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METALEPTEA

THE NEWSLETTER OF THE ORTHOPTERISTS' SOCIETY

President's Message

By DAVID HUNTER
President
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Dear Society members,

With 5 months until our 14th Congress in Mérida, Yucatán in October, the plenary speakers and a number of symposia have been organized. Mario Poot, President of the Organizing Committee, has been organizing the Congress in collaboration with National Plant Protection Agencies who are planning to send substantial numbers of delegates to the Congress to give us a good basis for a successful Congress. And the Yucatán is a wonderful place, with the biosphere reserves, cenotes, and the pyramids of the ancient Mayan civilization all on display which you can enjoy in the Post Congress Tour. Meeting in Mérida will be a great opportunity for all of us to get together once again in a most beautiful and interesting setting. ¡Bienvenido a Yucatán!

In this regard, it is time for all of us to finalize what we will present at the Congress. The congress website (**https://ico2023mexico.com/**) has information on registration, accommodation, presentation requirements and abstracts. Under Program/Scientific Program, you will find our list of Plenary Speakers who will update us with their latest research in a variety of important topics. There have been symposium proposals covering the latest research in Latin America, several on locust management, including the use of biopesticides and

new vision for the future, Orthoptera conservation, group behavior, Anthropogenic Impacts and Systematics and Phylogeny. There will be a workshop on TaxonWorks and HopperWiki and of course opportunities for oral and poster presentations on a wide variety of topics. Note that the deadline for abstracts has been extended to 16 July so you have time to think about your contribution to making our congress a success.

I also bring to your attention the travel grants to the Congress. We have set aside a total of $15,000 for these grants that can cover travel accommodation and registration in part or in full. If you are a student or young member of our Society or have members in your research group who are, we encourage you to send your applications to me at **davidmhunter100@gmail.com**. Send a short CV, the abstract(s) of what you want

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to present and an estimate of costs you want us to cover. While the official deadline is 31 May, I will accept applications until the 7th of June. The Board will assess the applications and announce winners by mid-June, in time for you to make arrangements for the October meeting.

Once again, enjoy another excellent *Metaleptea*, thank you Hojun Song, Derek A. Woller, and everyone who has contributed!

The 14th International Congress of Orthopterology: October 2023!

By MARIO A. POOT-PECH
President, Organazing Committee
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The International Congress of Orthopterology draws near, and the history and flavor of the Mayan culture is already in the air. We are hosting events that will be a mix of flavors: symposia, meetings, forums, cultural, and archaeological events. The Congress will be in the Hotel "El Conquistador" in Mérida City, Yucatán State, México.

The deadline for abstract submission has been extended to **16 July, 2023**. Please register and submit your abstract at: **https://ico2023mexico.com/registration/**.

For abstract submission, please download the abstract template from the link above, and upload the completed form directly to the website. If you want to pay by credit card, then send an email to **ortopterapago@gmail.com**, with information such as name, country, type of participation and amount. Later we will send you a link to make the payment.

The 14th International Congress of Orthopterology Grants and Awards

By DAVID HUNTER
President
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GRANTS

2023 Travel Grants to the 14th International Congress of Orthopterology (ICO) in México, October 16-19, 2023.

Call for Applications

The Orthopterists' Society will provide a total of $15,000 for travel to the 14th ICO. The funds will be for 5-8 separate grants of varying amounts, which will cover costs of travel to the ICO, plus congress hotel and registration expenses. The grants are mainly for students and young professionals who are giving a presentation at the congress (papers or posters) and who have insufficient funds for travel and who need either partial or complete funding for their travel.

In order to allow planning by recipients, applications should be sent to David Hunter (davidmhunter100@gmail.com) by June 7, 2023.

AWARDS

All awards will be presented at the 14th ICO in México, October 16-19, 2023.

2023 Ted Cohn Award for Excellence as a Young Professional Orthopterist Call for nominations (2 Awards Available)

Call for Applications

This award is for young professionals, aged 35 or less, who are at the last stage of dissertation, or doing a post-doc, or even early-stage research or another relevant professional position. There are two $2,500 awards, one for applied and another for non-applied orthopterists. Because this is an excellence award, it should be based on research products, such as publications. The application is based on a 1-page personal statement, C.V., the applicant's most significant publication, and 1-2 letters of support.

Proposals should be sent to David Hunter (davidmhunter100@gmail.com) by August 31, 2023. The OS Executive Board will choose amongst the candidates.

2023 D.C.F. Rentz Award for Lifetime Dedication to Orthopterology

Call for Nominations

This award is intended to recognize the outstanding contributions of the nominee to Orthoptera research, particularly the work of retired or Emeritus orthopterists who have devoted their entire life to the study of Orthoptera. Complete applications consist of a letter of nomination with a brief description of the accomplishments of the candidate proposed, along with one or two letters of support.

Proposals should be sent to David Hunter (davidmhunter100@gmail.com) by August 31, 2023. The OS Executive Board will choose among the candidates and the awardees will receive a personalized award certificate to reflect the nature of their contributions to Orthopterology.

2023 Sir Boris Uvarov Award in Applied Acridology

Call for Nominations

This award bears the name of the Father of Modern Acridology, the famous Russian-English Orthopterist, Sir Boris Uvarov (1886-1970). Co-sponsored by the Association of Applied Acridology International and the Orthopterists' Society, this award recognizes outstanding contributions that have a direct impact on both the theory and practice of locust and/or grasshopper management. The award consists of a plaque and a $4,000 prize. Nominations can be submitted by any person or organization and self-nominations will be accepted. Nomination packages must include a C.V. of the nominee (5 pages maximum) and a letter of recommendation specifically stating the nominee's significant contributions to the theory of locust and/or grasshopper management in the form of publications, research grants, student advising, and presentations at national and international scientific forums as well as evidence of major impact into the practice of locust and/or grasshopper management at national or international level.

Nominations should be sent by email to David Hunter (davidmhunter100@gmail.com) by August 31, 2023. Nominees/candidates will be judged by an award panel consisting of Orthopterists' Society members with international expertise in both theoretical and practical locust and/or grasshopper management and will include at least one previous recipient of the award.

The 2023 Theodore J. Cohn Research Fund Recipients

By MICHEL LECOQ
Chair, Theodore J. Cohn Research Fund Committee
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Dear fellow Orthopterists,

This year, we received 22 research proposals from Algeria, Cameroon, Ethiopia, India, Mexico and the U.S.A. As usual, the selection was a delicate task. Based on their merit and our financial possibilities, we have selected 10 projects for a total amount of $14,827 USD. The selected projects are the following (in alphabetical order by surname):

- **Troy Bowers**, U.S.A. (OH) - The effects of anthropogenic and heterospecific sound on male field cricket behavior.
- **Amanda Klingler**, U.S.A. (CO) - Does evolutionary history mediate plastic responses to anthropogenic change?
- **Anshuman Pati**, India - Does protected area play an important role in insect conservation? Community assemblage study of Orthoptera insect in Desert National Park from land-use perspectives.
- **Vivian A. Peralta Santana**, U.S.A. (TX) - Mother knows best: Investigating the unknown chemicals behind maternal effects in locust.
- **Laura Rengifo**, U.S.A. (IL) - A molecular dissection of the role of genotype and sperm competition risk in nuptial gift investment of decorated crickets.
- **Bhaavya Srivastava**, U.S.A. (NY) - On the scent of speciation: Investigating the genetic architecture of cricket pheromones.
- **Onur Uluar**, Turkey - Taxonomy and phylogeography of *Poecilimon zonatus* group (Phaneropterinae, Orthoptera): A story linked to the Taurus Way.
- **Jose Vasquez**, U.S.A. (MN) - Does sound-producing structure morphology affect song pulse rate in crickets?
- **Madison F. Von Deylen**, U.S.A. (OH) - Modeling biodiversity ssing the prairie soundscape.
- **Jeanne Agrippine Yetchom Fondjo**, Cameroon - Taxonomy, Phylogeny and Biogeography of the Grasshopper genus *Pteropera* Karsch, 1891 (Orthoptera: Acrididae: Catantopinae).

On behalf of all the members of the selection committee, I would like to thank all of our applicants for their participation, congratulate those who have been selected, and wish them

good luck in their work.

