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METALEPTEA

THE NEWSLETTER OF THE ORTHOPTERISTS' SOCIETY

President's Message

By **MICHAEL SAMWAYS**
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The Orthopterists' Society is in a very vibrant phase of activity with the dissemination of several grants from the Ted Cohn Research Fund to support various student projects across the world (see the report by Michel Lecoq in this issue). This really does emphasize the value of being a member of the Society where networking and opportunities are available to young orthopterists wherever they are. Also, with the International Congress of Orthopterology in Brazil in 2016, there is further opportunity to network.

One of the great opportunities that a whole range of orthopteran species offer is that not only are they among the most interesting organisms on the planet, but they can also serve well as indicators of changing landscapes in this current era of the Anthropocene... the first geological era where just one species, the settled and industrialized human, is changing the world in a meteoric way.

Orthoptera species are excellent bio-indicators of a changing environment, for better or worse. One of the reasons for this is that they are sensitive at the local spatial scale, and readily seek out ideal conditions for their survival and that of their offspring. Nymphs may even be in one habitat and adults in another. Sometimes, adults even move across habitats to find their ideal immediate environment, such as spatial shifting according to hot and sunny conditions or cool and overcast ones.

The range of orthopteran species making up a local assemblage in any particular area fine tunes their role as bio-indicators. Highly mobile species may rapidly move away from an anthropogenic impact, such as the planting of exotic trees. In contrast, highly endemic local species may not be able to move in this way, and may be locally extirpated. This differential response means that we can measure the changes in the environment using a range of orthopteran species traits and responses and then manage the landscape accordingly. We can then test whether our management has been successful by investigating which species have re-colonized after an environmentally acceptable landscape management program has been put in place. In short, Orthoptera of all sorts give us an opportunity for future-proofing the planet in a sustainable way.

* Table of Contents is now clickable, which will take you to a desired page.

The 2015
Theodore J. Cohn Research Grants Funded

By MICHEL LECOQ
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We received a number of research proposals this year for the Theodore J. Cohn Research Grants call that has never been achieved in the past. A total of 28 projects were submitted to the Committee, issued from 17 countries: Brazil, Bulgaria, Canada, China, Croatia, Cuba, Czech Republic (2), Germany (3), India, Netherlands (2), Mexico, New Zealand (3), Singapore, South Africa, Spain (2), Uruguay, and the U.S.A. (5). If it was still needed, this is further evidence of the continuing interest in our Society and in our grants in support of students and young scientists.

As you know, this year, thanks to a large donation from the estate of our late colleague Theodore J. Cohn, it was possible to increase the amount of each grant to a maximum of USD 1,500 for an annual total of USD 15,000.

Among the proposals received, the proposed topics are diverse and concern taxonomy as well as ecology, physiology, behavior, and phylogeography, and involve very diverse groups of Orthoptera *s.l.* As usual, it was a hard, but exciting, task for the jury (David Hunter, Battal Ciplak, and myself) to analyze and classify the various proposals. A consensus was reached fairly quickly and it was decided to fund 11 proposals. The following grants (in alphabetical order) were made in amounts from USD $500 to $1,500 (for a total of USD $14,599):

- **Katherine Crocker** (U.S.A.) - Whether parents are helping: Is variable hormone provisioning an adaptive, plastic phenotype?
- **Lara-Sophie Dey** (Germany) - Phylogeography and evolution of the band-winged grasshopper genera *Thalpomena* Saussure 1884 and *Pseudoceles* Bolivar 1899.
- **Kristin Duffield** (U.S.A.) - A terminal investment threshold for male decorated cricket calling based on age-dependent residual reproductive value and infection cue intensity.
- **Matthew Heck** (U.S.A.) - Testing for reductions in age-associated damage upon dietary restriction and RNAi-mediated knockdown of neuropeptide F in *Romalea microptera*.
- **Paul Alvarado Lenhart** (U.S.A.) - The effect of gut microbiomes on nutrient regulation in a grazing insect.
- **Jorge Gutierrez Rodriguez** (Spain) - Ring speciation and evolutionary history of the genus *Lluciapomaresius* Barat 2012.
- **Matan Shelomi** (Germany) - Bergmann's and Allen's Rule in Mediterranean Phasmatodea.
- **Tobias Schulte-Middelmann** (Germany) - Inter- and Intra-island diversification in the genus *Ariagona* Krauss, 1892 (Orthoptera: Tettigoniidea).
- **Louisa Maree Sivyer** (New Zealand) - Phylogeography and environmental niche modelling of the grasshopper genus *Phaulacridium* in New Zealand: evidence of range shifts.
- **Josip Skejo** (Croatia) - The phylogenetic position of the Eurasian genus *Psophus* Fieber, 1853 (Oedipodinae: Locustini).
- **Jantina Toxopeus** (Canada) - Physiological and molecular adaptations to freezing in the great grig, *Cyphoderris monstrosa* (Orthoptera: Tettigoniidea).

Our congratulations to all the successful applicants, and on behalf of the Committee, our best wishes for the full success of their work. Of course, all our readers will anxiously wait for their report in our newsletter. We are sorry not to have enough money to fund all the excellent projects we received. For candidates who were not selected, the Committee thanks them all for their efforts of presentation and formulation of their research projects. All the projects were greatly appreciated by the Committee and I invite them to submit further proposals at the next call in early 2016.

Platycleis intermedia (Tettigoniidae) is a widespread species in the Mediterranean and into Asia. The young stages are tolerant of some farming and can develop in low-intensity wheat fields. As they mature, they move into bushes in the surrounding area. However, the species is overall highly sensitive to anthropogenic change to the landscape and has been extirpated from some localities in southern France as human impact has increased in intensity and extensiveness.

- Michael Samways

The 12th International Congress of Orthopterology

Ilhéus, Bahia, Brazil, October 30 to November 3, 2016

ORTHOPTERA IN A CHANGING WORLD

By **MARCOS LHANO**
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Dear friends,

It is a great pleasure to invite you to contribute to and attend the 12th International Congress of Orthopterology. The Congress will be held in the city of Ilhéus, Bahia, Brazil, from October 30 to November 3, 2016.

Ilhéus was founded in 1534 and is located in the Northern coastal region of Brazil, about 220 km south of Salvador, the capital of the state of Bahia. Today it is one of the most important tourism centers of northeastern Brazil, due to its beautiful beaches and cultural heritage. Ilhéus has approximately 222,000 inhabitants, with an area of 1850 km^2, and its downtown is located on the seaside of the Atlantic Ocean. Ilhéus is also well known as the hometown of Jorge Amado, one of the most popular Brazilian writers (some of his novels: "Gabriela, Clove and Cinnamon" and "Dona Flor and her two husbands"). Also, the city used to have the major cocoa plantations in Brazil, and nowadays tourists can enjoy the chocolate produced in the city. During the months of October and November (dry season), the temperature is around 28°C. I invite everyone to visit http://en.wikipedia.org/wiki/Ilhéus and read more about the city.

We're working on releasing the complete information about the Congress soon, which will be displayed on the Congress website. It is a challenge to keep up with the high scientific quality and the friendly atmosphere experienced on the previous Congresses, but we will try our best to do it. We hope that the program and scientific topics will draw your attention and that you will contribute your papers and discussion to ensure the high quality that we are used to seeing in our OS Congresses.

Last February, Dr. Maria Marta Cigliano (as a member of the OS Congress Committee) briefly came to Bahia to visit the city and help to define some perspectives for the Congress, including some of the topics mentioned below. I would like to thank to all the OS Committee members for their suggestions and support.

The venue for the event will be in a hotel located in front of the beach, close to the suburbs of Ilhéus and 5 minutes by car (2 km) from the airport. It is a small hotel with beautiful gardens, swimming pool and restaurants, which can be used to accommodate all the attendants. We are currently discussing the prices for the rooms (including breakfast, four lunches and two dinners - without beverages), so once we have reached to a final price, I will announce to you the name of the venue hotel. We have hired an event management company: GT5 Group, which has the expertise and ample experience in organizing congresses and meetings in Brazil.

Please bookmark the deadline for abstract submission in your agenda: **July 31, 2016.** The final form of the presentations of regular submitted papers will be announced in the website. The Scientific Committee will dispatch and group the abstracts according to the different symposium topics, and will select those abstracts which will be presented as oral presentations and those as posters. We will invite prominent and distinguished orthopterists to present their experience and the results of their latest research during the Plenary Lectures and Symposia.

The Congress will also include the following activities:

- Opening Ceremony
- Posters sessions
- Workshops
- Information Sessions
- Oral Presentations
- Special Meetings
- Awards

We will have a new activity during the Congress "Information Sessions" consisting of short courses through which the attendants will have the opportunity to discuss and learn about specific topics such as new methods and statistical techniques for data registration and analyses.

I am glad to announce an "Open Call" for those interested in proposing and organizing a Plenary Symposium and Information Sessions. This call will be open until July 31, 2015.

As social events, we will have a welcome cocktail, the traditional Gala Dinner and the "Nations' Party" (a tradition that began in China), where the attendants will be asked to bring some traditional costume/hat/shirt, etc. for this night and will be invited to sing a song from their country.

Daily tours will be offered to some nice touristic places in the region for accompanying members. Besides, one-day tour to Itacaré (a beautiful beach close to Ilhéus) for all the attendants will be also organized.

Finally, the Post Conference Tour will consist of a trip to the amazing Chapada Diamantina region and Salvador city. This is a very attractive tour that will soon be announced on the Congress website. It is important to note that it will be mainly a touristic and photographic tour since it is not allowed to collect insects or any other organisms without collecting permits in Brazil. The ICO 2016 organization is not able to make any arrangement for collecting permits for the whole group. If someone is interested in collecting Orthoptera material, there will be a plenty of stops and time to do so, however, each scientist will be responsible for obtaining proper collecting permits and paperwork/export permits to carry the material outside Brazil (they are different permits) from the Brazilian Government: the Ministry of the Environment's (MMA) and the Ministry of Science and Technology (MCT).

Important dates for your agenda:

- 12th International Congress of Orthopterology: October 30 to November 3, 2016
- Deadline for abstract submission: July 31, 2016.

As the President of the ICO 2016, I am delighted to cordially invite you to join us.

The European Red List of Orthoptera

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Participants of the Italian workshop in the Teatro di Vicenza. With from left to right: Axel Hochkirch, Roy Kleukers, Paolo Fontana, Bruno Massa, Filippo Buzzetti, Baudewijn Odé and Ana Nieto (photo: Antonio del Lago)

IUCN SSC Grasshopper Specialists Group

The IUCN Species Survival Commission Grasshopper Specialist Group (GSG) is composed of 74 experts on grasshoppers, crickets, bush-crickets, mantids and stick insects from 30 countries worldwide. The aim of the GSG is to conserve orthopteroid insects and their habitats around the world. An important component of conservation is the assessment of species for the *IUCN Red List of Threatened Species*^{TM}. This greatly helps to communicate threats to policy makers and the general public, and helps to prioritize conservation measures. The process of red-listing is very useful as it adds to our knowledge of the species, but also identifies knowledge gaps. Moreover, several funding possibilities exist for research on or conservation actions for species that are in the threatened categories of the IUCN Red List.

The workshop in progress. (Photo: Baudewijn Odé)

European Red List

The European Red List (ERL) is a review of the status of European species according to IUCN Regional Red Listing guidelines. It identifies those species that are threatened with extinction at the European level (pan Europe and the European Union), so that appropriate conservation action can be taken to improve their status.

The ERL has already assessed the status of nearly 10,000 European species and currently the status of all Orthoptera species (grasshoppers and crickets) is being assessed, a total of approximately 1,100 species.

The European Red List of Orthoptera is compiled by IUCN's Global Species Programme and the experts of the Grasshoppers Specialist Group. The project started in November and great progress has already been made towards completing the Red List. A workshop was held in Vicenza, Italy on 15-17 May to assess the status of grasshopper species with an Italian-restricted distribution. The workshop, hosted by the Museum Naturalistico Archeologico of Vicenza, was attended by seven experts; a Red List Category was assigned to the species on the basis of information available and by reaching consensus.

Additional workshops will be held throughout 2015 and beginning of 2016 to assess all the Orthoptera species and it is expected that in October 2016 the Red List assessments will be completed and a publication summarising the results will be produced.

Orthopterists that are interested in participating in conservation of orthopteroid insects are welcomed to become a member of the GSG. Please contact Axel Hochkirch.

