppe inhabitants

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After a three-stage data accumulation on the Bulgarian Orthopteran fauna, in the 2000s, a significant upgrade has been done based not only on new findings but also due to changed understanding on the taxonomic outline of many taxa, and even due to range expansion of certain species. Part of the new records are published in scientific editions. Additional new data are included in the IUCN Red List assessments of the European Orthoptera, while new records are still accumilating. Here we report new data on the distribution and taxonomy of Orthoptera of Bulgaria, focusing on the dry grassland habitats. This study was supported by grant KP-06-N31/13 of the National Science Fund (Ministry of Education and Science of Bulgaria) to Dragan Chobanov.

Field Cricket & Wartbiter in the UK

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A light review of the UK's Wartbiter project, and my experiences growing up with the Field Cricket conservation project.

Crickets and their secrets: *Myrmecophilus acervorum* is not always parthenogenetic

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Fertilization is a basic process of life, as most of the eukaryotes reproduce with the

merging of gamete nuclei. A variation of the reproductive system, the parthenogenesis can be defined as the development of an individual from an unfertilized gamete. Parthenogenesis is a relatively common phenomenon in the animal kingdom. This type of reproduction occurs in many insect groups, occasionally among bisexual forms: Aphidae within Hemiptera, Curculionidae within Coleoptera, Hymenoptera and Lepidoptera.
The ant-loving crickets are amongst the most inconspicuous inquiline insects taking advantage of the stable ant-nest conditions. Genus *Myrmecophilus* Berthold, 1827 comprises around 60 species of ant-loving crickets, with almost cosmopolitan distribution. For living undetected in ant nests, the crickets developed a particular adaptation: chemical camouflage. These small insects are known kleptoparasites, exploiting different food resources, such as ant eggs, larvae or disrupting ant trophallaxis. This behaviour can be dangerous, so, another way ant-crickets can escape the attacks of ants is their great physical agility. Ten species have been described from Europe and all of them are located in southern and south-eastern Europe, excepting *Myrmecophilus acervorum* (Panzer, [1799]), widely distributed throughout Europe from Spain to the Caucasus, reaching Denmark and Sweden in the north. Previously considered as an example of thelytokous parthenogenetic organism, the common ant-cricket *Myrmecophilus acervorum* is actually a species having mixed reproductive systems, subject to geographic parthenogenesis. Authors' recent surveys in the central area of its distribution area showed the presence of males, previously unknown in this insect.

Not only climate change – decline and extinction of the Speckled Buzzing Grasshopper (*Bryodemella tuberculata*) in Central Europe

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The Speckled Buzzing Grasshopper (*Bryodemella tuberculata*) colonized large parts of Asia and Europe until the mid-19th century. While the species remains widespread in Asia, it is considered extinct or critically endangered in many parts of Europe. Using population genetics and ecological niche modeling, we investigated the decline of the grasshopper species in Central Europe
and discovered that climate change is not the only factor threatening the biodiversity of our landscapes.

Monitoring the Atlantic beach-cricket, *Pseudomogoplistes vicentae*, populations in the UK

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The Atlantic beach-cricket, *Pseudomogoplistes vicentae*, is classified on the IUCN Red List as 'Vulnerable' and is very unusual in occupying coastal shingle habitats. In the U.K., the main populations occur at 3 sites that are potentially vulnerable to severe Atlantic storms, such as the one that hit the U.K. in the winter of 2013/14. The aims of the present study were to establish new baseline data for on-going monitoring of the U.K.'s *P. vicentae* populations and to compare the relative size and extent of each population prior to, and following, the storm surges of 2013/14. All three sites (Chesil Beach, Branscombe and Marloes Sands) were surveyed in summer/ early autumn 2016 and 2019, with further surveys at Marloes Sands in 2020 and at Branscombe in 2021 (plus a survey of a further site at Dale in Pembrokeshire in 2020). Pitfall traps (baited with dried cat biscuits) were left overnight. This was combined with timed hand searches at the Marloes site. Traps/ hand searches were done at the same grid locations as in pre-2013/14 surveys. In addition, improved monitoring points were established for the Chesil site. At Branscombe, the number of crickets per trap in 2016, 2019 and 2021 were lower than in the pre-2013 surveys and showed a decreasing trend. A Chesil, the number of crickets per trap in 2016 was much lower than in the pre-2013 survey but appeared to show a recovery when the 2016 and 2019 surveys using the new monitoring points were compared. At Marloes, the numbers per trap and/or in timed searches in 2016, 2019 and 2020 were not significantly different from those in the pre-2013 survey; where the cricket still occurred, numbers at each sampling point were higher, however loss of shingle habitat and crickets was evident in the eastern half of the beach, encompassing the majority of pre-2013 sampling points. The survey at Dale in Pembrokeshire in 2020 confirmed that an additional population is still present at this site. While caution is needed in interpreting the relative number per trap because populations may naturally fluctuate from year to year, this study highlights the need for on-going monitoring of Atlantic beach-cricket populations in the U.K.