I would like to draw attention to the fact that some projects were rejected because they did not meet the requirements of the T.J. Cohn research funds. The jury suggested that these authors reorient their projects for submission to the Orthoptera Species File (OSF) Grants in the next call for proposals. Full details on the OSF grants are available on the Orthopterists' Society website at: **https://orthsoc.org/resources/grants-awards/orthoptera-species-file-grants/** as well as on the Orthoptera Species File website at: **http://orthoptera.speciesfile.org/HomePage/Orthoptera/Grants.aspx**

For the T.J Cohn research funds, the next call will be in early 2024 and we strongly invite all students and postdocs from around the world to submit their research proposals. I remind everyone that, other than being a student, the only requirement is that the applicant be a member in good standing of the Orthopterists' Society. As usual, upon completion of their research, selected candidates will be asked to provide a brief report, which will be published in our *Metaleptea* newsletter. All information on these T.J. Cohn research funds is available on the website of the Orthopterists' Society at: **http://orthsoc.org/resources/grants-awards/the-theodore-j-cohn-research-fund/**

The transition of Orthoptera Species File (OSF) to TaxonWorks:
Call for interested users to experiment with the pre-production version

By **MARIA MARTA CIGLIANO**
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After this has been announced for many years, the Orthoptera Species File (OSF, **http://orthoptera.speciesfile.org**) is finally about to migrate from Species File Software to the new platform TaxonWorks. The OSF group at the Museo de La Plata has been working for a long time on the migration of the database to a preliminary "sandcastle," and we can finally say that we will soon "go to production," meaning that OSF living in TaxonWorks will be open to the public during this year.

TaxonWorks (**http://taxonworks.org**) is an integrated web-based workbench for taxonomists and biodiversity scientists, and is going to be the new infrastructure that powers OSF. This first public version of OSF (Fig. 1), that is presented by TaxonPages and curated in a TaxonWorks instance, will display an overview of the most relevant information of the database. The design in panels will provide the option to download the data in DwC/CSV formats.

The interfaces of TaxonWorks in-

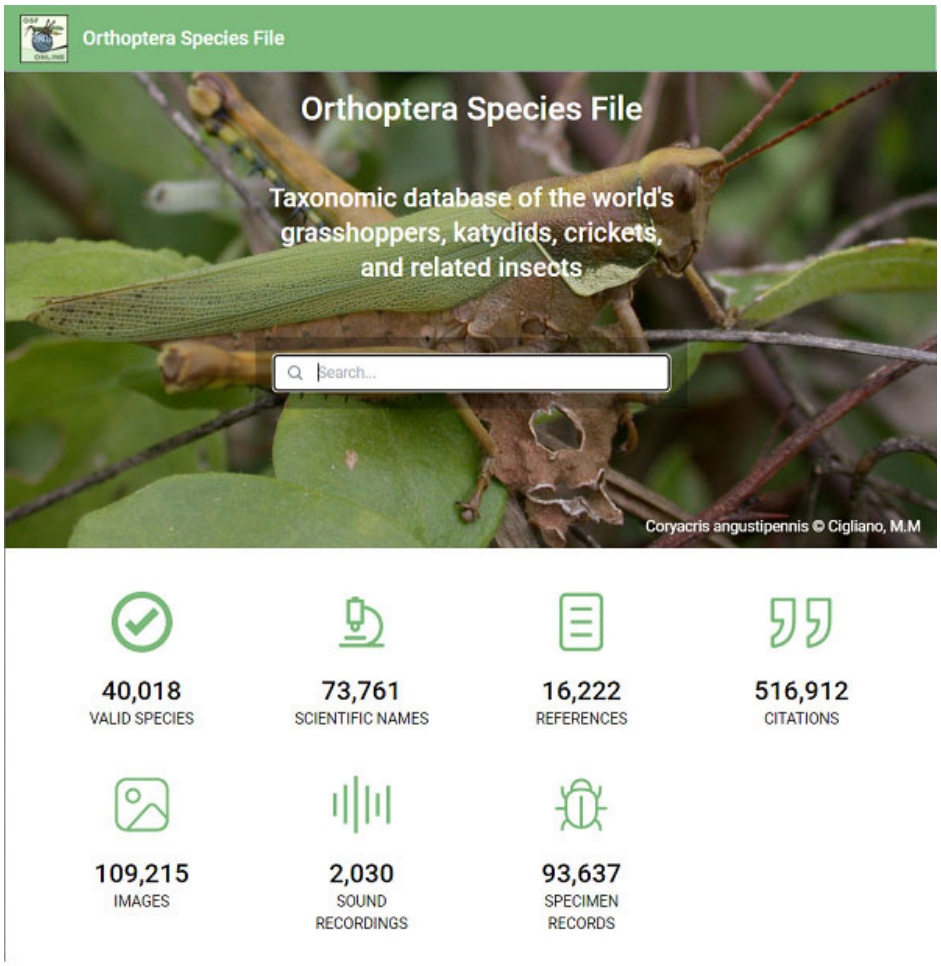

Figure 1. First public version of the new OSF powered by TaxonWorks

clude a wide range of additional filtering and reporting functionalities. This new platform, constituted by a collection of open source tools and services that cover all aspects of the taxonomic workflow, will help to maximize the efficiency of taxonomic work, allowing the exchange of data among the orthopterists' community. Those who would like to dig in deeper into the data will have to contact us to get extended access to the whole database.

Since OSF powered by TaxonWorks will have many differences compared to the current version, we are developing several help workflows. We invite interested users to experiment with OSF under the new infrastructure. The feedback from those interested in using OSF under the new infrastructure would be of great help to us in discerning which are the most common filters that they would use once we go to production. So, we will create a focus group of those interested in using OSF to test them on the use of Filters/Search of the most common tasks. We could meet virtually on a periodic basis to develop the help for OSF in TaxonWorks. Those interested in joining this group, please contact me.

Update on the Singing Insects of North America (SINA) Website

By TERESA YAWN
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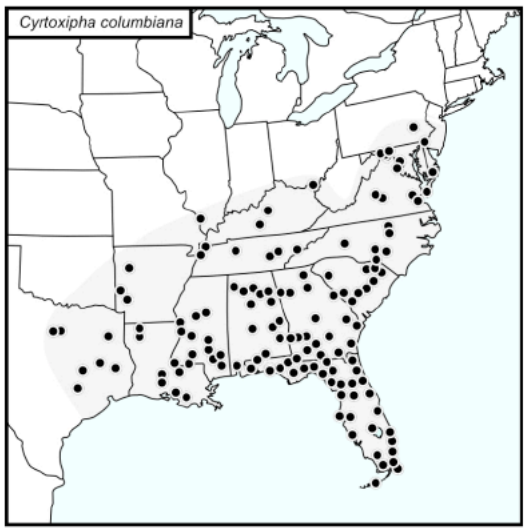
A **Singing Insects of North America (SINA)** user emailed me and asked if the sound icons on most of the katydid species pages would eventually be replaced with audio bars. When I began working with Tom Walker, one of the first things we did was design a new template to update SINA pages, which included replacing the sound icons with audio bars. I completed all the cricket species pages and started on the katydid pages, but soon we found ourselves working on one project after another, and updating pages became secondary. After Tom retired and I became editor of SINA, I continued this practice of not prioritizing updating the pages, but when I received this email, it dawned on me how frustrating this may be to SINA users. When you click on the sound icons, depending on your browser, the song is downloaded, opened in a new tab, or opened in the same tab, but requires a back-space to return to the webpage. Most websites now have audio bars that allow you to click on the play button and listen to the audio while remaining on the page. Because the songs are such an essential part of SINA, I decided to prioritize updating the katydid species pages to include audio bars. In October 2022, there were 146 katydid species pages to be updated. When I received word from Nancy Collins that the description for *Oecanthus beameri* had been published, I took the time to add this new species to SINA. But I soon picked up the update-katydid-pages pursuit again and, as I write this (April 30, 2023), there are only 12 pages left to update. By the time this is published, I will have finished these pages. You can compare the difference by looking at the **before** and **after** pages for *Hubbellia marginifera*.