SIGTET – Special Interest Group Tetrigidae – the fascinating world of pygmy grasshoppers

By **JOSIP SKEJO**
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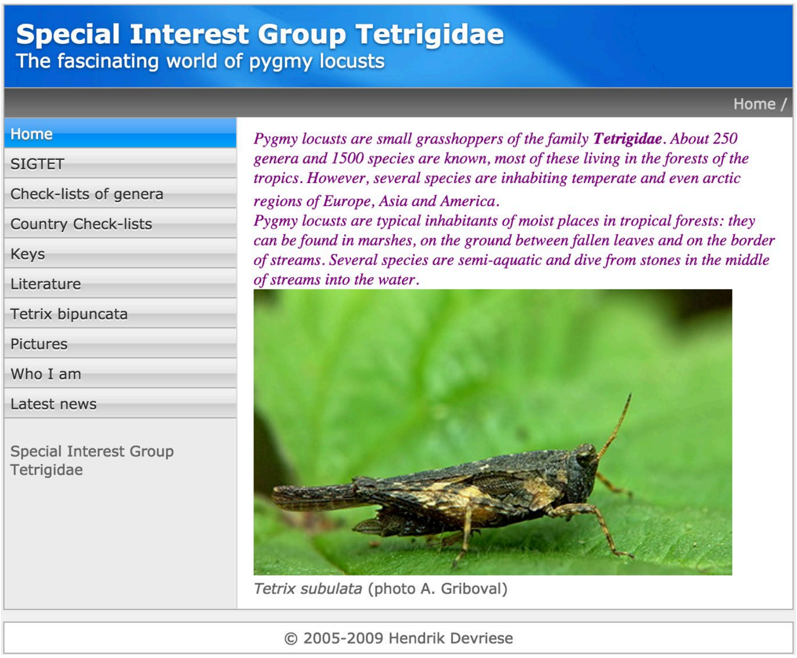
Pygmy grasshoppers (Tetrigidae) are the least studied family within the order Orthoptera. The family counts 9 subfamilies that are artificial groups made for easier identification, and most of them are paraphyletic, thus not evolutionary units, with 268 genera and subgenera (of which 6 are fossil and 262 extant) and 1,912 species and subspecies (of which 9 are fossil and 1,903 extant). The members of the family are easily distinguished from all other Orthoptera primarily by their prolonged pronotum that usually covers the whole abdomen, and also by tarsal formula 2-2-3, lack of arolium between the claws, and absence of tympana.

Since there are only a few researchers that deal with systematics of this fascinating group, Hendrik Devriese initiated the establishment of the Special Interest Group Tetrigidae – SIGTET during the meeting of *Deutsche Gesellschaft für Orthopterologie* held in Bonn (Germany) from 15 to 16 March 2008. The group aimed to put at the disposal of the orthopterists' community all the resources concerning the family: checklist of genera and species, distribution information, literature lists, identification keys, photographs etc. and it also aimed to enhance contact and information exchange between Tetrigidae experts. (webpage: http://home.scarlet.be/~ping0646/index.html).

Since we are in the era of social network mass use and a lot of information of a lot of themes is being exchanged on these networks, such as Facebook, Flickr, Gmail and its accompanying sites. Also, since the SIGTET website was not being used continuously at the time, I decided to make an address book containing contact information of every available Tetrigidae researcher, and, with this information, to make an exhaustive mailing list for information exchange. After I made the group, Daniela Santos came to me with the idea to found a Facebook page for SIGTET as well. The Facebook group is aimed at providing continuous discussions on Tetrigidae research, to initiate collaborations among researchers, material, and literature exchange, spend some good, free time discussing, collecting and scanning more and more literature on pygmies, and also to examine Tetrigidae photos from all around the globe (Facebook group: https://www.facebook.com/groups/807063066036549).

The Facebook group was created on April 3, 2015. At the same time, an exchange of literature and photos started, we updated the Tetrigidae researchers address book and it now contains information on 31 researchers from 19 countries and 4 continents. Currently, we lack researchers in Africa and Australia. In the Facebook group there are 16 of us studying Tetrigidae and some contributors that are helpful in our study and willing to collect material on their expeditions. Also, we have collaborations with Holger Braun and Piotr Naskrecki, administrators of the Orthoptera Species File, so the valuable information and new literature data can be added and some errors can be corrected in the database.

In the name of our little team, I would like to call all the readers who possess Tetrigidae photos, material and literature to contact us and to collaborate with us. More eyes are always better. We are not able to tell you everything about Tetrigidae since little is known, but we are able to instruct you how to look and what to look for and we are always looking forward to learning more together.



Pygmy locusts are small grasshoppers of the family ***Tetrigidae****. About 250 genera and 1500 species are known, most of these living in the forests of the tropics. However, several species are inhabiting temperate and even arctic regions of Europe, Asia and America.*
Pygmy locusts are typical inhabitants of moist places in tropical forests: they can be found in marshes, on the ground between fallen leaves and on the border of streams. Several species are semi-aquatic and dive from stones in the middle of streams into the water.

Tetrix subulata (photo A. Griboval)

© 2005-2009 Hendrik Devriese

Regional Reports - What's happening around the world?

Southern Africa

By **CORINNA S. BAZELET**
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In 2014, 129 species of South African katydids (Tettigoniidae) had Red List assessments published by the IUCN (www.iucnredlist.org). These species represent approximately three-quarters of the katydid species known to occur in South Africa (170 species in total), and the full complement of species which are currently capable of being assessed. Of the unsuitable species, eight are recognized new species which await formal description and 33 are species whose validity requires verification, such as members of the problematic genera *Ruspolia* and *Conocephalus*, many of which can be distinguished only on the basis of their call, and are in need of taxonomic revision on the basis of this character.

Completion of the Red List assessments took approximately two years and support from many people. First, Piotr Naskrecki and I met in November, 2012 to write most of the text which appears in the final assessments. Then, using 810 geo-referenced South African localities from Piotr's MANTIS database, I calculated coarse scale distribution ranges for each species in ArcGIS 9.2, generously provided by the IUCN and ESRI. All threatened species (Vulnerable (VU), Endangered (EN), and Critically Endangered (CR) were assessed on the basis of their geographic range (Red List Criterion B) or as a result of having a very small and restricted population (Criterion D). I then uploaded all data and Piotr's photographs into IUCN's Species Information Service (SIS) software and completed all draft assessments. Each draft assessment was peer-reviewed by Axel Hochkirch, Mark Bushell, and/or Baudewijn Odé, founding members of the IUCN's Grasshopper Specialist Group (GSG), before being submitted to the IUCN for publication.

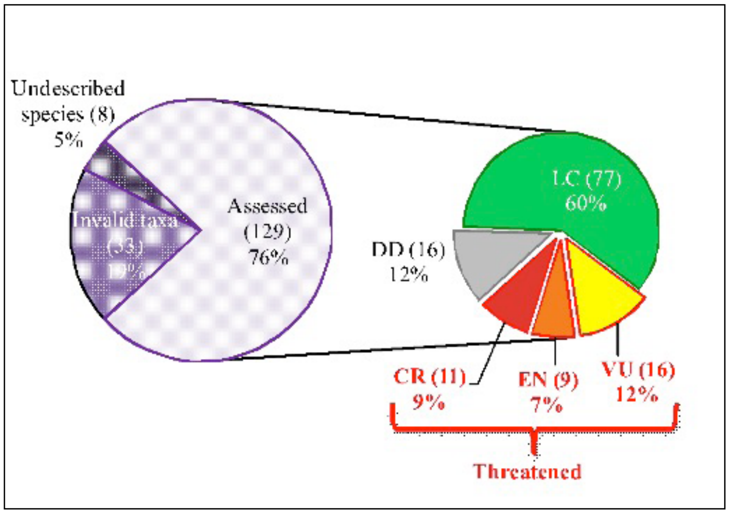

Figure 1. Pie charts showing distribution of South African katydid species in terms of Red List threat status. Numbers in parentheses indicate number of species; DD = Data Deficient, LC = Least Concern, VU = Vulnerable, EN = Endangered, CR = Critically Endangered.

So how are South Africa's katydids faring? Slightly over half (58% of assessed species) are of Least Concern (LC) (Fig. 1). Many of these species are widely-distributed generalist herbivores which show no signs of decline. Some of these species, such as the *Plangias* (*Plangia compressa* and *P. graminea*) and the Armoured Katydids (*Acanthoplus* spp.) are even facultative crop pests arguably in greater need of control than of conservation. A significant proportion of species (12%) are Data Deficient (DD) because the available information is just not enough to estimate their future trends. For example, the enigmatic Cederberg Shieldback (*Namaquadectes irroratus*) has only been encountered twice, in 1916 and 92 years later in 2008, despite many collecting trips and hours spent attempting to track it down.

Unfortunately, one-third of South Africa's katydids are of conservation concern, with 30% of species assessed as VU, EN, or CR. Among the six CR species is the world's only known Cave Katydid (*Cedarbergeniana imperfecta*; Fig. 2a). This species persists in a small number of high elevation caves within the Cederberg Wilderness Area in the Western Cape. The highly fragmented nature of the

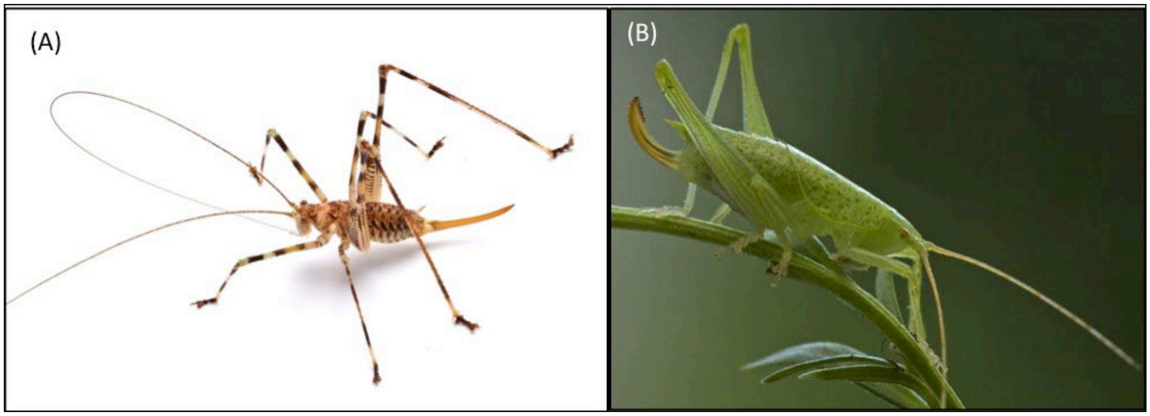

Figure 2. Two Critically Endangered South African katydid species: the Cave Katydid (a) and the Imperiled Grass False Shieldback (b). Photos by Piotr Naskrecki.

populations and their current distribution at peak elevations is of great concern. In the event of habitat destruction or change in climatic conditions within their caves, this species appears to have few options for survival. Similarly, the Imperiled Grass False Shieldback (*Paracilacris periclitatus*; Fig. 2b) was only encountered once in a small patch of remnant indigenous forest slated for cultivation to exotic plantation forestry in KwaZulu-Natal. At present, it's unknown whether this species survives or not.

Completing the Red List assessments is the first step in an on-going process to draw attention to South Africa's fascinating and threatened katydid fauna. Several student projects are underway and publications are in preparation to analyse katydid diversity patterns across South Africa and katydid utility for a rapid assessment technique (see e.g. Aileen Thompson's article in this issue).

Western Europe

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This report contains information on main events, like international and local meetings, as well as a count of the main outputs of research on orthopteroid insects during the current year.

Scientific meetings

The biennial meeting of the International Bioacoustics Council (IBAC) will be held in Murnau, Germany from 7th-11th September 2015. This meeting usually covers a diversity of topics in bioacoustics from humans to insects. Different topics are organized across specific symposia. This year, Dr. Tony Robillard from the Muséum national d'Histoire naturelle (MNHN) in Paris is the chair of the symposium of 'Acoustic communication of Arthropods'. As expected, this symposium will have a number of talks on Orthoptera bioacoustics. Other research outputs will be presented in four different poster sections at the end of each conference day.

Research in the different fields of Orthoptera bioacoustics (physiology, neurobiology, biomechanics, systematics, taxonomy, etc.) has, for decades, considerably advanced thanks to many important contributions by our German colleagues. Therefore, a significant participation of German Orthopterists is expected in this meeting. The IBAC meeting will also attract the participation of labs from other countries in and out of Europe, focusing on a diversity of bioacoustics research in various groups of arthropods and superior animals.

The German Society for Orthopterology

The DGFO (German Society for Orthopterology) holds a meeting every other year. The last meeting took place in Salzburg (Austria) in 2014, and the next one will be in the spring of 2016 in Trier (Germany). The DGFO is active and twice a year the society publishes a magazine called Articulata. The homepage of this society can be found in the following link http://www.dgfo-articulata.de/en/home.php

Major contributions to Orthoptera research

Recent outputs on the various areas of research on orthopteroid insects coming from European labs are listed below. Of course, there is a large number of scientific research on Orthoptera published, and the list below includes only large reviews or books, not specific papers.