A governmentally funded grasshopper monitoring scheme in Baden-Württemberg, Germany – methods, perspectives and first results

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Due to the recent discussions on insect decline initiatives on insect monitoring are widely considered. In 2018, the state of Baden-Württemberg (SW Germany) established a governmentally funded biodiversity monitoring scheme that includes several insect taxa such as grasshoppers. In this ca. 35000 km 2 state, 121 sampling sites (40 nature reserves and 81 grassland sites) were randomly selected in a spatially balanced design for grasshopper monitoring. Sites are sampled in a rotational manner as each year 10 reserves and 40 grassland sites are visited. In each site, two grasslands are selected and on each one 50 m long transect is laid and walked two times in a year in July and August by professional recorders. Counts cover 2 m on both sides of the transect. We also map the habitat and land-use types on the sampled grasslands. In 2018-19, we recorded 14285 and 16536 individuals of 35 and 39 species, respectively. Some additional species were recorded outside the transect count. Some possibilities for analysing the dataset will be presented.

Diversification dynamics in the alpine bushcricket genus *Anonconotus* Camerano, 1878

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The genus *Anonconotus* Camerano, 1878 contains ten species that are all endemic to the Alps and the Apennines. All Anonconotus species are flightless and exclusively occur in alpine meadows and subalpine shrubland above the treeline. For a long time, the large diversity within the genus has not been acknowledged, largely due to their phenotypic plasticity and their hard to delimit distribution ranges. While some Anonconotus species occupy isolated and very small ranges such as only a single valley, others occur in comparably large areas such as almost the entire Western Alps. All in all this suggests a dynamic spatiotemporal history for the whole genus that must have been heavily influenced by recurring Pleistocene glaciations. Given the limited dispersal capacity of *Anonconotus*, their strict prefer-

ence for habitats that underwent dramatic climate induced contractions and shifts, and their coercive mating strategy that potentially favored cross-species hybridization, *Anonconotus* bush crickets are an intriguing model to study speciation of alpine species in the light of Pleistocene climatic oscillations. To explore this intriguing system, we sampled individuals from multiple populations from of all extant *Anonconotus* species and sequenced parts of their genomes by ddRAD-seq. By applying phylogenomic analyses, we first evaluated the validity of the morphology based species hypotheses and tried to obtain estimates on the age of all Anonconotus species. We further analysed gene flow within and among species, and explored if the resulting patterns are in line with suggested sexual incompatibilities, or reflect Alpine geography. In a final step, past demographic changes were analysed by using both explorative and explicit phylogeographic analyses. Our phylogenomic results were in line with morphology based species hypotheses and confirmed monophyly of all extant species. Gene flow between species was detected between the two most widely distributed species in the Western Alps. Our data also shows that range overlaps did not facilitate gene flow in all species and we suggest that sexual incompatibility is probably the main factor maintaining the genetic integrity of most *Anonconotus* species.

Grasshopper sounds on Xeno-Canto

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Xeno-Canto (xeno-canto.org) is a website for collecting bird song recordings worldwide. Amateurs and professionals add their sound recordings to this freely accessible database. Sound recordings are being used to identify unknown songs and potential song races of species or subspecies. After some experimenting with Orthoptera songs of some common Western European species, the taxonomic database will soon be extended with the global list of Orthoptera (OSF). Not only will it be possible for orthopterists to add their sound recordings. Also it will be very easy to add a sound recording with an unknown species, potentially to be identified by other people using the website. Furthermore, it is expected that birders will also add their sound recordings of Orthoptera and use the recordings in Xeno-Canto to identify Orthoptera (and maybe add to global mapping of species) or even start collecting sound recordings of Orthoptera themselves. Key sound recordings of individual species may be made accessible through QR-codes, in apps or using other techniques.
It may be expected that this exposure of sound recordings yields in a better knowledge of Orthoptera songs and may help to raise awareness and public interest for Orthoptera and Orthoptera conservation.