As well as updating katydid pages, I have completed another long-term task of creating a new map template for SINA. The map covers the same area as the old maps, from north Mexico into Canada, and from the east coast to the west coast of North America. SINA records in the United States are plotted as counties for given states. The map template has layers containing county maps for all the states, which allows me to add new records quickly and accurately. The county maps are removed before the final rendering of the map that is displayed on SINA. The new map has higher resolution for better viewing on hi-res screens and allows the creation of similar-sized maps, whether it includes the entire map or zooms in on a single state. Additionally, water is now colored a light blue to differentiate it from land. You can see an example on ***Cyrtoxipha columbiana*'s map** page. As I add new records to SINA (and I have a backlog of records that need to be added!), I will replace the old maps with the new map. The old maps will be archived. Please contact me if you have new records for SINA species.

Columbian trig
Cyrtoxipha columbiana



Dots show county records; shaded area shows likely general distribution.
Computer-generated distribution map, produced in 2004 from records in a database available on this site.

Regional Reports - What's happening around the world?

North America

By KATHLEEN KING
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Spring is in the air and field work is on the mind! It's good to hear from cooperators and researchers. Here are some current updates:

The C.P. Gillette Museum of Arthropod Diversity, College of Agricultural Sciences, at Colorado State University in Fort Collins, Colorado USA recently appointed Dr. Marek Borowiec as the new Museum Director. Dr. Borowiec replaces the late Dr. Boris Kondratieff, a longtime Director at the C. P. Gillette Museum of Arthropod Diversity - Agricultural Biology (**colostate.edu**). Dr. Borowiec has extensive experience with Hymenoptera, particularly Formicidae. The Museum contains nearly five million specimens, with holdings dating back to before 1890. It is particularly strong in insects of the Rocky Mountains region, and is well-represented in Lepidoptera, Hymenoptera, and aquatic insects. The Orthoptera collection holds over 40,000 specimens, with over 30,000 acridids. Current efforts continue to add specimens from throughout the western United States and to digitize specimen data in the Southwest Collections of Arthropods Network (SCAN) database (**scan-bugs.org**). The data from approximately 25,000 Orthoptera specimens is currently available within SCAN.

The Global Locust Initiative Network's "HopperLink" is now 217 members strong and has become a global hub for representing expertise, sharing updates, and discussing important themes related to grasshopper and locust biology, as well as management. Please **join us** if you haven't already! Below are some recent updates on activities on the platform.

We recently launched monthly stakeholder highlight posts to showcase the amazing individuals that make up our network of experts and enthusiasts. Last month we featured Amlan Das, Associate Professor at the University of Calcutta. Amlan has expertise in biology, ecology, behavior, and integrated pest management. He's worked on the bioecology of 38 species of acridids from the Indian subcontinent since 1998. We see this as an exciting opportunity to highlight diverse individuals working on orthopteran topics broadly and strengthen our global community.

Several recent papers on locusts, sharing a similar theme, have generated engaging conversations on HopperLink. Chang et al. published a paper in Science called "**A chemical defense deters cannibalism in migratory locusts**." Arianne Cease and Gregory Sword were interviewed for their reaction to the publication in ***Science News***. There was also a piece in the *Science* perspective issue called "**The chemical ecology of locust cannibalism**." Additionally, Maeno et al. published "**How molting locusts avoid cannibalism**" in *Behavioral Ecology*. We'd love to hear your perspective if you're interested in joining the discussion.

The **FAO** issued a warning on May 10th of the potentially grave nature of the recent Moroccan locust (*Dociostaurus maroccanus*) outbreak across provinces in North and Northeast Afghanistan, the country's wheat basket, sparking discussions on HopperLink about management issues. Other recent notable orthopteran outbreaks have been reported in **Trinidad and Tobago**, and **Italy**.

We would also like to send a big thank you to the **Behavioral Plasticity Research Institute (BPRI)** student organizing committee of the **2023 Symposium on Behavioral Plasticity**. We enjoyed the excellent speakers, student posters, and discussions on behavioral plasticity. The GLI continues to connect the BPRI with locust and grasshopper researchers, and stakeholders through our global network and we look forward to seeing many of you again soon at the upcoming **International Congress of Orthopterology**.

East Asia

By LONG ZHANG
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In February of 2023, a new committee for orthopteran insects in the Chinese Entomology Society has been elected. A total of 39 scientists are in this committee. Dr. Long Zhang is the director of the committee, and four other scientists are deputy directors. They are Professor Yuan Huang from Shanxi Normal University, Professor Bingzhong Ren from Northeastern Normal University, Professor Bin Chen from Hebei University, and Professor Qing Li from Sichuan Agricultural University.

The research of members spans locusts and grasshoppers, crickets, katydids, stick insects, cockroaches, mantises, and termites. Although most of them are studying Orthoptera taxonomy, a few work on pest control, physiology, molecular biology, and behaviour.

During the election meeting, the activities in 2023 were proposed. In this meeting, the committee called on all members to participate in the 14th International Congress of Orthopterology (ICO) in Mexico. And a conference of the Orthopteran Insects Committee has been proposed to be held in June, 2023 in Guilin, Guanxi province, China, with the themes for this conference set to be "**Harmoniously Co-living Between the Diverse Orthopteran Insects and Human Being**."

Theodore J. Cohn Research Fund Reports

Establishing a dataset on the morphological diversity of the katydid ear

By CHARLIE WOODROW
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Katydids (Tettigoniidae) offer a fantastic model for studying the diversity of acoustic signals and signaling behaviours. They are known to produce sounds for conspecific communication ranging greatly in frequency composition, from 600 Hz in the Palaeotropical *Tympanophyllum arcufolium* (Heller 1995) to over 160 kHz in the Neotropical genus *Supersonus* (Sarria-S et al. 2014). This extreme diversity in acoustic signal composition must, in theory, be accompanied by diversity in ear function, to remain tuned to conspecifics in noisy environments. However, to date, no studies have investigated the anatomy or function of the katydid ear from a large comparative perspective. Such a dataset could be used to help us understand the evolution of acoustic communication in insects and offer new morphological characters to aid in resolving challenging taxonomic polytomies. To begin to address this, I investigated the morphological

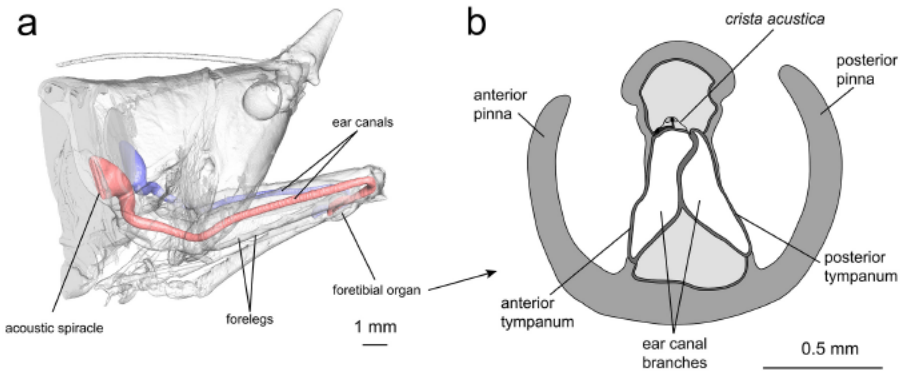

Figure 1. Auditory system anatomy in the katydid *Copiphora gorgonensis*. a, lateral view of head and thorax with ear canals. b, cross-section of the foretibial organ to highlight the location of the crista acustica.

diversity of the katydid acoustic trachea, or ear canal. Using funds from the Orthopterists' Society to support specimen loans, travel, and computer hardware, I conducted micro-CT scans of preserved katydid specimens. This dataset currently comprises the 3D geometries of ~350 ear canals representing ~160 species of tettigoniid.