1. A new edition of the book edited by Delvare, G. & Aberlenc, H.P., "Les Insectes du Monde, Biodiversité - Classification, Clés de détermination des familles", includes a chapter on Ensifera by Sylvain Hugel and Laure Desutter-Grandcolas. The book will be released soon this year.
2. A guide for identification of Orthoptera from France, Belgium, Luxembourg and Switzerland, by Sardet E., Roestli C. and Braud Y. This book will be released soon this year.
3. The MNHN in Paris has published an online guide for the identification of grasshoppers from Northwest Africa, edited by Laure Desutter-Grandcolas. Contributors to this publication are Louveaux A., Amédégnato C., and Poulain S. This guide contains photos of all the species, interactive keys for identification of families, genera and species, and distribution maps. It was originally published in French, and the contributors are working on the English translation. The material can be accessed in the following link: http://lncn.eu/bhrv5
4. The Journal of Comparative Physiology published in January 2015 a special Issue with the title "Insect hearing – from physics to ecology". This issue contains current research and reviews on auditory physiology and sensory ecology. A large proportion of the featured articles come from European laboratories focusing on crickets and katydid hearing. Articles can be accessed here: http://lncn.eu/bdiz
5. Axel Hochkirch is coordinating the elaboration of a red list of European Orthoptera for the UICN. This work receives contribution from several orthopterist groups from different European countries including Germany, Spain and Greece. A meeting IUCN was held in Agrinion/Greece on May 20th, 2015.

Theodore J. Cohn Research Grant Reports

Are finders always keepers? Understanding the influence of courtship residency on male contest outcomes in the Cook Strait giant weta (*Deinacrida rugosa*)

By **MORGAN D. DEPERNO**
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The genus *Deinacrida* (giant weta) is a clade of nocturnal, herbivorous, apterous Orthopterans belonging to the family Anosostomatidae. They are of Gondwanan lineage with eleven endemic species found in New Zealand, most exhibiting female-biased size dimorphism (Fig. 1). *Deinacrida rugosa* males are known to move great distances each night while foraging and searching for mates; size and mobility in males is thought to be under indirect sexual selection related to the scramble competition mating system (Kelly et al. 2008). The purpose of our study was to identify factors that influence contest outcomes between males competing for mating privileges. Previous work in our lab with *Deinacrida rugosa* demonstrated that, given equal access to a female, with neither male beginning courtship earlier than the other, that male size reliably predicts contest outcome. In this study, we asked how male residency influences contest outcomes. We hypothesized that males allowed to court a receptive female before encountering an intruding male competitor, thus holding an investment in the pairing, would compete more robustly and hold a contest outcome advantage over similar-sized intruder males. We also hypothesized that residency may offset the size advantage, with smaller resident males winning a larger proportion of contests than predicted by a simple size advantage model.

Figure 1. Female *Deinacrida rugosa*

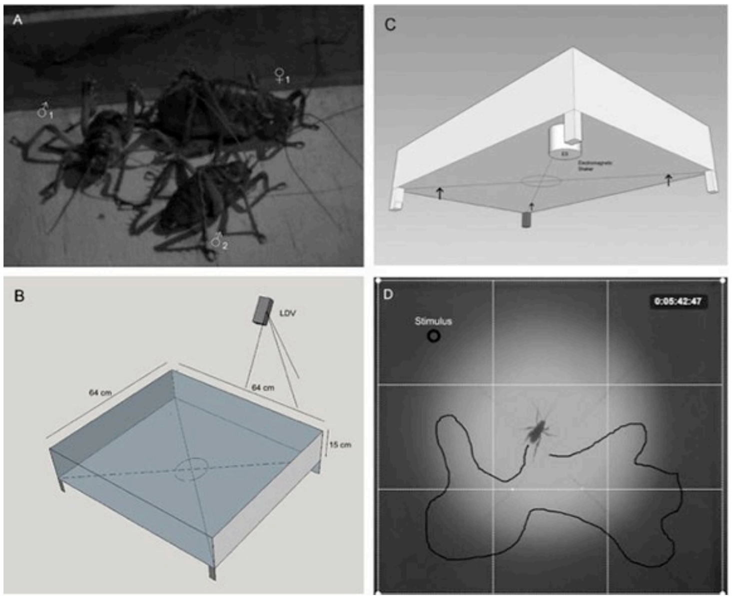

Figure 2. Males engaged in duetting contest for a female; arena prep from above (b) and below (c), and general male weta mate search pattern (d).

Methods

Site: *D. rugosa* were opportunistically hand-collected at Matiu Island Scientific and Historic Reserve (41.257° S, 174.865° E) on the North Island of New Zealand during the period 20-26 January 2015.
Measurements: To calculate a size parameter for each male, we measured right femur length and pronotal width using image analysis techniques in ImageJ software (http://imagej.nih.gov/ij/), and mass using a Pesola Micro-Line Spring Scale, 60g x 0.5g (Fig. 3). We included mass measures with Mass also measured to create a morphometric index for each of the males. This size index value was then used to determine contest pairings.
Treatments: In the presence of a receptive female, we conducted male-male contests in resident-intruder combinations. The two experimental treatments used were Same Size male combinations (< 1.0 SD size difference) and Different Size male combinations (larger-smaller, ±2 SD size difference) in a 2x3 design. All trials were conducted in a confined arena (Fig. 2), and digital recordings of male vibrational duets were collected during contest trials.
Analysis: During each trial we recorded the contest latency, duration, and outcome. Vibrational signals were recorded from the arena substrate with a Polytec PDV-100 portable laser Doppler vibrometer and Marantz PMD-661 portable digital audio recorder (24 bit/48 KHz). At trial outset high definition digital video was captured with a Logitech HD webcam and Sony HD video recorder for

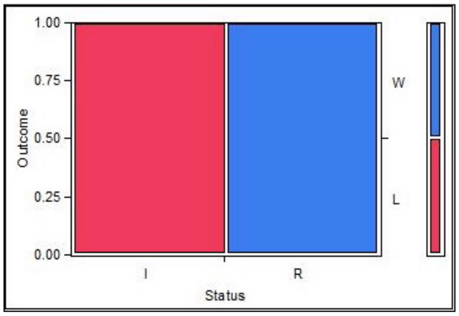

Figure 3. Mosaic plot of male status and contest outcomes in same size contest pairings. We found a significant relationship between residency status and outcome for same-sized contestants (Fisher's Exact Test, N = 4, P = 0.029), with resident males of equal size winning all contests.

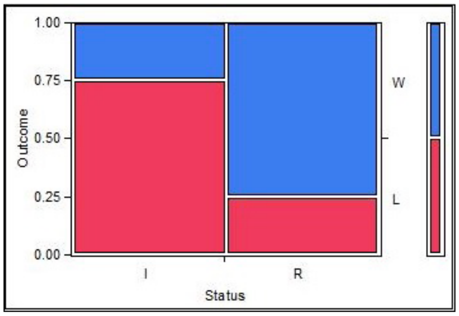

Figure 4. Mosaic plot of status and outcomes for asymmetric size contest pairings between small residents and larger intruders. A trend for smaller male residents winning (75% of the time) is a reversal from the typical condition in which larger males win; with the small sample the results fell short of significance however (Fisher's Exact Test, N = 4, P = 0.48).

purposes of coding contest outcomes. Trials were concluded when one of the males abandoned the courtship triad after a male-male vibrational duetting bout.

Results

A total of 20 females and 35 males were collected from the study site. The average morphological index value for females was 8476.17 and 3310.04 for males. We conducted ten trials with **same sized** males, four of which resulted in an outcome and clear contest winner. In these cases the two males competed for the female, participated in a vibrational duet, and one male abandoned the duet and courtship activities. If the males did not interact with the female or compete with each other the trial was excluded from analysis. In each of these successful trials, the resident male won the mating contest against the intruder male in all cases (Fig. 3; Fisher's Exact Test, N = 4, P = 0.029). Eleven trials were conducted involving males of **different sizes**. In these trials, three of the four trials in which males actively contested were won by the smaller resident male (Fig. 4; Fisher's Exact Test, N = 4, P = 0.48).

Main Findings & Discussion

Our research found that males with established residency (20 mins. of active courtship) held a contest advantage in contest where no male held a size advantage, but that this size advantage was eroded when smaller males had invested in courtship, and the larger male was a novel intruder into the pairing. This suggests that the male investment in courtship shifts the competitive balance in inter-male contests away from a simple size advantage model to something more complex and potentially related to a mate-guarding strategy.

In *D. rugosa*, given equal access to a receptive female, larger males hold a significant advantage in inter-male contests, mediating these through vibrational duetting bouts. When males are allowed to invest in solitary courtship, resident males tend to defend the female vigorously, initiate the vibrational duetting bout, and most often outcompete intruder males given equal contestant size. Our findings support our hypothesis that investment in courtship can extend to outweigh the advantage of size in some cases, with smaller resident males outcompeting larger intruder males, in effect exhibiting a form of the 'Napoleon Complex' (Just and Morris 2003). This investment in courtship may switch smaller males to exhibit higher levels of aggression as they display mate-guarding behavior.

Photo of the author at the field study site in New Zealand.

Acknowledgements

We would like to thank the New Zealand Department of Conservation and rangers Jo Greenman, Emma Dunning, Daryl Stephens, and the local Maori Iwi Taranaki Whānui ki Te Upoko o Te Ika and the the Harbour Islands Kaitiaki Board for approval of and support in conducting this research. I thank the Augustana College AURAFA program for funding to support travel to New Zealand, and the Orthopterists' Society's Theodore J. Cohn Research Fund for the financial support to conduct the research.

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Sexual communication and the species boundary in closely related *Teleogryllus* crickets

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Field crickets have long been renowned for their conspicuous advertisement calls, which play an important role in mate choice and are often species specific. However, the causes for divergence in communication systems and the consequences in regards to speciation and species coexistence are not well understood. Growing evidence, based on advances in genetics, is highlighting that species' boundaries may be more dynamic and porous than previously believed (Harrison & Larson, 2014).

As part of my Ph.D., I am examining the patterns of geographic variation in sexual signals and the nature of the species boundary in two closely related field cricket species, *Teleogryllus commodus* (Fig. 1) and *T.oceanicus*. These species provide an ideal study system to determine the role of sexual communication in species coexistence as there is a rich body of knowledge on their acoustic behaviour (e.g. Bailey & Macleod, 2013; Doherty & Hoy, 1985; Hoy, 1974). Both species overlap across a large area on the eastern coast of Australia (~23.37°S – 26.38°S latitude (Hill et al., 1972)) and are known to hybridize in the lab, but very little is known about the extent of species admixture in the wild. Calling song is the most distinguishable feature differentiating the species and has long been believed to play a critical role in maintaining the species boundary. However, despite the wealth of previous studies on these species' acoustic behaviour, the focus has almost solely been on allopatric populations, ignoring the potential contribution of interactions between the species (exception: Hill et al., 1972). In addition, almost nothing is known about the level of genetic divergence or evolutionary history of these species. The aim of this project is twofold:

1) Determine if the species hybridize in the wild and how discrete the species boundary is.

2) Identify the strength and form of the key reproductive barriers and the potential evolutionary forces which underlie them.

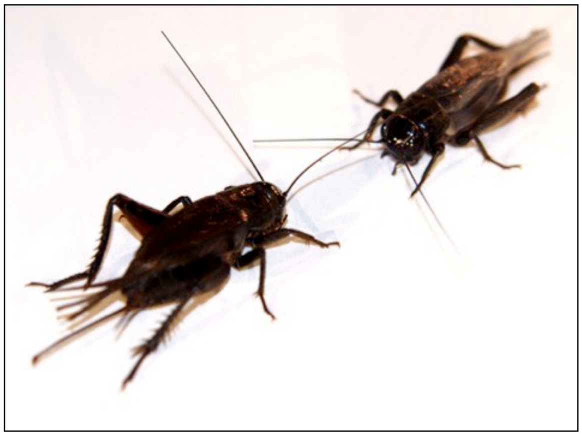

Figure 1. Laboratory photo of male and female *T. commodus* in close contact.

At the outset of the project, a fieldwork sampling trip was conducted from March to April 2013 across an extensive area of eastern Australia (~2,500km), encompassing the species' contact zone (Fig. 2.). Sampling involved identifying suitable sites during the day, which generally were grassy human disturbed areas, and then returning at night to collect and record crickets. In total, sixteen laboratory populations were initiated from eggs laid by wild caught females (Fig. 2.). Extensive recordings of calling song, from both the field and the F1 generation of common garden reared laboratory populations, were made. The two calling song datasets allow for a comparison between patterns of natural song variation in the field and inherent population differences, revealed by controlling for environmental sources of variation in the lab populations.

In the area of overlap we frequently encountered males of both species singing in very close proximity to each other, with no obvious environmental segregation. *T.oceanicus* appeared to predominate and calling song recordings of the F1 laboratory generations suggested all of the offspring from sympatric populations were of the *T.oceanicus* species. Analysis of calling song, from both the field and laboratory populations, allowed me to test if the species are reproductively isolated in the wild. As we know from previously published research (Hoy, 1974) and personal observations, hybrid song is intermediate for many parameters between the two species. Therefore, if the species are hybridizing in the wild we would expect intermediate song types in the area of overlap. However, the pattern of song variation amongst the field and laboratory recordings, revealed two distinct clusters reflecting the discrete species groups, with no evidence of hybridization.