Orthopteran species sound classification using deep learning with small data

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Automatic sound classification is potentially a very useful tool for surveying many species groups. Deep learning has recently shown high-accuracy monitoring in many habitats, terrestrial and marine. Insect sounds have not been extensively researched in this context, in part because of the absence of large public datasets of sound recordings annotated to species. Many Orthoptera species have species-specific song: automatically identifying this could be useful for taxonomy, citizen science and biodiversity monitoring. We report on a pilot study applying deep learning classification across 9 European Orthoptera species, in which we explore modern deep learning techniques (data augmentation, pretraining, raw-waveform networks) to achieve satisfactory classification performance despite modest data sizes.

Effect of landscape structure on the presence of Orthoptera in Schleswig Holstein, Germany : bioacoustic surveying with Audiomoth and machine learning classification

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Wildflower compensation measures are becoming an increasingly common method of assisting biodiversity in agricultural landscapes, and offsetting biodiversity losses to development elsewhere. However, research on what factors influence their effectiveness has been limited - especially for landscape factors such as the percentage of nearby permanent semi natural habitats and the degree if habitat fragmentation. In our study, we are using inexpensive Audiomoth bioacoustic detectors and building a Random Forest machine learning classifier to detect Orthoptera at 20 sites across Schleswig Holstein, northern Germany. Our preliminary results have not yet identified a statistically significant relationship between Orthoptera species diversity and landscape factors. However, the bioacoustic detectors and machine learning classifier methods show enormous promise for future Orthoptera focused studies.

Biogeography of the Adriatic Orthoptera

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Being the northernmost Mediterranean bay, the Adriatic Sea has evolved into a unique biogeographic unit. The region covers eastern Italy in the west, and Slovenia, Croatia, Bosnia & Herzegovina, Montenegro, and Albania in the east. Only 13000 years ago, the Adriatic was a large valley with many mountains, whose highlands and peaks today represent islands and coasts. A lot of relict species, such as *Epacromius coerulipes* and *E. tergestinus*, have witnessed the formation of the Adriatic Sea by great post-glacial floods. Cycles of drying up and flooding were the signature events which shaped the biogeographical patterns of the Adriatic grasshoppers and crickets. Examples of unusually fragmented distributions include species with distinct northern and southern subpopulations (e.g., *Andreiniimon nuptialis* and *Barbitistes ocskayi*), and those with distinct eastern (Apennine) and western (Balkan) subpopulations, such as *Barbitistes yersini*, *Platycleis escalerai*, *Poecilimon jonicus*, or the complex of brachypterous *Tesellana species* (*T. carinata*, *T. orina*, *T. nigrosignata*). Furthermore, this area is characterized by endemic species, such as *Barbitistes kaltenbachi*, *Bicolorana kraussi, Pseudoprumna baldensis, Rhacocleis buchichii, R. japygia, Roeseliana brunneri, Uromenus dyrrhachiacus*, and *Zeuneriana marmorata*. These distributional patterns can, naturally, be explained by geological events in the Adriatic basin. Starting with the formation of Paratethys Ocean ~34 mya, through the Messinian salinity crisis ~5,96 mya, the Zanclean flood ~5,33 mya, decreasing sea level during the last glacial period, and another flood in the Adriatic basin as a consequence of ice melting which started around ~18 000 years ago, many events conditioned the current distribution patterns of the Adriatic Orthoptera. Correct timing of species divergences is important for the interpretation of speciation during the aforementioned events. For now, only a few case studies on trans-Adriatic taxa have been published. Examples of the known cases are the speciation in *Troglophilus* and *Eupholidoptera*, which took place ~5-3 mya and a few hundred thousand years ago, respectively. The most recent divergences, such as those of the subpopulations of *B. yersini* or *P. jonicus*, probably occurred after the last glaciation, whereas the older ones occurred after the Messinian salinity crisis (during the Zanclean flood). The oldest relicts originate from the period of the Paratethys Ocean formation. In order to better understand the history of speciation in the Adriatic, phylogeographic studies are planned, while biogeographic analyses are currently taking place.

Orthoptera diversity patterns on Mitsikeli Mountain

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Orthoptera are an important component of the biodiversity of grassland ecosystems and the related food chain. In the present study, Orthoptera diversity patterns were recorded in the Natura area of Mount Mitsikeli (GR2130008). The effect of 12 environmental parameters as well as the intensity of grazing on the composition and structure of orthopteran biocommunities was examined. The sampling took place in the summer of 2019 and 2020 on 30 areas of 100m^2, evenly distributed among the five habitat types in the study area. A total of 34 Orthoptera species were identified, including Paracaloptenus caloptenoides, an annexed species of the European Directive (92/43/EC). The beech forest openings are home to the largest number of Orthoptera species (18 species). The tree cover and the bare soil cover affect mainly negatively the species, while the herb height can affect the species either positively or negatively. These three parameters are involved in shaping the orthopteran diversity patterns (Redundancy Analysis). The Bray-Curtis index showed that the greatest similarity between the habitat types, in terms of the composition of the biocommunities they hosted, was observed in agriculture ecosystems and mixed thermophilous forests. The intensity of grazing seems to have a negative effect on the orthopteran biocommunity, but the issue needs further investigation.