The tettigoniid ear canal runs through the forelegs, from a modified respiratory spiracle in the prothorax, until it reaches the tympanal organ at the top of the foretibia (Fig. 1a; Zeuner 1936; Bailey 1990). Here, the ear canal splits into two asymmetric branches which are coupled with two paired eardrums (tympana) which transmit the received sounds into a cochlear-like inner ear organ, the crista acustica (Fig. 1b; Oldfield 1982; Montealegre-Z and Robert 2015). The ear canal is believed to be the main port of sound entry for the katydid, and has historically been categorized as an exponential horn, which is

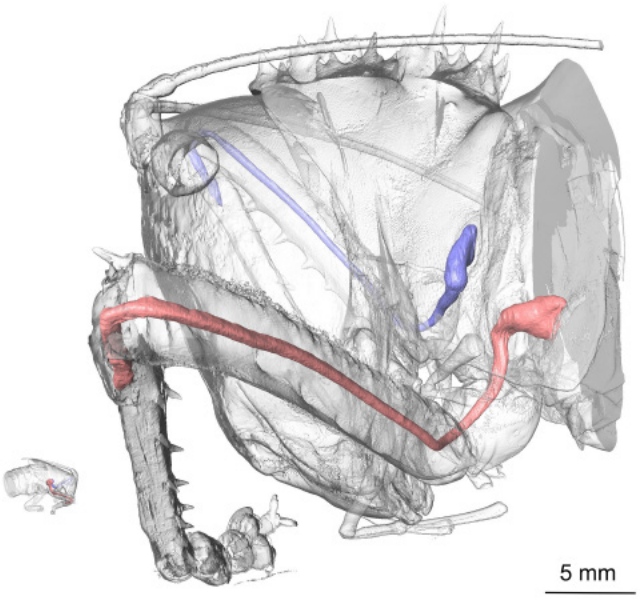

Figure 2. Ear canal extremes in the dataset. The small katydid pictured here is *Microtettigonia tachys* and the large katydid is *Lesina blanchardi*. *L. blanchardi* has an ear canal 15x larger than that of *M. tachys*, highlighting the diversity of scale of this hearing organ.

known to amplify sounds of specific frequencies before they reach the tympanal organ (Nocke 1975; Celiker, Jonsson, and Montealegre-Z 2020; Michelsen et al. 1994).

To collect the micro-CT data, I contacted various institutions and collaborators, as well as utilizing an extensive collection in the lab of my advisor Prof. Fernando Montealegre-Z. In total, we were able to put together samples covering a phylogenetic diversity of 14 Tettigoniid subfamilies. We also had a great diversity in size, with the largest katydid in the dataset having ear canals over 45 mm in length, while the smallest had ear canals that barely exceeded 3 mm (Fig. 2).

The first step of data analysis was to assess the geometry across different divisions of the Tettigoniidae (Fig. 3a). The data confirmed that the exponential horn is the most common ear canal geometry, but also identified that other forms such as linear tubes (cross-sectional area remains almost constant), conical horns (cross-sectional area decreases linearly), and catenoidal horns (cross-sectional area rapidly decreases then becomes linear) are common (Fig. 3b). These geometry data were used to conduct a principal component analysis (PCA) of ear canals, which revealed distinct differences between subfamilies of the Tettigoniidae (Fig. 4). The Phaneropterinae have the largest bullae (the part of the ear canal in the thorax), the Tettigoniinae have the largest acoustic spiracles (the opening to the ear canal), and the Pseudophyllinae and Pterochrozinae have the largest tympanal organs. Despite this diversity, preliminary phylogenetic analyses have revealed a weak phylogenetic signal of ear canal geometry (Woodrow, 2023). Instead, it seems that the length of the ear canal is the most important contributor to explaining diversity and tuning differences, as hypothesized by previous studies (Nocke 1975).

Future work, currently in progress with the data from this project, aims to connect form to function; using numerical models to demonstrate how changes to the size and shape of the ear canal relate to differences in auditory tuning. While the final findings of this project are still being analyzed for publication, some of the data has already been utilized in studies of ear evolution, auditory biophysics, and to supplement taxonomic contributions (Woodrow et al. 2022; Woodrow and Montealegre-Z 2023; Celiker et al. 2022; Hemp et al. 2023), highlighting the need for such comparative studies. I hope to soon make the full datasets from this project available in an open access form for shared use and I am excited to see how it will be used in the future.

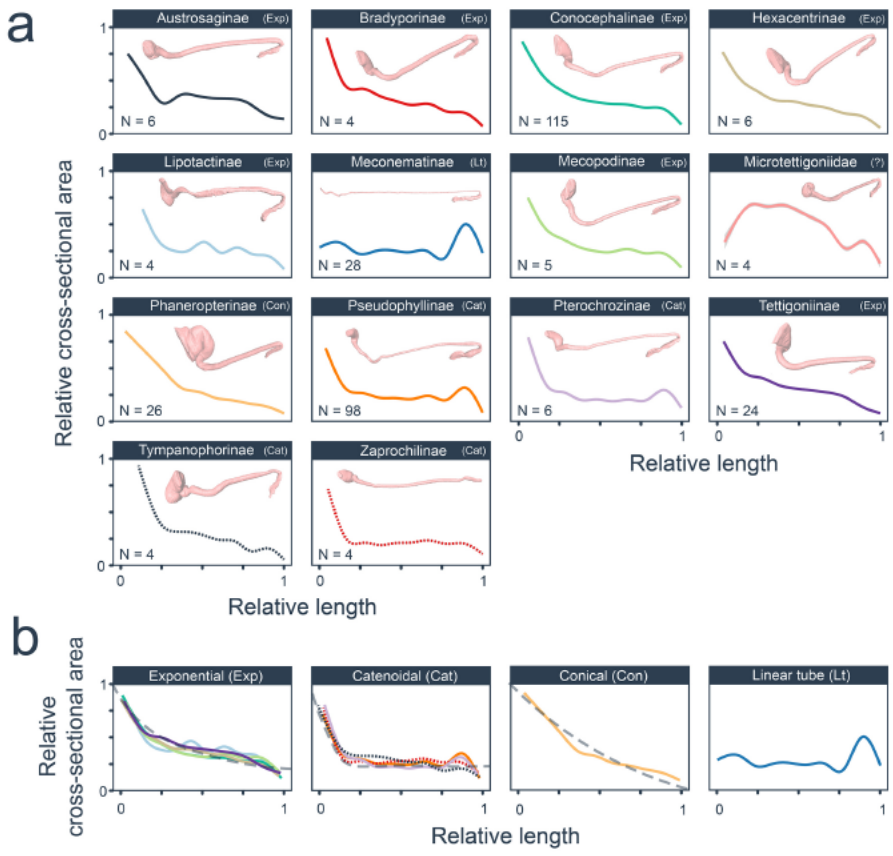

Figure 3. Morphological diversity of the katydid ear canal. a, mean cross-sectional area broken down by subfamily. b, four identified types of ear canal.

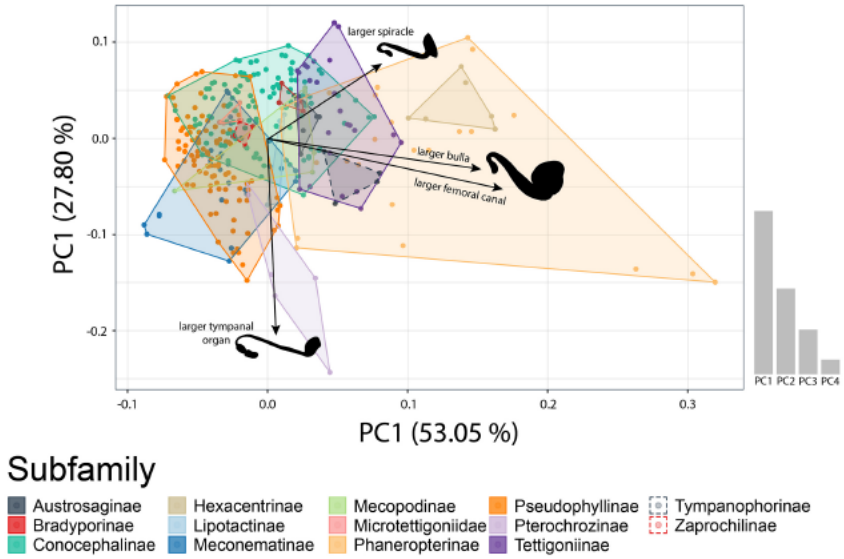

Figure 4. Principal Component Analysis of ear canal geometries. Arrows indicate direction of increasing contribution of each character.