Overall, the species distribution and apparent absence of hybridization is consistent with earlier findings from both Hill et al. (1972) and Otte & Alexander (1983) suggesting this pattern is stable, both temporally and spatially. On our last night of sampling in a small localized area of north eastern Australia, while wading around in a swampy, potentially crocodile-infested field, we encountered a third putative closely-related species, *T.marini*, singing amongst *T.oceanicus* males. This presumed species, which has only been described once, decades ago (Otte & Alexander, 1983), is easily recognized based on its dis-

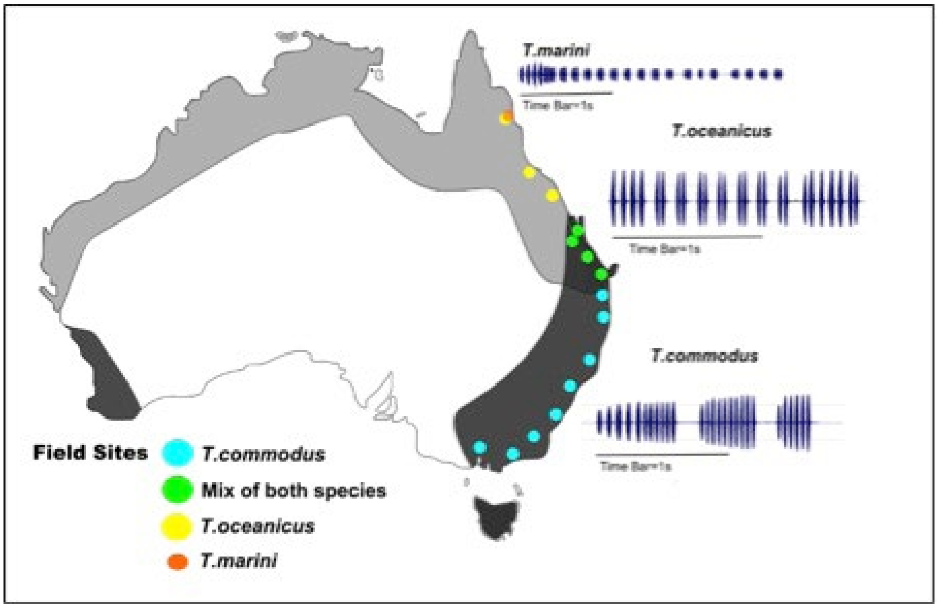

Figure 2. Map showing the sixteen field sites (coloured circles), the known distribution of the study species within Australia and oscillograms of each species calling song. *T.oceanicus* is distributed along the north (represented by light grey area), while *T.commodus* (dark grey areas) is mainly restricted to the south. Both species overlap in an area ~500km long on the mid-eastern coast. The yellow circles indicate allopatric populations of *T.oceanicus*, green sympatric populations of both species, and blue allopatric populations of *T.commodus*. The overlapping yellow and orange circles in the north represent the site where we encountered and sampled both *T.oceanicus* and the putative species *T.marini.*

tinct calling song, which has a lower carrier frequency and a drawn-out trill section compared to the other Australian *Teleogryllus* (Fig. 2.). Excitingly, this provides another contact zone in which we can examine the role of sexual communication in maintaining species divergence.

Following on from this, I'm currently examining chemical signals (cuticular hydrocarbons) and genomic data, sampled from individuals along the same population transect. Integrating the results from these phenotypic and genotypic traits to test if the patterns are concordant will provide powerful and comprehensive insight into the role of sexual communication traits in delimiting the species boundary.

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Sex or Death: Behavioral syndrome of a field cricket (*Gryllus* sp.) as a function for parasitoid avoidance

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Sexual dimorphism of secondary sexual traits (e.g., coloration, vocalization) is commonly observed in many species across varying taxa: the males of many species of birds have ornamental feathers and/or colorful plumage while females do not (Owens and Hartley, 1998; Cuervo and Møller, 2001); males of most species of frogs have vocal sacs while females do not; and usually, only male crickets have the stridulatory features to produce chirps. These secondary sexual traits function as mating signals to attract female conspecifics. Males with the most conspicuous displays are preferred by females and gain fitness by obtaining more mating opportunities than less conspicuous males (Thornhill and Alcock, 1983; Andersson, 1994). These preferred traits may undergo a directional selection and can become even more exaggerated in the subsequent generations. However, predation or parasitism exerts an opposing selection pressure on conspicuous males. Similar to female preference for more attractive signalers, predators/parasitoids also hone in on these conspicuous signals (Wagner, 1996; Zuk and Kolluru, 1998). Attractive males, therefore, experience a tradeoff between increased fitness and risk of mortality.

G13, an unnamed species of field cricket (*Gryllus*) found at Kofa National Wildlife Refuge (NWR), Arizona, faces these opposing selection pressures (personal observation). Males chirp to attract mates; however, their signals are often intercepted by female parasitoid flies, *Ormia ochracea* (Diptera: Tachinidae). These parasitoids deposit larvae on calling crickets, which then burrow into and consume the hosts from within. Approximately 7–10 days later, the larvae erupt from their hosts resulting in the death of the crickets. This parasitoid pressure, however, is not constant throughout the year. G13 is bivoltine, with adult emergence peaking in spring and autumn, while *O. ochracea* is abundant in autumn, but not in spring (David A. Gray, personal communication; Paur and Gray, 2011). Previous research on *Gryllus rubens* (similar life history as G13) documented that males in autumn populations called significantly less than males in spring populations due to the presence of *O. ochracea* in autumn (Vélez and Brockmann, 2006).

The significant reduction in the number of calling males in autumn could stem from one of two causes: (1) males adaptively decrease their calling effort due to parasitoid pressure, or (2) parasitoid flies preferentially target and eliminate the bolder male crickets that exhibit great calling effort. Wilson et al. (2010) found a positive correlation between calling effort (in terms of time spent calling per night) and exploratory behavior (correlated to boldness) for individuals of the European house cricket (*Acheta domesticus*) that were commercially bred. The bolder males in the study were found to emerge much quicker from their refuge to explore their surroundings. The findings of the study suggest that bolder crickets are more likely to be out of their refuge and calling, which makes these males more vulnerable to the predators and parasitoids. However, as the Wilson et al. study (2010) only used commercially-bred crickets, I am interested in applying the similar protocols to field-caught G13's. I predict that the autumn population of crickets will have a higher ratio of "shy" males to bold males. The results of this study can provide direct evidence that behavioral syndrome has a major role in fitness tradeoffs. Furthermore, this study can provide insight into the balance of sexual and ecological selection on conspicuous signals.

The first objective of my research is to determine if calling behavior of G13 varies seasonally as a result of differential parasitoid presence. I conducted monthly surveys at Kofa NWR (Yuma, Arizona; 33.36°N, 114.11°W, elevation of 648 m) starting in February, 2014, until November, 2014, to document the presence of (1) O. ochracea using sound traps (Walker, 1989) and (2) calling G13s by performing transect surveys. I was only able to capture a limited number ($n < 30$) of males from the field from both seasons to be used for song recording. Each field-captured cricket was kept separately in individual plastic tubs stored in a temperature-controlled dark room (27°C; 12:12 light dark cycle) and given ad libitum water and cat food and a section of egg carton for refuge. As some crickets had the potential to be parasitized, I started recording the males the first night they were brought back to the lab. Each individual was housed in sound-insulated chambers fitted with microphones and recorded using an audio data logger for five days. The means of total nightly calling time will be compared between the two seasonal populations using ANOVA.

The second objective of this study is to determine whether behavioral syndrome correlates with the seasonal variation of calling behavior. Previous research found crickets with a "shy" disposition to be risk-averse and called significantly less compared to "bolder" crickets (Wilson et al., 2010). I conducted laboratory experiments to assess shy/bold personalities of G13 males by measuring the duration of time that a male took to begin exploration of a novel area. Each male was placed inside PVC tubes (capped on one end) that were 12 cm in length and approximately 3.5 cm in internal diameter. The males were allowed to acclimate inside the PVC tubes with the capped end down for 2 minutes. Subsequently, the tubes were turned on their sides and the timers were started. The collected data from both components still need to be analyzed at a later date.

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Testing the effects of snow cover on hatching success in an Australian alpine grasshopper: the story of an ongoing field experiment

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Alpine environments cover 3% of the Earth's land area and contain a disproportionately high number of endemic species, each adapted to the long periods of seasonal snow that characterise these regions (Körner 2003). Snow forms a critical component of the ecology of high mountain regions, providing a thermally stable environment where temperatures typically hover close to 0°C and fluctuate by less than 2°C over the course of the winter (Körner 2003). This space is an important winter refuge for mountain fauna – both those that are active underneath the snow layer and those that overwinter in a dormant or inactive state.

At a global scale, substantial changes in mountain snow cover have occurred over the last 50 years, with the depth and extent of the snowpack declining in most mountain regions (Brown & Mote 2009; Stewart 2009). Loss of this insulating snow layer will mean that underlying communities are exposed to colder soil temperatures, an increase in freeze-thaw cycles and greater temperature fluctuations (Körner 2003). Despite this, only two studies (both from the Rocky Mountains in Colorado) have directly tested the effects of reduced snow cover on overwintering insects.

In Australia, snow seasonally covers only 12,500 km2. Spring snow depth has declined by 40% over the last 40 years (Nicholls 2005) and the extent of snow cover is predicted to decline by 20-85% by 2050 (relative to 1990; Hennessey et al. 2007). In this context, understanding how overwintering species might respond to a changing snowpack is urgent.

Grasshoppers are dominant herbivores in Australia's mountain regions and the alpine-endemic "chameleon grasshopper", *Kosciuscola tristis*, is the most abundant and widespread grasshopper above the winter snowline. This species lays eggs that overwinter in diapause, under the snow. The goal of this study was to examine the effects of reduced winter snow on the hatching success of these eggs. The project was carried out over two years, at two locations – Mt Stirling, Victoria (1,700 m.a.s.l) in 2013 and the Snowy Mountains, New South Wales (1800 m.a.s.l) in 2014. I collected egg pods from the field during the peak laying season in late March. The pods were then placed into individual mesh cages and submerged 1 cm below the soil surface in either experimental or control plots. Experimental plots were kept free of snow throughout the winter, while control plots were left to accumulate snow naturally (Fig. 1). Temperature loggers were also installed in each site to monitor conditions throughout the winter.

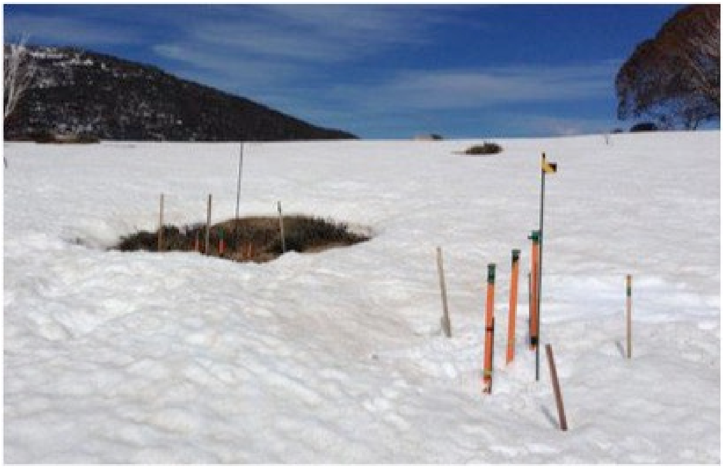

Figure 1. Experimental set-up: experimental plots (left) were kept free of snow throughout the winter, while control plots (right) were left undisturbed.

I'll first describe the part of the experiment that worked really well! Removing the insulating snow layer dramatically increased temperature fluctuations (mean: <0.5°C vs 6°C), exposure to cold extremes (absolute minimum: 0.1°C vs -4.8°C) and

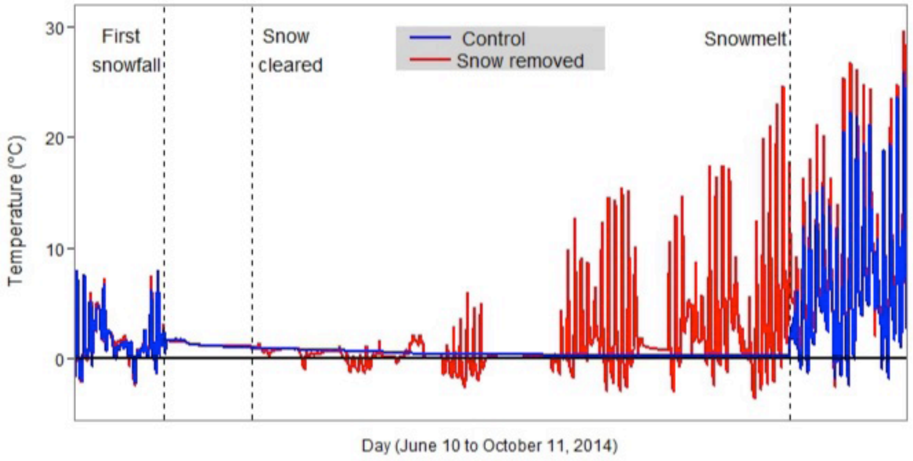

Figure 2. Near-ground temperatures following snow removal

the frequency of freeze-thaw cycles (0% days vs 46%). These effects are shown for one pair of sites in Fig. 2.