Conserving one of the 100 amazing species: The Beydaglari bushcricket *Psorodonotus ebneri*

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The highlands in glacial refugia of west Palaearctic host many endemic cold adapted species. Regarding the mythology of the region we named these summits as ‘Noah Arks’. As a representative of such species we conducted a project on the Beydağları bush cricket *Psorodonotus ebneri*, which was considered as one of 100 amazing species by IUCN in the book entitled ‘Priceless or Worthless: 100 Amazing Species’. The study was funded by The Mohamed bin Zayed Species Conservation Fund. From the obtained data the main ecological conditions determining the range limits of P. ebneri were determined to be as follow: (i) 1750- 1950 m

elevation; (ii) the high grass meadows of mountains in forest opening, (iii) the east and southeast faced slopes, (iv) the terra rosa Mediterranean soil, (v) the 0-10 oC temperature for egg period and 15-20 oC for live period, and (vi) the humidity of %RH 90-100. The live forms (nymphs + adults) were observed during early-May-late June. Therefore, their hatching, molting and egg laying periods in total last about 60 days. Altogether prove that Beydağları bushcricket P. ebneri is a stenobiont insect demanding very narrow ecological conditions. Under these condition we classified it as 'critically endangered' and the main threat to species as global warming plus livestock grazing. However, the local authorities started to regulate the grazing season since 2018 to start from July 2018 after the species nymph and adult stage. This provided considerable help for security of the species. By generalizing these results we concluded that the cold adapted species restricted to summits in the refugia of west Palearctic should be considered as doomed species.

Towards the Red Book of Croatian grasshoppers and crickets

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In 2018, the first annotated checklist of Croatian crickets and grasshoppers (Orthoptera: Ensifera, Caelifera) was published. This publication provided insight into the diversity of local orthopteran fauna and served as a basis for future taxonomic, biogeographical and ecological research on these insects. Inhabited by 187 orthopteran species, 105 ensiferans and 82 caeliferans, Croatia is among the richest European countries when it comes to Orthoptera diversity. Nevertheless, as many as 27 species inhabiting the country are under or near the threat of extinction, according to the IUCN European Red List. Among them are stenoendemics *Stenobothrus croaticus* (Critically Endangered), *Barbitistes kaltenbachi* (Endangered) and *Rhacocleis buchichii* (Vulnerable). Accordingly, there is an objective need for the publication of the Red Book of Croatian grasshoppers and crickets, in order to evaluate the IUCN status of orthopteran species at the national level. By bringing together the existing and new, yet unpublished data on their distribution, ecology and threats, this book would be the first publication dedicated exclusively to threatened orthopteran species inhabiting Croatia. Supplemented by distribution maps and quality photos of the species and their habitats, it would be a valuable source of information for specialists and the general public alike.

European collections and their significance for global Orthoptera taxonomy and conservation

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European collections store about 50% of Orthoptera type specimens from all over the world, often reflecting the colonial past. Traditionally, this information was accessed via a 'Great tour' visiting museums in person. Thanks to digitization and web technologies, Orthoptera Species File provides virtual access to pictures of type material, but is far from complete. In addition, many type specimens are singletons, i.e. the only representative of a species. Status and challenges for digitization of European collections is presented, together with a roadmap for better accessibility and connection with citizen projects such as inaturalist.