Acknowledgements

I would like to thank Glenn Morris, Hojun Song, Kevin Judge, Ming Kai Tan, Thorin Jonsson, and You Ning Su for providing specimens from their personal collections and/or institutions for use in this study. Through You Ning Su, I thank the CSIRO Australian National Insect Collection (ANIC) for providing Australian endemic specimens which provided a much broader phylogenetic comparison. I greatly appreciate the Orthopterists' Society's Theodore J. Cohn Research Fund. Given that my Ph.D. started in late 2019, my project was soon in need of assistance following the emergence of Covid-19 in early 2020. Without the funds from the society, I would have struggled to replace the elements of my project lost to the pandemic, so I am very grateful for the support. My Ph.D. is funded by the University of Lincoln, UK. Some equipment used in this study was funded by an ERC grant to my advisor, Prof. Fernando Montealegre-Z and an NSF-NERC grant to Fernando Montealegre-Z and Hojun Song.

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Orthoptera Species File Grant Reports

Orthoptera of the Balkan Peninsula and the Carpathian Basin II: a database of digital data in the Orthoptera Species File

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Situated at the crossroads between Central Europe and Western Asia, the Balkan Peninsula and the Carpathians (Fig. 1a) border the Temperate Continental and the Mediterranean Subtropical climates. This territory is covered in hundreds of mountains separated by deep valleys. The combination of diverse geomorphology, climate, and geotectonic history is a basis for diverse fauna and flora. Thus, no surprise, the Balkan Peninsula has the highest number of animal taxa compared to Iberia, Apennines, and North Africa (Husemann et al., 2014). On the other hand, this territory is among the least explored in Europe, due to not only the complex geomorphology and the large number of endemic taxa, but also because of a combination of additional factors, including the political history, poor economic situation in many countries, and comparatively low population density. Therefore, the Balkans still represent a nature paradise for naturalists and scientists.

The current project is the second stage of the successfully accomplished OSF grant "Orthoptera of the Eastern Balkans and the Carpathian Basin (Bulgaria, Macedonia, NE Greece and Romania): a database of collections, literature and digital data in the Orthoptera Species File," during which the team photographed 221 taxa alive in their habitats. Yet, many known species remain poorly represented in the OSF database.

To test for the completeness of the data available for the Balkans and Carpathians, we selected all taxa occurring in the Balkan and Carpathian area adding a few taxa from the Crimean Peninsula, from which photos and sound records were available. The final dataset numbered 560 taxa. Then, we checked all taxa for available photos of living or museum specimens, and song recordings in the OSF database and color-marked each taxon as follows:

- **Green** – taxa for which full set of photos of male and female in vivo and a song recording for the acoustically communicating taxa is available;
- **Yellow** – taxa partly covered in OSF with photo of one of the sexes and/or museum specimens and song recordings, or with photos available but no song recording uploaded;
- **Orange** – taxa with only song recordings or a poor photo, or only with museum specimens photographed;
- **Red** – taxa missing illustrations (or at least of live specimens) and song recordings.

Further, we marked the main distribution range of the taxa to allocate regions with the highest number of taxa missing data (Table 1).

Fieldwork and results

We started with a short trip to the Republic of North Macedonia in February 2020 where, with the help of our colleague Dr. Slavco Hris-

Table 1. Summary of missing image and sound data for the Balkan, Carpathian and partly Crimean taxa of Orthoptera in the OSF database by late 2019. Numbers refer to taxa (species and subspecies).

Region/country	Red (missing images/files)	Orange (poor quality data)	Yellow (moderate quality data)	Green (high quality data)
Greece	66	5	16	
Peloponnesus	10	0	1	
Rhodos	7	1	2	
islands	28	1	4	
Bulgaria	29	8	36	
Romania	27	7	23	
N Macedonia	7	1	6	
Crete	14	1	3	
Crimea	7	1	1	
Albania	5	0	0	
Dalmatia	10	1	13	
European Turkey	3	1	3	
Total	**213**	**27**	**108**	**210**

plus *Tachycines asynamorus* – orange

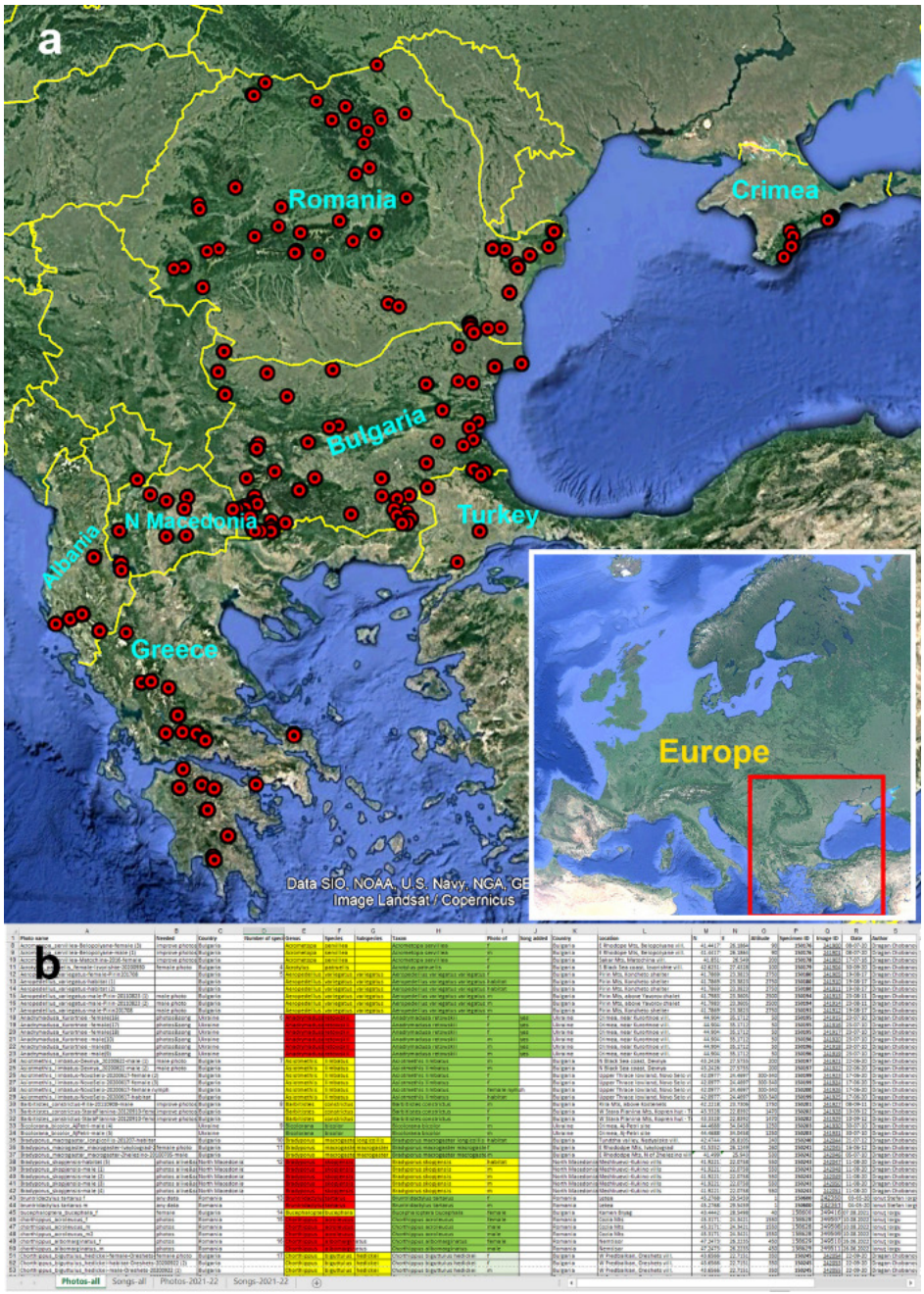

Figure 1. Sampling design and data. a) Sampled localities on the map of Southeastern Europe; b) Part of the our database with data uploaded to the OSF.

tovski, we managed to photograph males of the endemic cave cricket *Dolichopoda remyi*. Unfortunately, we entered a lockdown for the following two months due to the Covid-19 epidemic, when just a few chances to go out of town were possible. Crossing borders and field travels abroad became seriously troubled; therefore, we decided to focus on possible trips mostly in our own countries. As a result, when travel was facilitated, we performed series of trips in Bulgaria (Dragan Chobanov, Simeon Borisov and Georgi Hristov), Romania (Ionuț Iorgu), as well as one trip to North Macedonia (Dragan Chobanov). We also collected photos from some of our former trips to Bulgaria, Romania, Crimea (formerly Ukraine), Greece, Albania, Montenegro, and European Turkey. The following colleagues provided additional photos or helped in the field: Ljubomir Stefanov, Slavco Hristovski, Mario Langourov, Nikolay Simov, Stoyan Goranov.