Unfortunately, the most exciting part of the experiment – how an altered thermal regime influences development and survival of *K. tristis* eggs in the field – has not yielded any results as of yet. In 2013, a ‘wildlife incident’ meant that most egg pods were lost prior to data on hatching success being recorded. The egg pods from 2014 were removed from the field in early Spring (to avoid the aforementioned wildlife issues) but are yet to hatch. The next step for the project is to try and induce hatching. Very little is known about the diapause of *K. tristis* eggs, however, so any ideas or suggestions are most welcome.

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Investigating the distribution of the IUCN Red Listed katydid species in South Africa

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Global biodiversity is centred in 34 biodiversity hotspots. Characteristically, these are areas of high endemism that are facing considerable threat, specifically from habitat loss. Although they only cover 2% of the earth’s surface, biodiversity hotspots contain up to 50% of all plant species and 42% of terrestrial vertebrate species. However, their efficacy at protecting invertebrates, insects in particular, remains unknown.

South Africa is one of few countries that can be considered as megadiverse, being home to not just one biodiversity hotspot but rather three, namely: the Cape Floristic Region, the Succulent Karoo and the Maputaland Pondoland Albany hotspots (Fig. 1). Mapping and understanding the distribution of diversity is important at a global scale, but it can be argued that it is essential in a megadiverse country, such as South Africa.

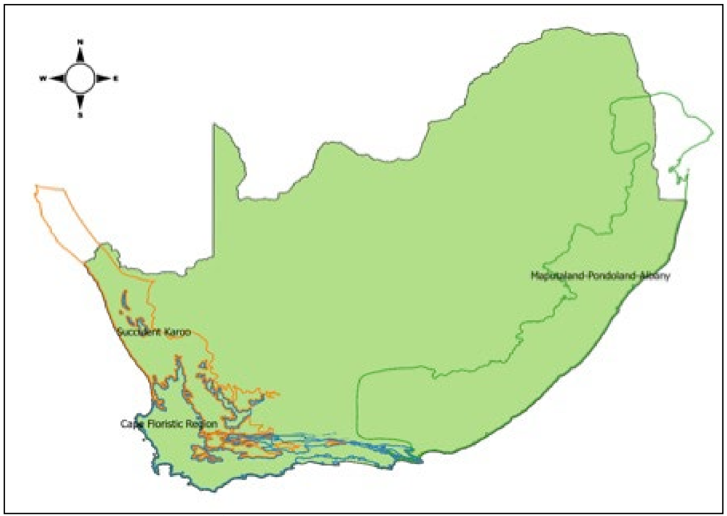

Figure 1. Location of the three biodiversity hotspots in South Africa

One way in which the distribution of biodiversity can be investigated is to look at regional species richness. A further step along is to include species specific information into regional assessments. In South Africa, there currently exists a rapid assessment method, the Dragonfly Biotic index (DBI), that uses dragonfly species as indicators of habitat quality (Simaika & Samways 2008). Each dragonfly species has been assessed according to its IUCN Red List status, distribution range and sensitivity to habitat change and allocated a score between 0 and 9. This allows mangers to as-

Table 1. Showing how mobility and trophic level were assessed

Score	Mobility	Score	Trophic Level
0	Flighted Species	0	Omnivorous
1	Only one sex flighted/partially flighted species	1	Predatory
2	Flightless Species	2	Herbivore (multiple plant species)
		3	Single host herbivore (single plant species)

Table 2. The Katydid Scoring System, showing how each category was assessed and scored. SA = South Africa, sA = southern Africa.

Score	Threat	Score	Distribution	Score	Life History Traits Sum
0	LC	**0**	Very common throughout SA and sA	**0**	0
1	VU	**1**	Localized across a wide area in SA, and localized or common in sA; or very common in 1 - 3 provinces and localized or common in sA	**1**	1 - 2
2	EN	**2**	SA endemic confined to 3 or more provinces; or widespread in sA but marginal and very rare in SA	**2**	3
3	CR	**3**	SA endemic or near-endemic and confined to only 1 or 2 provinces	**3**	4 - 5

sess the quality of riparian habitats by simply identifying each dragonfly species and adding the resultant species scores together to get a DBI value for the area. This allows for the comparison of multiple areas as well as to track changes in habitat quality within one area over time.

As of December 2014, 129 katydid (Orthoptera: Tettigoniidae) species found in South Africa were assessed according to the IUCN Red List criteria and assigned a threat status. As katydids are close relatives of grasshoppers, known indicators for grassland condition, it is believed that katydids possess the ability to be used as an indicator species within a rapid assessment method. Thus the Katydid Species Score (KSS) was developed. The KSS is based on criteria very similar to that of the DBI: threat status, distribution and life history traits. Drawing exclusively on the MANTIS database constructed and maintained by Piotr Naskrecki, species distributions were determined and, with the help of expert knowledge, each species was assessed with regards to its trophic level (host specific herbivore to omnivore) and mobility (flighted to non-flighted) (Table 1). As with the DBI, each of the three categories within the KSS was assigned a value between 0 and 3, preventing the score being biased towards a particular category (Table 2).

To illustrate how the KSS works, a Critically Endangered endemic species that is unable to fly and depends on a single host plant for survival will therefore score a value of 9 (e.g. the Cave Katydid, *Cedarbergeniana imperfecta* Naskrecki). While on the other hand, a Least Concern, widespread and highly mobile polyphagous species will score a value of 0 (e.g. the Robust Conehead Katydid, *Ruspolia ampla* (Walker)). This system ensures that vastly different species are directly comparable.

In order to determine where possible katydid hotspots occur in South Africa, all the GPS coordinates available in the MANTIS database were mapped, in GIS, onto a map of South Africa. Firstly, a grid consisting of 1o cells was drawn and the average KSS per grid cell was calculated. This highlighted a few areas of interest: the grasslands of the Drakensberg Mountains, as well as along the northern reaches of the West Coast, within the boundaries of the Succulent Karoo hotspot (Fig. 2A). Secondly, the average KSS values for the 9 terrestrial biomes of South Africa were calculated, although here the scale was too large for any real distribution patterns to be seen (Fig. 2B). Third and finally, the average KSS scores for the 44 bioregions were calculated (Mucina & Rutherford 2006). Drakensberg Grasslands and Cape Floristic Region were identified as important areas but it was the West Coast of the Succulent Karoo hotspot that was identified as containing the species that required the most conservation attention (Fig. 2C).

Consistently, the areas of interest lay within the Succulent Karoo and Cape Floristic Region hotspots, pointing to katydid assemblages within these areas that contain threatened

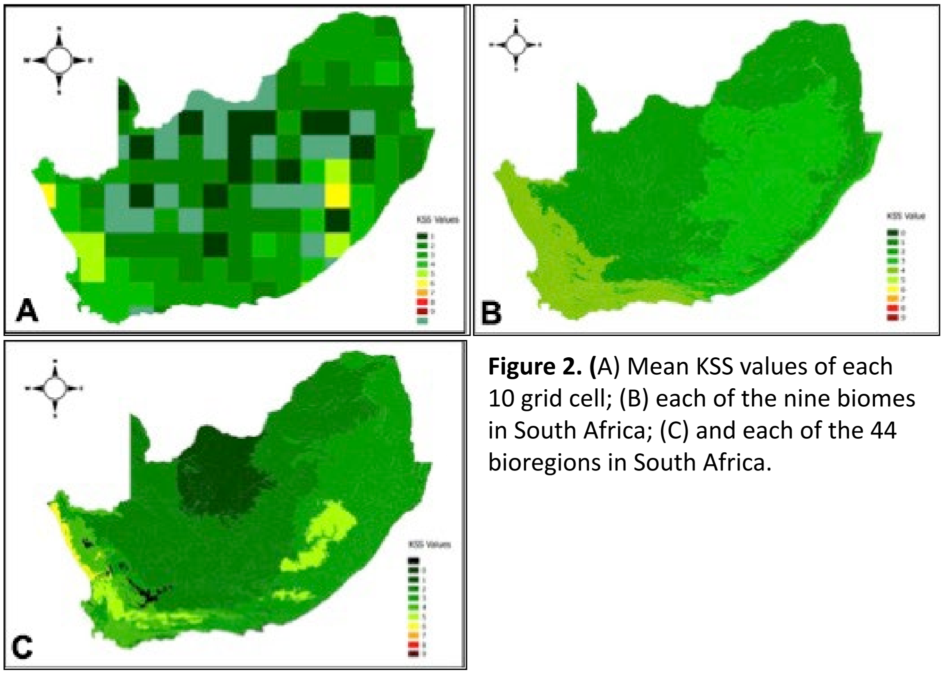

Figure 2. (A) Mean KSS values of each 10 grid cell; (B) each of the nine biomes in South Africa; (C) and each of the 44 bioregions in South Africa.

and endemic species with specialized life history requirements. Interestingly enough, though, is the presence of a katydid hotspot in the Drakensberg Grasslands where 25% of all grasshopper species are endemic (Foord et al. 2002). This could possibly hold true for the katydid species within these areas as well and help to explain the presence of this katydid hotspot.

Before we jump to any conclusions about the ability of katydids to be used as an indicator group, we will have to determine if the KSS method is representative of other taxa and further tests will need to be conducted, on smaller geographic scales, to see whether the KSS is able to accurately reflect the quality of a specific habitat, rather than large geographic regions that were tested in this project. As it currently stands, the KSS method has shown itself to be a successful tool with which katydids species can be compared against each other and so with adequate sampling of the South African katydids should be able to be used in order to systematically compare regions and hotspots of katydid diversity. If congruence is found between the KSS and other taxon distributions, it could be possible that the KSS could be further developed into a Katydid Biotic index that could be used, as the DBI is, to determine the health of terrestrial habitats and not just as a method to determine the location of katydid hotspots.

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Type diversity of Pyrgomorphidae

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Commonly known as the gaudy grasshoppers, the family Pyrgomorphidae currently consists of 477 valid species in 150 genera. They are mainly distributed in the Old World, but there are some genera known from Mexico, Central and South America and Australia as well. As part of the grant "Enhancing digital content for Pyrgomorphidae (Orthoptera: Caelifera) in the Orthoptera Species File" (PI Hojun Song and Co-PI Ricardo Mariño-Pérez) funded by the Orthoptera Species File, I had the opportunity to visit four museums in order to photograph type material and borrow non-type material for the creation of a synoptic collection.

1. The Academy of Natural Sciences of Drexel University, Philadelphia (ANSP), USA

Founded in 1812, ANSP contains more than 3.5 million specimens of insects of which more than 11,000 are primary types. Of those, 3,664 of them belong to the order Orthoptera. This high number is due to scientists, such as Samuel H. Scudder (1837-1911), Lawrence Bruner (1856-1937), Joseph L. Hancock (1864-1922), James A.G. Rehn (1881-1965), Morgan Hebard (1887-1946) and Daniel Otte. Other orthopterists that have deposited type material are D. Rentz, D. Pérez-Gelabert, P. Naskrecki, M.M. Cigliano, K. McE. Kevan, and N.D. Jago among others.

Concerning Pyrgomorphidae, there are types of 26 valid species described by K. McE. Kevan and his collaborators, who were the most prolific taxonomist who worked on the family. The type collection is rich in material from Tropical Asia and especially from Mexico (in Fig. 1 you can appreciate some of them).

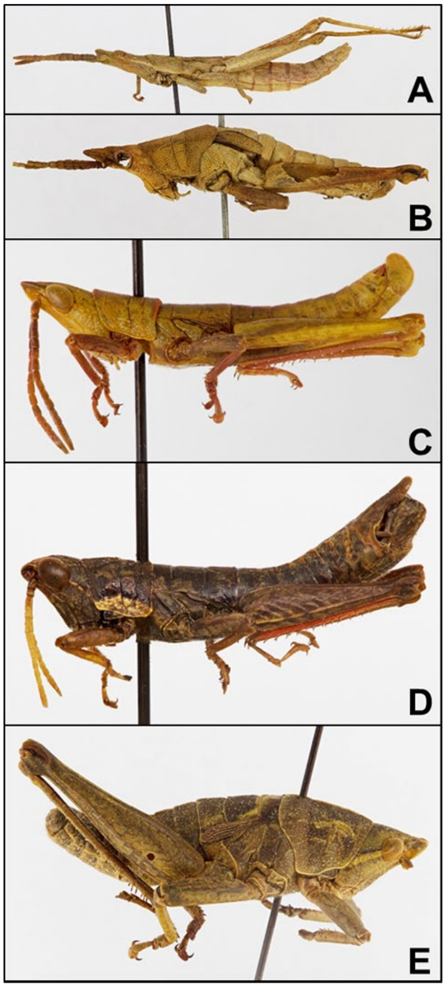

Figure 1 (right). Pyrgomorphidae types from ANSP. **A.** *Calamacris clendoni* Rehn, 1904 (♂, LT); **B.** *Prosphena scudderi* Bolívar, 1884 (♂, LT); **C.** *Sphenotettix nobilis* Kevan, Singh & Akbar, 1964 (♂, HT); **D.** *Piscacris affinis* Kevan, Singh & Akbar, 1964 (♂, HT); **E.** *Sphenarium rugosum* Bruner, 1906 (♂, LT). All from Mexico except B (Guatemala).