Poster abstracts

Grasshoppers (Acridoidea) in Mongolia

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Mongolia is landlocked country located in highlands of Central Asia. The geography of our country is varied, with the Gobi Desert to the south and cold, mountainous regions to the north and west. These various ecosystems contributed to rich of grasshopper diversity in Mongolia. We compiled Mongolian grasshopper fauna based on our collection and publication materials. There are 143 species belonging to 56 genus, 20 tribes, 8 subfamilies and 3 families (Table). *Mongolotmethis gobiensis* B.-Bien, *Mongolotmethis kozlovi* B.-Bien, *Rhinotmethis hummeli* Sjost, *Podismopsis altaica* Zub, *Eclipophleps bogdanovi* Tarb, *Eclipophleps carinata* Mistsh, *Eclipophleps confinis* Mistsh, *Eclipophleps glacialis* B.-Bien, *Eclipophleps kerzhneri* Mistsh, *Eclipophleps lucida* Mistsh, *Eclipophleps similis* Mistsh, *Eclipophleps tarbinskii* Oristsh, *Stenobothrus newskii* Zub, *Bryodema gebleri* (F.-W.), *Bryodema (M.) orientalis* B.-Bien, and *Compsorhipis bryodemoides* B.-Bien are Mongolian endemic species, almost all them distributed in desert and desert steppe zones.

Population dynamics of an alpine grasshopper (Orthoptera) community in the Hohe Tauern (Central Alps, Austria) over 30 years and the effects of climate warming and grazing

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Long-term studies on the population dynamics of grasshoppers are rare, and are even missing completely for the alpine regions of Central Europe. Here the effects of climate warming and the recent changes in land use, like abandonment of pasturing, are believed to be serious. Our study on an alpine grasshopper community over 30 years allows, for the first time, the long-term description and analysis of these processes in the northern part of the Alps. In the years 1991 to 2020 the distribution and abundance of grasshoppers (Orthoptera) was surveyed annually with a standardized method on fixed plots in the Hohe Tauern National Park

(Salzburg, Central Alps, Austria) in elevations between 2070 and 2440 m. Our results show, that the long-term influence of climate warming in alpine habitats leads to different reactions of species. The proof of bi- and triannual life-cycles in the studied populations of alpine grasshoppers increases the knowledge of their potential plasticity. The abandonment of grazing with heavy cattle had no negative effect on species composition and abundance in the long term. The study also exhibited very slow changes in the grasshopper-populations masked by very pronounced fluctuations in abundance, which underlines the importance of long-term studies to really understand the dynamics in these extreme habitats. The study is decribed in Illich & Zuna Kratky (2022).

Orthoptera fauna of Southwest Herzegovina and its conservational evaluation

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Bosnia and Herzegovina, located in the West part of Balkan Peninsula has an outstanding biodiversity in Europe. The local Orthoptera fauna has been studied for a long time, however its exploration in the last decades has taken slowly, caused by the war events and its consequences in the 1990s', as well as the lack of local expert for this group. Among the published occurrence data, the overall amount of the properly localized and trustworthy ones are surprisingly low. We took intense field sampling in a little known but seemingly promising area in the Lower Neretva Valley and the nearby mediterranean parts of South Herzegovina in June and August, 2019. We took samples altogether from 41 localities in this area covering the main representative habitats, such different calcareous grasslands, sandy grasslands and gravel bars along the Neretva River, hay meadows, freshwater swamps, dry Mediterranean forests and scrub as well as rocky seashore. During the field work we recorded nearly 700 distribution data, which may reperesent the Orthoptera fauna of the studied area of about 650 square kilometers. We detected 73 species, including three new ones for Bosnia and Hercegovina, *Pseudomogoplistes squamiger, Conocephalus ebneri* and *Rhacocleis buchichii*. The latter two species are listed as endangered (EN) in the IUCN Red List of European grasshoppers. We collected valuable data for several further rare, endangered or less known species, like *Pachytrachis frater, Arcyptera brevipennis, Prionotropis hystrix, Saga pedo, Arachnocephalus vestitus, Mogoplistes brunneus* and *Cyrtaspis scutata*. Together with the few, mostly old published data, the Orthoptera fauna of the studied area comprises of 85 species. On the basis of our field work, key areas can be delineated from

the point of view of grasshopper diversity here, such as Mount Žaba, Klek Peninsula, Neretva riverside grasslands at Dretelj and Hutovo Swamp. According to our new distribution data of two endangered species (*P. frater* and *R. buchichii*), it would be proposable to rethink their actual IUCN Red List status.