The travel restrictions in 2020 delayed our activities and the project was postponed to 2022. After collecting a significant amount of data from the Northern Balkans and the Carpathians, including endemic taxa or widely distributed species with poor data in the OSF database, for the next two years we decided to focus on the endemic taxa occurring in the mountains of the southwestern Balkan Peninsula in Greece and southern Albania.

Contrary to the solid forested mountains of Bulgaria, Romania, and North Macedonia, the western Balkans are characterised by a very hackly relief of steep mountain summits and ridges, separated by narrow valleys. Thus, high-elevated areas are difficult to access. Even if roads are present to middle or even high elevations in Greece, they are extremely narrow, steep, and curvy, and moving from one summit to the next, isolated at, say, 30 kilometers, may take an entire day. The situation in Albania is even worse, with roads reaching usually, at most, to 1,000 meters elevation. Thus, reaching the habitats of the target species 600 to 1,200 m higher requires long hiking. The combination of extreme temperatures (> 40ºC), lack of shadow from trees, and altitude differences of 600–1,200 m to

Table 2. Summary of the improvement of the data for the Balkan, Carpathian and partly Crimean taxa of Orthoptera in the OSF database as a result of the present project. Numbers refer to taxa (species and subspecies).

Project achevements	Red (missing images/files)	Orange (poor quality data)	Yellow (moderate quality data)	Green (high quality data)
Before	213	27	108	210
After	122	9	79	348

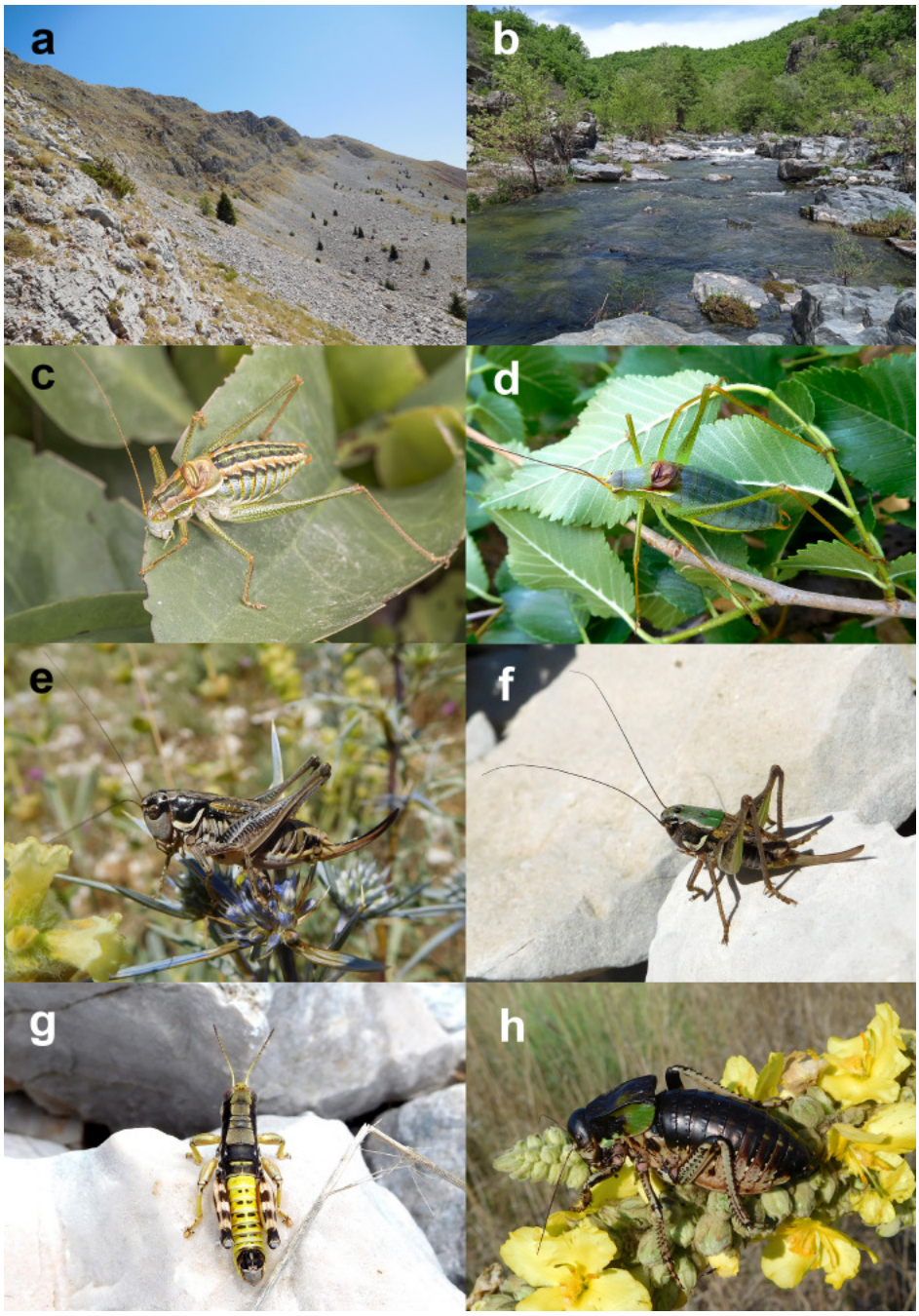

Figure 2. Example photos of localities and species. a) A stony scree in Kokkinia mountain in Greece – habitat of *Rhacocleis lithoscirtetes*; b) Pristine river near the locality of *Duroniella fracta* in the East Rhodopi mountains in Bulgaria; c) *Isophya dobrogensis* – local endemic to the small Popina Island in Romania (male); d) *Isophya gulae* – local endemic to a remnant of flooding forest in southeastern Bulgaria (male); e) *Parnassiana* sp.n. 1 – endemic to a mountain group in southern Albania (female); f) *Parnassiana* sp.n. 2 – endemic to the Tomorr massif in southern Albania (female); g) *Peripodisma llofizii* – recently described endemic species found in a few mountains of southern Albania (male); h) *Bradyporus skopjensis* – endemic to the dry grasslands of central-eastern North Macedonia (male).

climb on rocky slopes almost every day was a serious challenge. To add to this, orthopterans were frequently hiding within the stone screes (Fig. 2a). However, after the exhaustive work, we enjoyed camping with beautiful mountain views or sometimes even with a river bath (Fig. 2b). And as a result of thousands of kilometers of driving and many "Everests" climbed, we visited multiple localities scattered over the Balkans and Carpathians (Fig. 1a) and met plenty of interesting orthopterans, many residing only on a single mountain top or an island (Fig. 2c-h).

The collected photos and recordings were processed to files of moderate size to represent a good image of the species, their habitats, or a representative part of their song, and uploaded to the OSF database with a unique image or sound ID. All files were attributed to new specimens in the database with precise spatial and temporal data provided. Our data, organized in an Excel file (Fig. 1b), is available to anyone interested. Altogether, we uploaded 590 photos of 160 species and subspecies, their habitats, and 56 song files representing 52 taxa. Data for 140 taxa, including many local endemics, were uploaded for the first time.

With the present project, we focused on some of the genera, including high numbers of endemic species in the Balkans and Carpathians. Synthesized results from the project are presented in Tables 2 and 3. Genera with highest number of sampled taxa are *Isophya* – 33 taxa from 30 species of 34 total known to occur in the region; *Parnassiana* – 13 of 15 taxa in total; *Oropodisma* – 8 of 10 species in total; *Tetrix* – 7 of 10 species in the region. During the trips in Albania we also collected two so-far-undescribed species tentatively related to genus *Parnassiana* (Fig. 2e, f) and rediscovered populations of *Bradyporus skopjensis* (Fig. 2h).