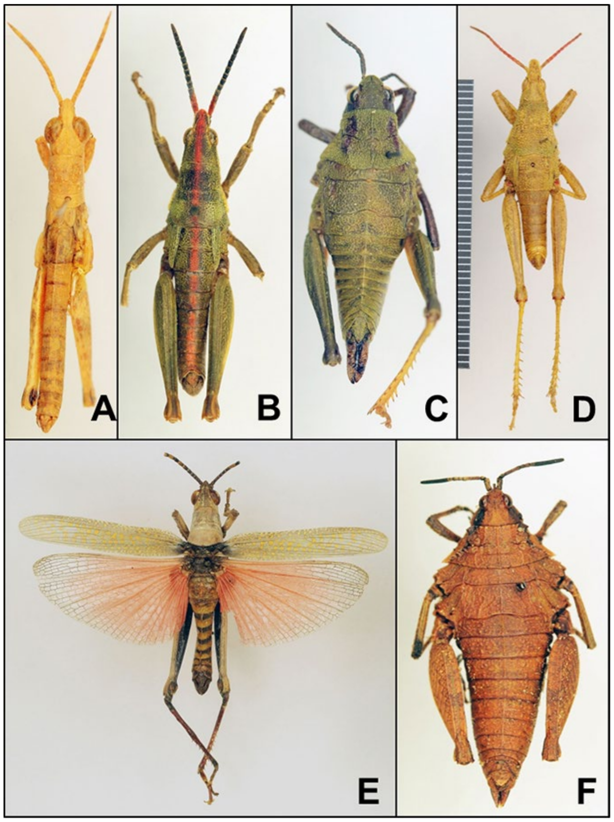

Figure 2. Pyrgomorphidae types from BMNH. **A.** *Popovia salvadorae* Uvarov, 1952 (♂, HT) Yemen; **B.** *Stenoscepa fusiformis* (Kevan, 1956) (♂, HT) Tanzania; **C.** *Mekongiella wardi* (Uvarov, 1937) (♀, HT) China; **D.** *Chirindites odendaali* Ramme, 1929 (♂, HT) Zimbabwe; **E.** *Poekilocerus arabicus* Uvarov, 1922 (♂, HT) Yemen; **F.** *Stibarosterna serrata* Uvarov, 1953 (♀, HT) Angola.

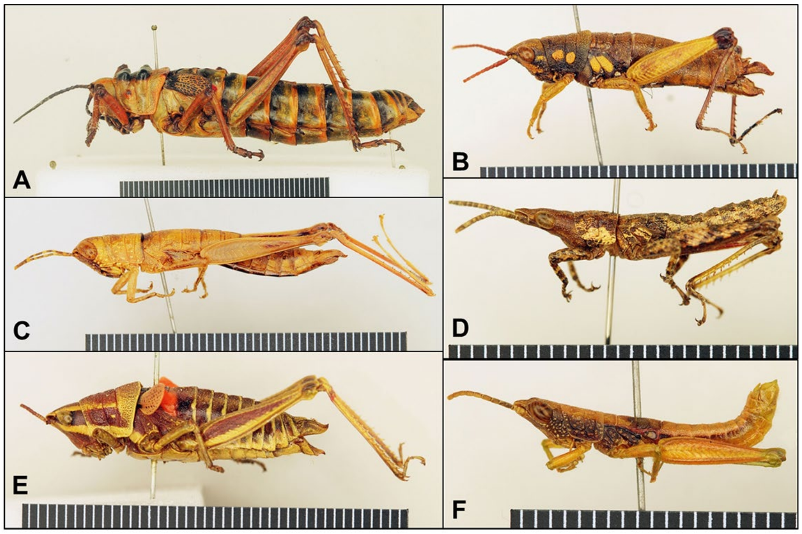

Figure 3. Pyrgomorphidae types from BMNH. **A.** *Paraphymateus roffeyi* Dirsh, 1962 (♀, HT) Somalia; **B.** *Kuantania squamipennis* Miller, 1935 (♀, HT) Malaysia; **C.** *Modernacris callosa* Uvarov, 1937 (♀, HT) Solomon Islands; **D.** *Xenephias socotranus* Kevan, 1973 (♂, HT) Yemen; **E.** *Monistria concinna* (Walker, 1871) (♀, HT) Australia; **F.** *Orthacris comorensis* Singh & Kevan, 1965 (♂, HT) India.

Apart from photographing the type material, I checked the worldwide collection of Pyrgomorphidae in order to select the best preserved identified specimens. It took me some days to carefully go through the 65 drawers one by one, but in the end I was able to obtain specimens of the best quality of around 200 species, in a lot of cases, both male and female. In this travel, I was accompanied by Dr. Hojun Song and Derek A. Woller who kindly helped me to complete this task. During the breaks it was a pleasure to have some lunches with Dr. Otte and on the last day we had a dinner to celebrate his wife's birthday. It was an honor to listen to endless field and museum experiences of Dr. Otte around the world. I remembered the way he referred to the leg position of mounted grasshoppers in different museums around the globe. Sharing the table with the people you know from reading their books is really a remarkable experience. His passion for Orthoptera is an inspiration to continue, unfortunately I don't even possess a 1% of his drawing skills, but I am compensating for that with photographs. A special thanks is given to the collection manager Jason Weintraub who kindly helped us in all the logistics of this trip.

2. The Natural History Museum (BMNH), London, United Kingdom

Formerly known as The British Museum of Natural History, it was founded in 1881. BMNH houses millions of insects for instance, 8 million specimens of Lepidoptera, 3 million specimens of Hymenoptera and 2.5 million specimens of Diptera. For Coleoptera it has type material of almost 100,000 species. Concerning orthopteroids, it houses 785,000 specimens in 4,639 drawers with 5,886 specimens as primary types. The Orthoptera collection comprises 378,000 specimens with 4,127 of those being primary types. These numbers are explained by the presence of Sir Boris P. Uvarov and Vitaly M. Dirsh who worked at the Anti-Locust Research Centre, which was established at the BMNH. There is also type material from J.C. Fabricius, F. Walker, C. Brunner von Wattenwyl, K. McE. Kevan, N.D. Jago, M. Descamps, and A.V. Gorochov among others.

Concerning Pyrgomorphidae, there are types of 109 valid species. Walker, Uvarov and Kevan were the most prolific authors. Although worldwide in scope, due to historical reasons associated with the United Kingdom the great majority of the material came from countries such as Kenya and South Africa, Saudi Arabia, Yemen, India, Sri Lanka and Australia. Other countries of Africa, China and Papua Guinea are represented as well. In Figs. 2 and 3 it is possible to appreciate such diversity.

For each type specimen I took 3 photographs: dorsal and lateral views and labels (Fig. 4), for the case of BMNH a number associated with the specimen was added to the label pictures. Additionally, a scale was positioned next to both lateral and dorsal pictures. As you can see the specimen is the holotype of *Petasida ephippigera* and there is an interesting story behind this specimen. Key (1969) explained in detail why this specimen was the holotype and added

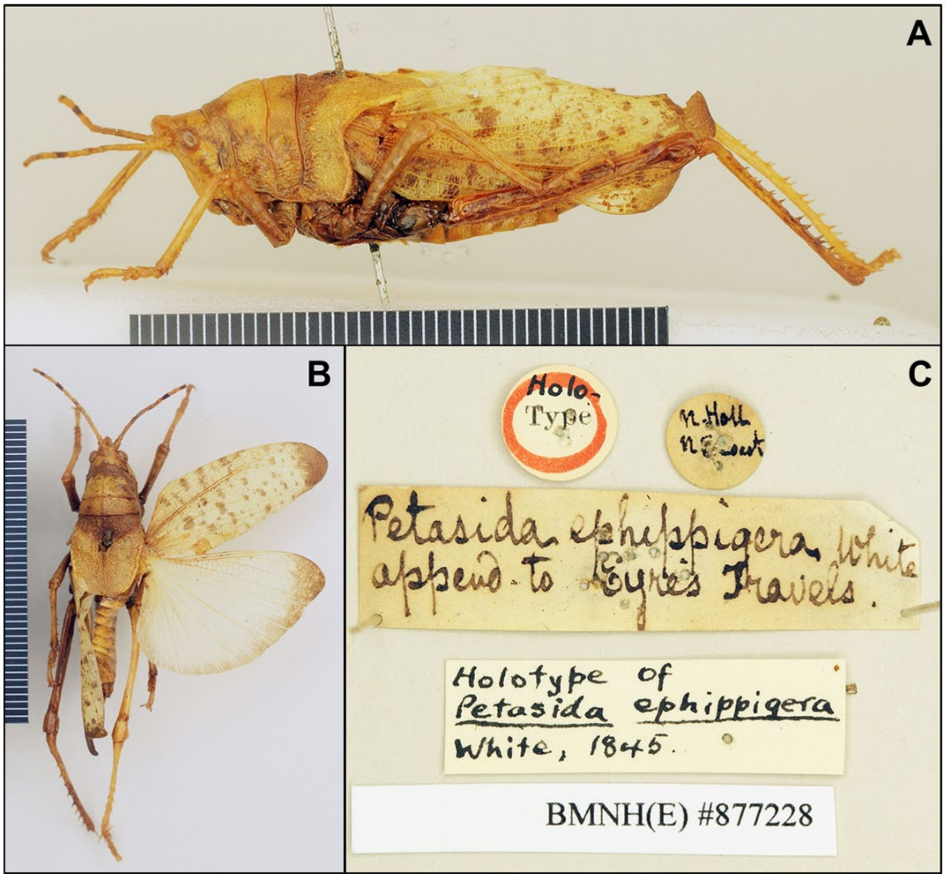

Figure 4. *Petasida ephippigera* White, 1845 (♀, HT) Australia. A. Lateral view; B. Dorsal view; C. Labels.

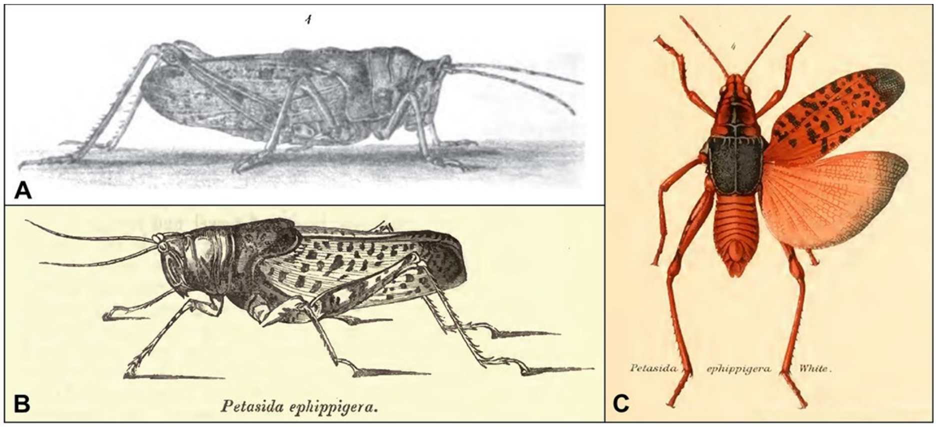

Figure 5. Illustrations of *Petasida ephippigera*. A. White, 1845; B. White, 1847; C. Bolívar, 1909.

the labels of holotype (red ringed) and the written explanation. In Fig. 5, three illustrations based on this specimen are provided. It is remarkable to be able to observe and photograph a specimen that despite the fact of being the holotype of such an amazing grasshopper has also been in this collection for 170 years and has been illustrated different times.

The curator of orthopteroids, Dr. George Beccaloni kindly provided me access to the collection, a workspace and helped me with the logistics of this trip. He was always on time to receive me early in the morning and allowed me to stay as late as possible in order to complete my task.

Also, Dr. Beccaloni provided me a database of Pyrgomorphidae types, which includes the drawer number. This information saved me precious hours considering the size of the collection. Dr. Beccaloni asked me to add a number label to each type specimen and at the end of my visit I left a copy of all the photographs for the museum's files. Something that I found useful was the way Dr. Beccaloni asked me to name the files, following the protocols of BMNH. For instance in the case of the Fig. 4, the files were named:

Petasida_ephippigera_White_1845_holotype_female_lateral_BMNH_BMNH(E)#877228
Petasida_ephippigera_White_1845_holotype_female_dorsal_BMNH_BMNH(E)#877228
Petasida_ephippigera_White_1845_holotype_female_labels_BMNH_BMNH(E)#877228

This way of naming files allows identifying them without seeing the images themselves. I realized the utility of this system and since then I have used it to name my files. It also has the advantage when I am uploading all these pictures into Orthoptera Species File because it allows faster uploading and an easy way to identify the files by me and other editors of OSF.

During the endless and enjoyable hours of pulling in and out drawers I had the opportunity to meet Dr. Judith Marshall, previous curator of the orthopteroids at BMNH, we talked for an hour and she was very enthusiastic about my work. She worked with Dr. Paolo Fontana from Italy on a book about mantids of the Euro-Mediterranean Area and it is precisely because of Dr. Fontana's invitation to collect Orthoptera in Mexico in 2007 that I started studying Orthoptera.