Population size and habitat use of the Large Banded Grasshopper *Arcyptera fusca* in Hungary – first steps of a regional conservation project

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Populations of the widely distributed Large Banded Grasshopper *(Arcyptera fusca)* are declining throughout Europe. It has disappeared from several locations in Hungary, too, and only a few surviving populations are known here in the Börzsöny and Bükk Mountains, and the Aggtelek-Karst. One of the main reasons of this tendency is the abandonment of mountain meadows. The lack of extensive management leads to quick changes in vegetation structure and eventually, the whole habitat may disappear due to afforestation. For long-term conservation of the Large Banded Grasshopper in Hungary, it is necessary to know its local habitat requirements, current distribution and the size of its populations.
During a field survey in 2021 we found 1 remaining population in the Börzsöny, 2 in the Bükk, and 5 in the Aggtelek. Most of them are restricted to small meadows of 1–2 hectares with an estimated tens of individuals. The biggest population is in the Bükk Mountains (Lusta-völgy) with around six hundred individuals based on our field data collected in 2019 and 2021. The only population in Börzsöny (Alsó-Hinta-rét) was also large with 962 estimated individuals in 2021 probably due to a gradation.
Meandering line transect sampling was performed in Lusta-völgy and Alsó-Hinta-rét where attributes of the vegetation at regular distance and in the close surroundings of detected specimens were recorded. These habitat preference studies have shown that this species prefers lower vegetation and areas with sparse vegetation there. These open grassland plots prove to be the oviposition sites based on the spatial distribution of the first and second instar larvae. The conservation of the species should therefore be promoted through habitat management, for example, mowing and litter removal. These activities have already at least partly begun in all known habitats in Hungary. In Bükk Mountains (Kismező) we successfully established a new population by translocation, where the ongoing specific habitat management (mowing, tree and scrub and litter removal) will hopefully effectively

help in its long term survival. The establishment of another new population is also in progress in Börzsöny Mountains (Nyír-rét) where the habitat management has also been going on for several years.

Saving the last dance: conservation actions for the Epirus grasshopper *Chorthippus lacustris*

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Chorthippus lacustris is an endemic Orthoptera species of Epirus, NW Greece, with a critically endangered conservation status globally. It strongly depends on wet grasslands, flooded on a seasonal basis. The species has already been extinct in two localities in the past and its population is severely fragmented (8 subpopulations). Only one subpopulation presents an increasing population trend, four present a fluctuating or unknown trend, whilst three subpopulations suffer a severe decline because of habitat loss. Shrubs have encroached humid grasslands in the former floodplains of Amphithea, where the species was first discovered. Rubble has been deposited in a locality near the city of Ioannina for touristic infrastructure development (population size decline of 92% in the period 2004-2016). Agriculture has been practiced and has destroyed most of the species' habitat in Paramythia lake. To address these threats and guarantee the long-term survival of the species, the scientific staff of the Management Unit of the Protected Areas of Epirus, responsible for the conservation management of 14 Natura 2000 sites in Epirus, collaborates with the University of Ioannina since 2016 for the species conservation. An annual systematic monitoring scheme for the Epirus grasshopper has been established since then, ecological and genetic research has been undertaken and an action plan is in progress together with public awareness activities. Management actions for 2022 include pilot mowing in selected localities for hampering shrub encroachment and a survey of the population trend in the localities subjected to intervention will allow the evaluation of the project success. Further actions should target habitat restoration, including debris removal and agro-pastoral sustainable use.

Threatened Tetrigids online: Assessing pygmy rainforests before they are gone

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Public interest in biodiversity and species extinction has never been higher, and the same applies to the amount of information being uploaded online. We have decided to check how many orthopterological data we can extract from online social media. More specifically, the data on Tetrigidae, and more specifically, from Flickr and iNaturalist. Flickr is an online network for uploading high-quality photos and is used by both, professional and amateur photographers; while iNaturalist is a platform for gathering observations and identification of all the living beings from all around the world, and is joining citizen scientists and professional researchers. A lot of pygmy grasshoppers' (Tetrigidae) photographs were uploaded, but not identified in those networks. As Josef Lane Hancock said more than a hundred years ago, those bizarre and grotesque looking critters are still an obscure and not well-known group. We identified a lot of photographs to subfamily, genus or species level using taxonomic publications and by consulting type specimens. Compiled are meta-data from more than 4000 photographs, representing more than 250 species belonging to more than 100 genera. In about 1000 photographs from tropical areas (about 25% of all), for example from Peruvian rainforests, Malagasy rainforests, islands of SE Asia, or eastern Australian rainforests, exceptional number of 200 species was identified. Compared to the Palearctic and Nearctic regions, tropical areas have insufficiently documented diversity, so the records from the tropics are of more scientific value, as they usually represent unique of rare species in natural habitat. We present species photographed for the first time in their natural environment: *Eucriotettix simulans, E. ridleyi, Falconius clavatus* and *F. pseudoclavitarsis* from Malay peninsula; *Andriana intermedia, Oxytettix cataphractus, O. macrocerus, Pterotettix bigibbosu* and *Pseudodsystolederus sikorai* from Madagascar; *Paraselina brunneri, P. multifora, Selivinga tribulata* and *Tetrix irrupta* from Australia; *Scelimena celebica* from Sulawesi; *Ascetotettix capensis* from South Africa; *Phaesticus monilliantennatus* and *Scelimena guanxiensis* from PR China, *Scelimena borneensis* and new species of *Discotettix* from Borneo; *Criotettix milliarius, Euscelimena gavilis* and *Gavialidium crocodylum* from Sri Lanka, and so on. A lot of photos represent new distribution data for the species. By gathering and sorting the data from online social media, it is becoming possible to assess species distribution, as well as its threats and conservation needs. More data will lead to better IUCN Red list assessments, and of course, to better understanding of pygmy grasshoppers' word and its needs. Finally, by identifying photos in online social media and platforms for observations, we are making it possible for beginners to start with pygmy grasshoppers' studies, learn, and try out identifying on their own.