Conclusion

Recently, the efforts to study the Balkan orthopterans significantly increased with a few more grants funded by the Orthoptera Species File. The numbers in Table 2 further shifted from the red towards the green field, with new data added from Albania, Croatia, Montenegro, North Macedonia, Serbia, etc. Nevertheless, the high number of endemic taxa known from a few specimens or a single locality require further efforts to increase the information available. Genera with poorest representation of data in OSF remain *Dolichopoda* (mostly cave dwellers with 29 species found in Greece out of 53 described), *Rhaco-*

Table 3. Electronic files uploaded and number of species and subspecies represented by country

Country by alphabetical order	Number of file entities uploaded	Number of taxa represented
Albania	40	6
Bulgaria	232	64
Greece	125	27
Montenegro	1	1
North Macedonia	50	17
Romania	150	52
Turkey	4	3
Crimea (formerly Ukraine)	43	10
Total	**646**	**171**

cleis (with 16 species in Greece out of 33 described) and *Eupholidoptera* (with 23 species in Greece out of 51 described). Yet, as the interest by naturalists and scientists grows and some new field guides are in preparation or have recently been published (Willemse et al. 2018), these gaps may soon be filled.

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The grasshoppers (Orthoptera: Caelifera) from Panga Ecological Reserve, Minas Gerais, Brazil

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Brazil is a Neotropical country with continental territory divided into six major biomes: Amazonia, Caatinga, Atlantic Forest, Pantanal, Pampa, and Cerrado (Brazilian Savanna), (IBGE, 2020). The latter one is considered a threatened hotspot, which already has lost 88 Mha (46%) of its original coverage, mainly due to agribusiness expansion (Strassburg et al. 2017). This biome occurs in 15 Brazilian states and formerly covered about 54% of Minas Gerais. Unfortunately, only 22.3% of the original area is well-preserved (IEF, 2020). These few areas are mostly restricted to natural conservation spots and among them, the Panga Ecological Reserve (19º10'54"S, 48º23'26" W) is one of the most important areas from Minas Gerais. This reserve holds different Cerrado vegetation types, such as forests, wooded savanna, and open grasslands in which are distributed 409 ha of the natural environment (Cardoso et al. 2009). In this area, previous research has already registered a significant asset of different taxa as 46 species of mammals, 310 species of ants, 1,111 plants, 21 bats, 16 anurans, and 95 species of bees (UFU, 2020). Nevertheless, insects, such as grasshoppers, have not been studied even with the known diversity of the area.

Figure 1. Areas of Panga Ecological Reserve: (A) the sugarcane crop on the border of this conservation area; (1B-D) environmental services workers against the fire; (E) fire burning the vegetation; (F) area after the fire and (G-H) burnt trees and non-native plant species invasion. Photos (1B-F) by Comunica UFU.

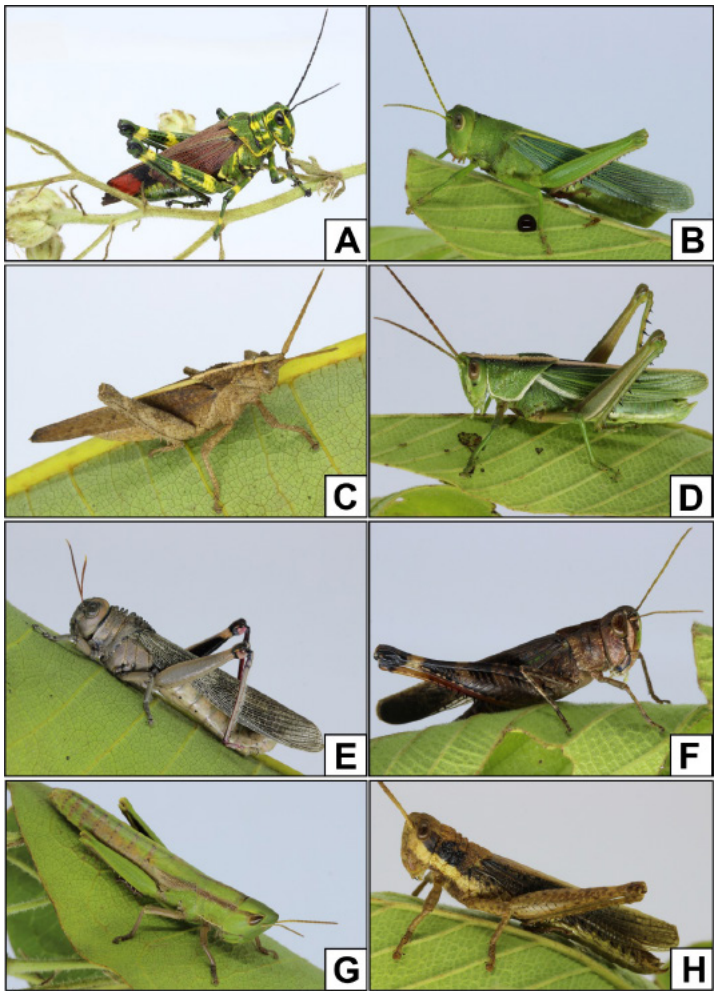

Figure 2. Some species of grasshoppers observed during the project: (A) *Chromacris speciosa* (Thunberg, 1824); (B) *Zoniopoda hempeli* Bruner, 1911; (C) *Procolpia* sp.; (D) *Staleochlora humilis* (Rehn, 1909); (E) *Prionacris* sp.; (F) *Rhammatocerus schistocercoides* (Rehn, 1906); (G) *Aleuas gracilis* Stål, 1878 and (H) *Zygoclistron trachystictum* Rehn, 1905.

To address this gap, this project was funded by a 2021 Orthoptera Species File (OSF) grant aimed at recording the diversity of grasshoppers in the Panga Ecological Reserve as a part of the "Grasshoppers (Caelifera) of Minas Gerais, Brazil" project.

However, in order to conduct two years of fieldwork in this area, we faced unexpected problems: the long-time lockdown provided by the Covid-19 pandemic and a huge fire that occurred in the reserve in September 2021. This fire destroyed about 200 ha, almost half of the entire area (Fig.1). During the lockdown in Brazil, access to natural areas to researchers were restricted or, in some circumstances, denied. We tried to plan ahead with strategies to handle these events and once vaccination started, we had to face the losses caused by the fire. It is assumed that the fire outbreak occurred in a sugarcane crop on the border of the Panga (Fig.1A) and the firefighters could not extinguish the fire quickly, fighting unsuccessfully for several days to contain the advance of the fire (Fig. 1B-D). As a result, more than half of the Panga area was destroyed and native flora were replaced by invasive plants (1E-H). During our fieldwork, we realized that the grasshopper fauna was negatively impacted and the presence of invasive plants contributed to the decrease in species diversity. Even in periods favorable to the presence of grasshoppers, we had some days in which we did not find any specimens. Despite the less-than-ideal conditions and even with the species richness impacted by the destruction from the fire, we collected interesting species, new reports, and several pieces of information.

Species collected

Regarding Romaleinae diversity, the *Chromacris speciosa* (Thunberg, 1824) was the most common and abundant species collected (Fig.2A). Its morphology varies geographically and locally, but most individuals that we collected had a red wing. We also collected *Zoniopoda hempeli* Bruner, 1911, which was an easy species to recognize by the tegmina with two yellow longitudinal veins (Fig.2B). Also, an interesting new record for Minas Gerais state was the *Procolpia* sp. (Fig.2C) specimen. This genus has a relatively broad range, extending from east-central Mexico to southeastern Brazil, Uruguay, Paraguay, northern Argentina, eastern Bolivia, and eastern Peru. Only one male was observed and we are working on this specimen since the morphology and diagnostic characteristics of this genus are poorly understood. An additional species that does not seem to be abundant in any place, and it was sparsely represented in most collections, is *Staleochlora humilis* (Rehn, 1909) (Fig.2D). This species was easily recognized by the tegmina with black stripe above the costal cream band absent or very faintly marked; cream band below it well-marked on basal half of tegmen, disappearing from middle of it to its apex (Roberts & Carbonell, 1992). This unique specimen, a male, was collected walking slowly on the ground.