3. Muséum national d'historie naturelle (MNHN), Paris, France

Founded in 1793, MNHN houses 20 million specimens of Coleoptera, 7 million specimens of Hemiptera, 3 million specimens of Lepidoptera, 1 million specimens of Hymenoptera and 950,000 specimens of orthopteroids orders the great majority being Orthoptera and Blattodea. Concerning Orthoptera, 2,131 primary types are reported. The researchers associated

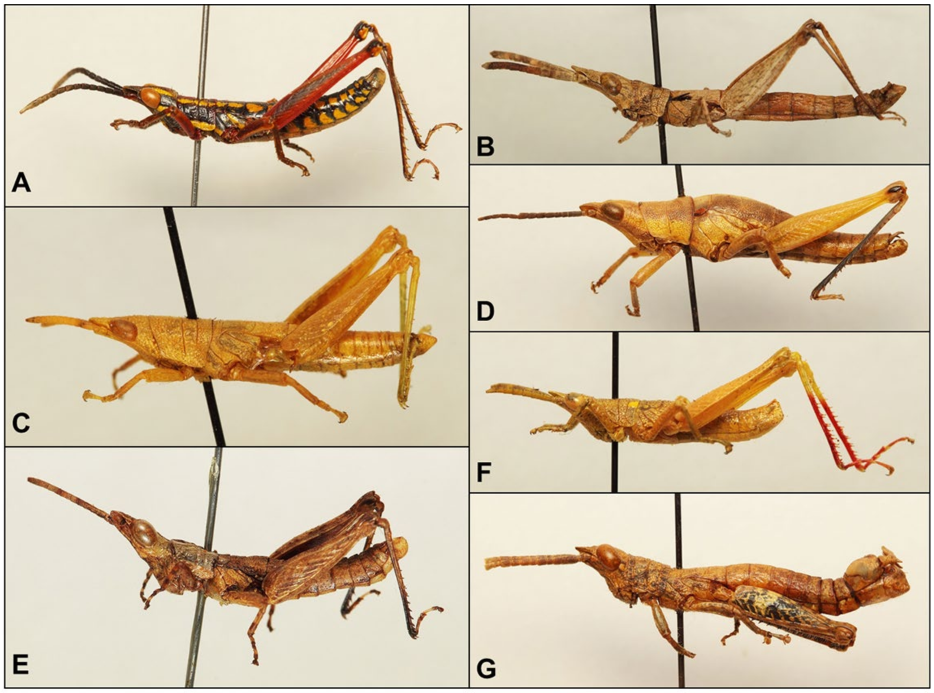

Figure 6. Madagascar type material from MNHN. **A.** *Pseudosphena dispar* (Dirsh, 1963) (♂, HT); **B.** *Geloius tanalanensis* Wintrebert, 1972 (♂, HT); **C.** *Pyrgohippus pallidus* Dirsh, 1963 (♂, HT); **D.** *Caprorhinus fotadrevensis* Kevan, Akbar & Chang, 1971 (♂, HT); **E.** *Pyrgomorphella minuta* Dirsh, 1963 (♂, HT); **F.** *Uhagonia wintreberti* Kevan, 1968 (♂, HT); **G.** *Pseudogeloius relictus* Dirsh, 1963 (♂, HT).

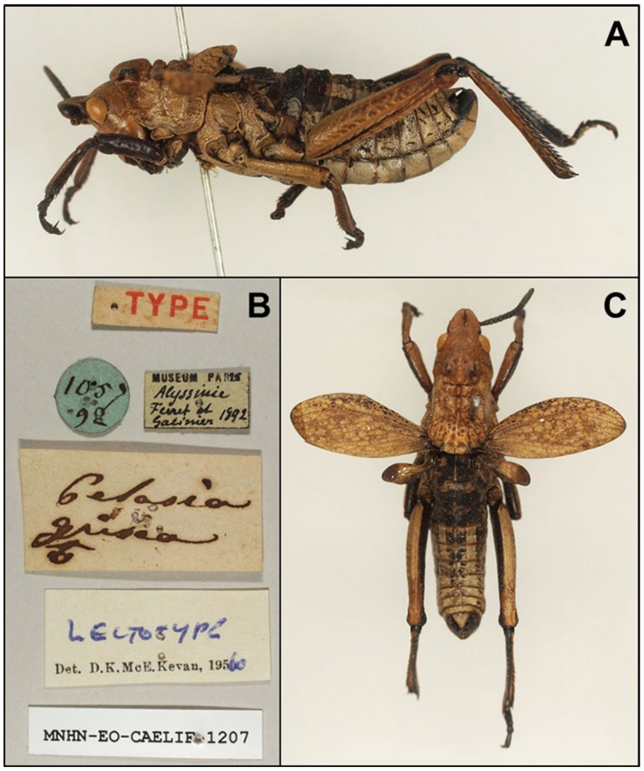

Figure 7. *Dictyophorus griseus griseus* (Reiche & Fairmaire, 1849) (♂, LT) Ethiopia. **A.** Lateral view; **B.** Labels; **C.** Dorsal view.

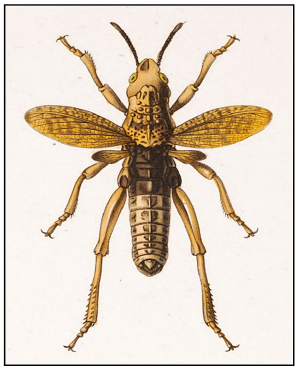

Figure 8. Illustration of *Dictyophorus griseus griseus* (as *Petasia grisea*) from Reiche & Fairmaire, 1849. Plate 28, fig. 2.

with these numbers are E, Blanchard, L. Chopard, M. Descamps, C. Amédégnato, L. Desutter-Grandcolas and T. Robillard. There is also type material of other authors such as J.G.A. Serville, I. Bolívar and A. Finot among others.

Concerning Pyrgomorphidae, there are types of 72 valid species. The great majority were described by Descamps and Wintrebert. Due to historical reasons the great majority of Pyrgomorphidae types are from Madagascar, although some from Mexico, India and continental Africa are present as well. In Fig. 6, a glimpse of Madagascar types is presented. Of special mention is the genus *Caprorhinus* from Madagascar, with primary type material of 23 out of 28 species deposited at MNHN and for the great majority of species the type series consists of dozens of paratypes of both sexes.

The curator of the Caelifera section, Simon Poulain, kindly helped me by sorting out all the types prior to my arrival which saved me hours. As in BMNH, Simon Poulain provided an extra label with a number for each specimen in order to be included in the label photographs (Figs. 7 and 9). This extra label will benefit the museum for database purposes and will save time for future references. Also as in BMNH I present here two cases of very old specimens. The first case is the lectotype of *Dictyophorus griseus griseus* (Fig. 7) and the illustration of the same specimen in the original work (Reiche & Fairmaire, 1849) (Fig. 8). I was shocked with the similarities between the photograph (Fig. 7C) and the drawing (Fig. 8). The details in colors and patterns are extraordinary; the diminutive hind wings are exquisitely illustrated. It is hard to believe that both images are 165 years apart. The second case is the holotype of *Chrotogonus homalodemus homalodemus* (Fig. 9) and its illustration from the original work (Blanchard, 1836) (Fig. 10). Although not in the same detail as the previous one, the illustration is remarkably accurate and based on the same specimen, but 178 years ago. For both species a lot of synonyms exist (13 for *D. g. griseus* and 7 for *C. h. homalodemus*) so it was imperative to have a photographic record for further revisions.

I really appreciated the hospitality of Simon Poulain at any given moment and I enjoyed all his field stories in Mexico, Central and South America with Dr. Christiane Amédégnato. His memory for places and localities (especially the Mexican ones with which I am familiar) was remarkable.

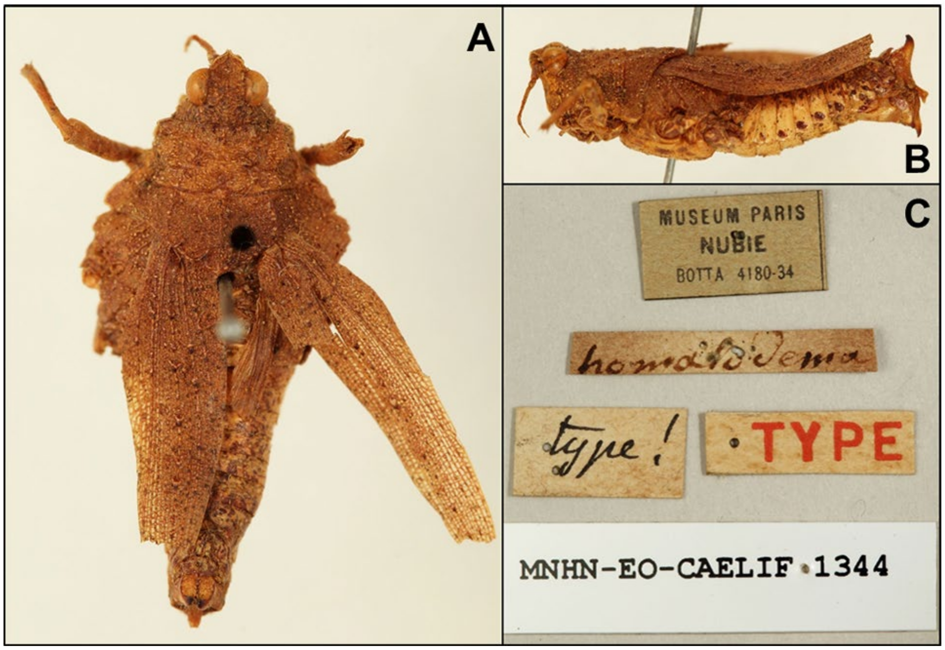

Figure 9. *Chrotogonus homalodemus homalodemus* (Blanchard, 1836) (♀, HT) Sudan. **A.** Dorsal view; **B.** Lateral view: **C.** Labels.

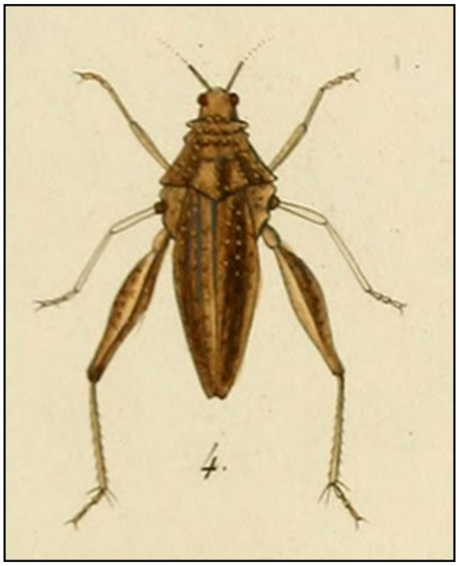

Figure 10. Illustration of *Chrotogonus homalodemus homalodemus* (as *Ommexecha homalodemum*) from Blanchard, 1836. Plate XXII, 4.

I was astonished by his perfect Spanish, which made a difference during my stay (my French knowledge is zero). I also want to thank Drs. Laure Desutter-Grandcolas, Tony Robillard, and Ranjana Jaiswara who kindly shared the table during their lunches in the museum cafeteria with me. It was nice to see a museum alive, where a lot of research is being done.

Also, I had the privilege to meet Dr. Roger Roy who is the oldest active Mantodea taxonomist. It was a pleasure to show him some photographs of live mantids I had taken on recent trips to Southern Mexico. Dr. Roy diligently identified the specimens in those pictures and showed me very old books with descriptions and drawing of Neotropical mantids.

4. Museum für Naturkunde (ZMHB), Berlin, Germany

Established in 1810, ZMHB has more than 15 million specimens of insects. The orders Coleoptera (6 million) Lepidoptera (4 million), Hymenoptera (2.2 million) and Diptera (1.3 million) account for the 90% of the specimens. In the case of Orthoptera, there are 2,105 primary types. This number is due to descriptions of C. Brunner von Wattenwyl, A. Gerstaecker, F.A.E. Karsch, K. Günther, W. Ramme. C. Bolívar and more recently A.V. Gorochov, S. Ingrisch and C. Hemp among others.

In the particular case of Pyrgomorphidae, there is primary type material of 49 species. For historical reasons the great majority of the material is from Tanzania (part of Deutsch-Ostrafrika), Cameroon and Congo (part of Kamerun) and northern Papua New Guinea (Deutsch-Neuguinea). There is also material from other countries of Africa, Mexico and particularly other parts of Malesia (Philippines, Indonesia). The great majority described by Karsch and Ramme. In Figs. 11 and 12 some of the type diversity is presented.