Horticulture spread Mediterranean insects in Hungary (Orthoptera, Mantodea, Blattodea)

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Trade of horticultural products has a high and even growing volume worldwide. In Europe, its centre is in the Netherlands but some South European countries also have a significant production of ornamental plants. Italy uses the biggest area on the continent to grow and export nursery plants. It is obvious that transportation of live plants has a high risk to spread insects, either as adults, larvae or eggs. Frequency of Mediterranean insects' observations has been increasing in Hungary for a few years. Numerous pictures are published in the social media and we received other ones also on further informal ways. Many of these were taken in nurseries and gardening shops. We started to collect these data as well as own observations, furthermore we made systematic searches in some public gardens too. *Meconema meridionale* has a Mediterranean origin but recently expanded its range rapidly in Europe, now already widely distributed also in the western half of Hungary and having some new data in the eastern part of the country as well. Horticulture certainly take part in this process among others (forestry, tourism etc.). The cockroach *Ectobius vittiventris* shows a similar area expansion, being a common species in the suburbs of Budapest and some surrounding towns.
A small population of *Eupholidoptera garganica* was discovered in Budapest in 2018. Its origin is unknown but first specimens arrived most probably from Italy. Until now, the population seems to expanding slowly. On the same locality a single specimen of a small cockroach, *Planuncus tingitanus* (s.l.) was found as well. This Mediterranean species has introduced populations also in other European cities. *Gryllomorpha dalmatina* is known based already on three independent occurrences in the country. In 2021 another Mediterranean cricket, *Arachnocephalus vestitus* appeared in Budapest. There are several observations of *Anacridium aegyptium*, partly proved that arrived with nursery plant transport from Italy. Others were found in Budapest and in further settlements. Only a single specimen was captured in a natural grassland in South East Hungary. This good flyer grasshopper occasionally probably may reach the Pannonian Basin with the help of strong southern winds of Mediterranean cyclones. Two bush-crickets (*Rhacocleis annulata, Yersinella raymondi*) and a praying mantid (*Ameles spallanziana*) are observed more and more regularly in nursery gardens and sometimes also in their neighbourhood. Climate of urban areas seems to be suitable for some of these taxa to establish viable populations far out of their natural distribution. It is known also

in the case of native and other exotic species that plant transport may help their spreading, especially bush-crickets which lay eggs in bark or leaves (*Leptophyes punctatissima, Phaneroptera* spp.). The East Asian *Tachycines asynamorus* has been introduced to Europe obviously with plants. In Hungary it was found mostly in greenhouses but also out of them, however for today it is probably extinct due to the wide use of insecticides. Since 2020 *Hierodula tenuidentata* has several observations in Hungary. This Asian praying mantid has an expansion in Europe and may spread partly with ornamental plants as well.

Effect of agroforestry on diversity of insects in organic arable crops

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Organic farming has been proven to be beneficial for many groups of organisms in comparison to conventional farming systems. However, in the case of some crops such as cereals, the diversity of arthropods is still relatively low in comparison to semi-natural habitats such as grasslands. The reason for this is often low diversity of landscape, absence of trees and water pounds, as well as intensive tillage present on arable fields. Tillage as well as lack of refugium causes loss in some insect communities, creating an ecological sink. There are many agricultural practices enhancing insect diversity in arable lands, such as flower strips, hedgerows, and agroforestry. Especially agroforestry has been proven to enhance environmental conditions and increase carbon sequestration, however, effects on the insect communities have not been clear in many cases. In this study, we have measured insect diversity in organic spelt and buckwheat in three different distances from the tree line. We found out that the abundance of some groups of insects, relevant from the point of agricultural production (pests and natural enemies) was changing with the distance from the trees while most of the groups seemed to be unaffected by the presence of the trees (grasshoppers, pollinators).