Further interesting specimens collected were in the genus *Prionacris* sp. (Fig.2E). Finding them was unexpected since we weren't supposed to collect many specimens from such a disturbed area. This genus has a widespread range, from French Guiana and Brazil North to Colombia, Bolivia, Peru, and Paraguay, and is well-known for occupying an arboreal forest habitat. The specimens collected represent an expansion in the area of this genus since there are not many records for the Cerrado or for the central regions of Brazil. This genus represents dendrophilic habits, since it usually rests on high branches in trees, and we notice its presence due to its loud singing. *Prionacris* is hard to grab, and for this reason, is not common to find a considerable number of specimens in entomological collections.

Among the Gomphocerinae, we collected some *Staurorhectus longicornis longicornis* Giglio-Tos, 1897 and *Rhammatocerus schistocercoides*

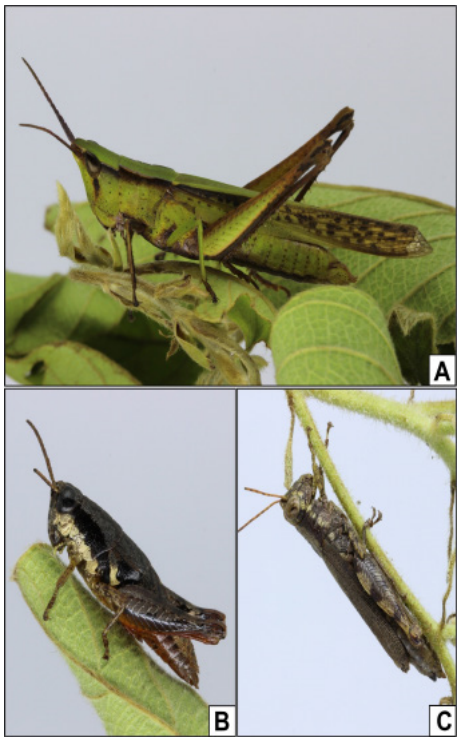

Figure 3. Some species of grasshoppers observed during the project: (A) *Metaleptea adspersa* (Blanchard, 1843); (B) *Eujivarus fusiformis* Bruner, 1911 and (C) *Eucephalacris borellii* (Giglio-Tos, 1897).

(Rehn, 1906) (Fig.2F). Regarding the first species, there is little information about biology, while, from the latter, there are several studies, since it was an important crop pest mainly in central Brazil in the 1980-90's. Our specimens have a peculiar green frontal face, resembling a unique individual examined by Carbonell (1988) in the species revision. Concerning Copiocerinae, there were two species collected: several females and males of *Aleuas gracilis* Stål, 1878 (2G) and a unique male of *Zygoclistron trachystictum* Rehn, 1905 (2H). Species of these two genera are very closely related and are easily distinguished by the head frontal ridge, the pronotum medial carina, and color patterns are distinctive among them. In our fieldwork, we report the first *Z. trachystictum* for Minas Gerais state.

Among Acridinae, *Metaleptea adspersa* (Blanchard, 1843) (Fig.3A) was a unique and abundant species found in our fieldwork and we observed them associated with the wetlands (named Veredas, Cerrado vegetation type characterized by hydromorphic soils). This species occurs in the widest range on the American continent, extending from Southern Canada to Argentina. In this same area, we found a new species of *Tettigidea* sp. Only one specimen of Cyrtacanthacridinae, *Schistocerca cancellata* (Serville, 1838), was collected. This is an important species, with the potential for swarms that can devastate many crops, pastures, and fruit trees in several South American countries. For Ommatolampidinae, two species of Abracrini were collected: *Abracris dilecta* Walker, 1870 which also presents a wide range from Mexico, Central America, South America East of the Andes to Uruguay, and was one of the most common species of this subfamily in this fieldwork. The other was *Eujivarus fusiformis* Bruner, 1911, a small fusiform grasshopper (Fig.3B) that is abundant in an open habitat of Cerrado.

For Melanoplinae, *Baeacris punctulata* (Thunberg, 1824) was the most abundant species in our samples. This species has the widest known geographical distribution within the genus and is considered a species with economic importance since it is an agricultural pest. We also collected some *Propedies* sp. on the Vereda vegetation type. Only one Leptysminae was collected, *Stenopola bohlsii* Giglio-Tos, 1895, with this specimen found in an area that was formerly a wetland, but, after the fire, it became dry, and the native vegetation was replaced by invasive grasses. Also, *Temnomastax hamus* Rehn & Rehn, 1942 was collected in this same area, our unique Eumastacidae. *Eucephalacris borellii* (Giglio-Tos, 1897) (Fig.3C) was the single Proctolabinae species reported for Minas Gerais. This species is less strictly arboreal since is easily collected in the grass and shrubs near the ground.

Thus, data collected from the field trips in 2021-2022 are still being processed, since some specimens still need to be verified and written into manuscripts. Indeed, I am in the process of describing new species from Panga and these new records will, as soon as possible, be readily available in the OSF. Despite the Covid-19 pandemic and the fire damage that disrupted most of our fieldwork, the results presented here are positive. I intend to continue working in this area soon and I believe that all the activities on this project will contribute greatly to the overall Grasshoppers of Minas Gerais project and to the knowledge of the Brazilian grasshoppers.

Acknowledgements

I thank the Orthopterists' Species File for funding this project and providing me the opportunity to conduct this research on Brazilian Cerrado. I am most grateful to Marcelo Ribeiro Pereira, Alan Nilo da Costa, and Welliton Carneiro da Silva for all their fieldwork support.

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Editorial

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As some of you may know, I am organizing a workshop called the **CRICKET COURSE**, which will take place at the Archbold Biological Station in Florida on July 2-8, 2023. This course is designed to provide hands-on training in collecting, identification, ecology, behavior, and bioacoustics of ensiferan insects. Sixteen students will participate and five instructors will teach this course.

In preparation for this workshop, I am reading many books and papers on crickets, katydids, and relatives to brush up on my knowledge of these insects. One of the books open in front of me right now is a monograph titled "The Australian Crickets (Orthoptera: Gryllidae)" by Daniel Otte and Richard Alexander. This famous treatise published in 1983 was based on their year-long expedition across Australia between June 1968 and August 1969. Otte and Alexander drove across the entire continent (46,000 miles of travel) and collected from 905 localities to explore and document the then-unknown cricket fauna of Australia. The work included 492 cricket species, of which 376 were new. A 12-month trip of continuous fieldwork! What an amazing trip it must have been!

Oh, how I wish I could take such a trip in my lifetime! There are still so many places in the world that have not yet been fully explored for Orthoptera. Places like West-Central Africa and Southeast Asia must harbor hundreds of new species. I know for a fact that there are hundreds of grasshopper species in Australia that need to be properly described. Although I'd love to take a trip like the one Otte and Alexander took many decades ago, such a trip is simply an impossibility for those of us working in academia today. Most of my time is spent in front of a computer, responding to emails, writing/reading/reviewing manuscripts or grants, or doing irrelevant tasks forced upon us by the university. Because of teaching responsibilities, taking an extended trip during regular semesters is becoming more difficult. The last three years have been particularly challenging due to COVID-related travel restrictions.

However, I do feel very fortunate that I have been able to take many exciting trips over my career. These trips are often physically draining, but emotionally refreshing. They remind me why I fell in love with orthopterans in the first place. I have always traveled with my students, and sharing the sense of wonder and excitement with them has been the most fun part of these expeditions. I really hope that the upcoming CRICKET COURSE is one of those trips, although very short.

This issue of *Metaleptea* is a bit shorter than previous issues, and perhaps it reflects the delays due to COVID-19. I hope to hear from more members for the next issue. I would like to thank our Associate Editor, Derek A. Woller, for his continued assistance in the editorial process. To publish in *Metaleptea*, please send your contribution to hsong@tamu.edu with a subject line starting with [**Metaleptea**]. A MS Word document is preferred and images should be in JPEG or TIFF format with a resolution of at least 144 DPI. The next issue of *Metaleptea* will be published in September of 2023, so please send me content promptly. I look forward to hearing from you soon!

Officers of the Orthopterists' Society