Abundance and diversity of Orthoptera in organic arable crops

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Agricultural areas cover about 60 percent of Poland's area, of which 70 percent is arable land, and 75 percent of which is covered by cereal crops alone. As a result, most of the country is unsuitable for Orthoptera insects, and only a few species

are able to survive and breed there. However, it has been shown that a small change in the management of agricultural production can have a positive effect on the insect diversity. The study was conducted between 2012 and 2015 in Eastern Poland. Insects were collected using soil traps and sweep nets in transects performed four times a year. Monitoring included 28 fields of winter cereal crops, half of which were under organic farming. The most common species in all areas was Tetrix subulata. It was found that in total, there are twice as many insects occurring in organic crops than in conventional ones. There were also significantly more field crickets Gryllus campestris in samples from organic fields. The number of species was on average higher in organic variant, as well as Shannon's diversity index for Orthoptera.

Hidden in forests: A new project on habitat management for *Barbitistes serricauda*

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Our knowledge on the distribution and population trends of Orthoptera is still limited. The Common Saw-tailed Bush-cricket, *Barbitistes serricauda*, is difficult to monitor due to its arboricolous life and the high frequency of its song. The introduction of ultrasonic detectors (bat detectors) in Orthopterology has increased detectability of such species, but still the population trend and precise habitat preferences of this species remain unclear. The overall aim of the project ELSA (Development of near-natural oak forests for the common saw-tailed bush cricket *Barbitistes serricauda* and other endangered insect species) is to close knowledge gaps about the ecology of the species, to create guidelines for the protection of *Barbitistes serricauda* and to implement conservation action in suitable areas. Implementation is planned particularly in areas where the development and protection of oak forest types, which are generally valued for their rich biodiversity, is possible. The project has a duration of six years (06/2021 -05/2027), project area is Rhineland-Palatinate and the south of North Rhine-Westphalia in the southwest of Germany. Data collected in the first year of the project suggest that *Barbitistes serricauda* declined by ca. 20% during recent decades and that its occurrence depends on a well-developed herb and shrub layer and a light canopy. Even though we found *Barbitistes serricauda* in a variety of forest types, the preferences for mentioned structures indicate that oak forest communities provide optimal habitats for this species.

The ugly duckling in the laboratory: A high percentage of brown colour *Tettigonia viridissima* when reared in the laboratory

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Orthoptera are known to be highly variable in coloration and this variability may be triggered by genetic and environmental factors. Animals reared in the laboratory experience unique environmental conditions and thus may often differ in morphological traits than in nature. The Great Green Bush-cricket, *Tettigonia viridissima*, is mostly green in nature. Yellow individuals are rarely found in nature in Central Europe and it has been hypothesised that this colour morph may be caused by a mutation. I have reared this species under laboratory conditions and a high percentage of individuals changed into brown sequentially, even though they were fully green when captured in nature. Hence, the hypothesis of a genetic mechanism (i.e., mutation) behind colour variation in *Tettigonia viridissima* can be invalid. While the causes of the colour variation remain unknown, the phenomenon might be triggered by phenotypic plasticity, i.e. a morphological response to an environmental factor, such as high population density, food or microclimatic effects.

Patterns of rare Orthoptera distribution over Eurasian steppes

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The orthopteran fauna of the Eurasian steppes includes a number of species and genera with limited ranges and/or with low abundance. Populations of some orthopterans suffered from human activity, because huge areas of the steppes were ploughed or overgrazed. However, local colonies of rare species may be extremely different. Some populations may be very abundant locally for long periods, while a few are continuously stable but at a low level of abundance.
The International Red List includes about 30 species which can be associated with the Eurasian steppes, but mainly with their European parts. However, some endemic and subendemic genera, species, and subspecies occur in the central and the eastern parts of the Eurasian steppes. Many endemics with very scarce populations and low abundance are in the semi-arid mountains as well. Among them are members of the subfamilies Zichynae, Odonturinae, Conophymatinae etc. and

the tribes Drymadusini, Bergiolini, Hypernephiini etc. In the south-eastern part of West Siberian Plain, the distribution of several rare species (*Asiotmethis muricatus*, *Mesasippus arenosus*) did not change significantly, but *Asiotmethis jubatus* and some others became extremely rare. Unfortunately, often we do not have real data about many populations. This results either in some dubious suggestions or, on the contrary, in missing some species prospective for global and regional conservation programmes.

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