As in the previous two museums, in Fig. 13 I present the three pictures taken per specimen. For the case of all

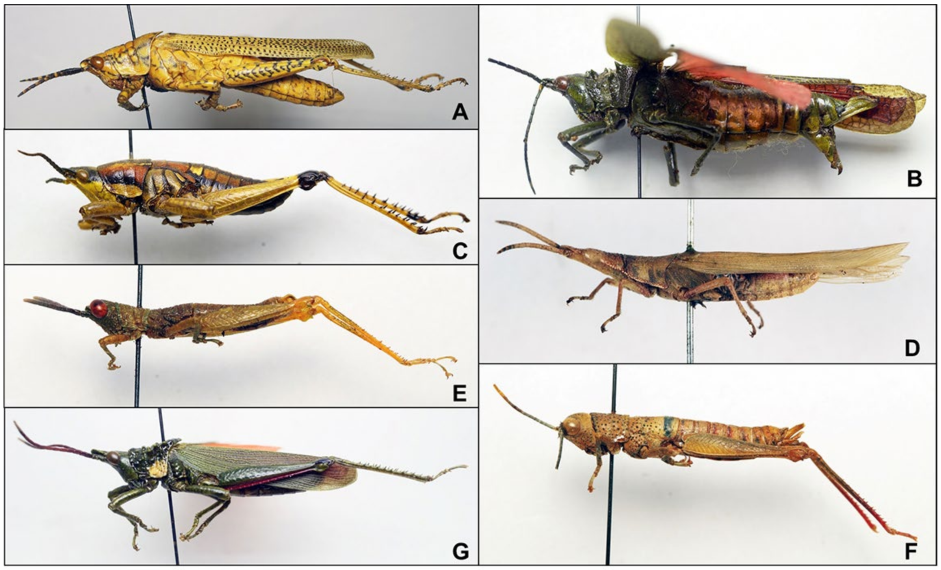

Figure 11. Pyrgomorphidae types from ZMHB. **A.** *Poekilocerus bufonius hieroglyphicus* (Klug, 1832) (♂, LT) Indonesia; **B.** *Taphronota cacuminata* Karsch, 1893 (♀, HT) Togo; **C.** *Sphenarium mexicanum histrio* Gerstaecker, 1884 (♂, ST) Mexico; **D.** *Atractomorpha angusta* Karsch, 1888 (♂, ST) Indonesia; **E.** *Buergersius olivaceus* Ramme, 1930 (♂, HT) Papua New Guinea; **F.** *Tarbaleopsis tuberculata* Ramme, 1930 (♀, HT) Papua New Guinea; **G.** *Taphronota occidentalis* Karsch, 1892 (♂, LT) Cameroon.

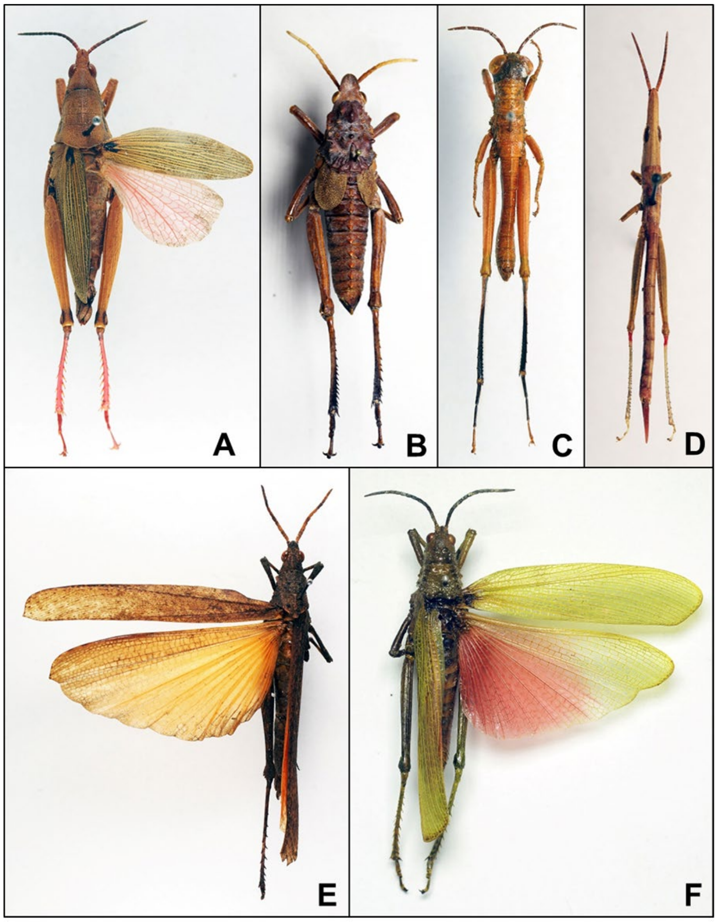

Figure 12. Pyrgomorphidae types from ZMHB. **A.** *Tagasta striatipennis* Ramme, 1941 (♀, HT) Philippines; **B.** *Loveridgacris impotens* (Karsch, 1888) (♂, HT) Tanzania; **C.** *Paratarbaleus novaeguinae* (Ramme, 1930) (♂, HT) Papua New Guinea; **D.** *Psednura pedestris* (Erichson, 1842) (♂, LT) Australia; **E.** *Stenoxyphus aurantiacus* (Karsch, 1896) (♀, HT) Papua New Guinea; **F.** *Phyteumas purpurascens purpurascens* (Karsch, 1896) (♂, LT) Tanzania.

the type material deposited at German Museums, an extra label from DORSA was added. DORSA stands for "**D**eutsche **Or**thopteren**sa**mmlungen" (German Orthoptera Collections in English). DORSA is a specimen-based database of Orthoptera collections held in German Museums. One important characteristic of this database is that is mutually linked with Orthoptera Species File so both are complementary. Before this grant, the only 86 available color images of Pyrgomorphidae types were made by Dr. Otte and DORSA.

In Fig. 14 two of the original illustrations of *Sphenarium purpurascens purpurascens* are shown. There is strong evidence that those drawings correspond to the lectotype (Fig. 13). Kevan left a label indicating this relationship. This species apart from being the type species of the genus is very special for me. As many of you know, some species of the genus *Sphenarium* are used as human food in Mexico and this one is the most common one. This species is also a plague in central and northern Mexico and due to its abundance it has been present in the backyard of my parent's house since I was a kid. Even these days I still grab some of them to teach others how to distinguish the male from the female (despite the fact that they always regurgitate on my hands). I would have never imagined 20 years ago that one day I would have in my hands the primary type and even less that is at least 172 years old.

The curator of the Orthoptera section, Dr. Michael Ohl, was very kind and helped me with all the logistics involved in this visit.

In total for the four museums, 1,437 photographs from 479 type specimens were taken and are in the process of being uploaded to OSF.

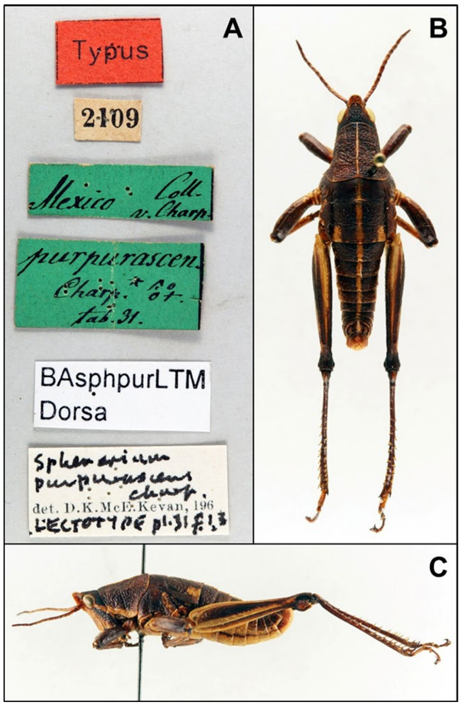

Figure 13. *Sphenarium purpurascens purpurascens* Charpentier, 1842 (♂, LT) Mexico. **A.** Labels; **B.** Dorsal view; **C.** Lateral view.

Figure 14. Illustrations of *Sphenarium purpurascens purpurascens* (as *Sphenarium purpurascens*) from Charpentier, 1842. Plate XXXI, 1,3.

Acknowledgments

Orthoptera Species File for funding, the curators and researchers from ANSP, BMNH, MNHN and ZMHB. Dr. Holger Braun for all his comments and suggestions related to edit entries and upload images to OSF. Derek A. Woller for taking all of the type pictures from ANSP. Dr. Hojun Song for his support through these years.

Re-discovery of a species thought to possibly be extinct: *Melanoplus foxi* (Acrididae: Melanoplinae)

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Since 2006, JoVonn and I had each independently tried in vain over the course of many field excursions to find specimens of *Melanoplus foxi* (Fig. 1), a member of the Melanoplinae Puer Group from the U.S. state of Georgia. JoVonn was simply curious about it because he had captured just about all other known brachypterous *Melanoplus* species from the state and was astonished at the difficulty he was having. I wanted the species for a different reason: my research is focused on examining speciation in the Puer Group, which is comprised of 24 *Melanoplus* species distributed across five southeastern U.S. states, primarily Florida. The backbone of my project is a molecular phylogeny and *M. foxi* was the one species that, so far, I had been unable to acquire fresh tissue from. I even tried using museum material, but failed to acquire any usable data.

Described by Hebard in 1923 and named for its original collector, Dr. Henry Fox, *M. foxi*'s type locality is Macon, Georgia and its habitat has been described by its collectors as being composed of longleaf pine (*Pinus palustris*) and scrubby undergrowth, fairly typical for other Puer Group members. However, JoVonn and I had each been to the general site as well as other sites in the region pulled from specimen locality data and mentions of the species in publications and found no trace of *M. foxi*, only other brachypterous *Melanoplus* species that belonged to different groups. We surmised that this might be because longleaf pine habitats have largely disappeared from Georgia with the exception of southern parts of the state and plantations that are often kept free of undergrowth and from which pine needles are collected frequently to be sold as mulch. Furthermore, there are only 35 specimens known from four U.S. museum collections with the most recent being from September 3, 1937.

Given the habitat degradation and long period of time since its last collection, JoVonn and I were considering the possibility that *M. foxi* was extinct. However, as the title of this short piece indicates, we managed to find the species again in mid-May of this year thanks to the additional discovery of 71 specimens hiding within the undetermined Melanopline specimens that I borrowed along with all of the University of Michigan's Museum of Zoology's Puer Group holdings (largely collected by Theodore H. Hubbell). These specimens were mainly collected by Hubbell and the late Ted Cohn during June of 1953 and 1956, respectively. Having more recent specimens gave us some hope, but even more exciting was that the locality data from these specimens combined with original field notebook entries from both gentlemen revealed exact property boundaries in an area that I had looked in twice before (Spring and Fall of 2014).

With new data in hand, we set out to look for *M. foxi* once more, this time together. At first, we were disheartened because all of the sections of property noted by Hubbell and Cohn have largely been either re-planted with different trees, destroyed, or simply allowed to grow out of control. Oddly enough, we finally found our prize within the boundaries of Seminole State Park, in a sandhill-like habitat, just outside of any of the areas in which Hubbell and Cohn found specimens and, hilariously, just around the corner from a site that I looked in the previous year. Over a length of time, we managed to capture a fair number of specimens (don't worry, many more eluded capture), all nymphs except for a single adult male, which was used to definitively identify the species. We are each currently raising the nymphs in our labs and having much success. I will soon extract the DNA and add it to

Figure 1. Live photo of a male of *Melanoplus foxi* (Photo credit: D.A. Woller).

my study, something that I thought might not be possible. We are both ecstatic that the site is a protected one, but obviously this species is having a harder time adapting to shifts in habitat unlike the majority of encountered melanopline species.

The re-discovery of this species took persistence, luck, and the assistance of invaluable specimen data, reinforcing the need for museum specimens (and their associated field notebook data, when possible). Without these things, we may never have found this species again, which would not only have been a loss for science, but orthopteran biodiversity as well because *M. foxi* is quite unique morphologically.

Rerefence

Hebard, M. 1923. An interesting new species of the genus *Melanoplus* from Central Georgia (Orthoptera, Acrididae). Entomological News, and Proceedings of the Entomological Section of the Academy of Natural Sciences of Philadelphia. 34:260-262.

Editorial

By HOJUN SONG
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This spring semester has been a pretty busy one for me. There were several major grant proposal deadlines to meet and manuscripts to turn around, in the midst of trying to finish setting up my new lab. My lab is slowly taking shape and hopefully soon I will be able to do some actual science! My two students, Derek and Ricardo, are adjusting well to the new school, which is good news. But, I am also looking forward to having new students in my lab. So, if you know any student who is interested in pursuing graduate work, I'd be happy to talk to you about some possibilities.

As usual, this issue is full of interesting articles. We have several grant reports, regional reports, and member-contributed articles. I would like to thank all those who have contributed to this issue. I would also like to thank our associate editor, Derek A. Woller, for his continued assistance in the editorial process.

Metaleptea is an excellent outlet to communicate to our members around the world. There is no limit on what we can publish: articles, stories, photos, artwork, etc. However, specifically, I would like to solicit the following types of contributions for all future issues:

-Collecting travelogues
-Museum visit travelogues
-Highlights of your peer-reviewed publications
-Photography/collecting techniques
-Collecting techniques
-Personal stories

To publish in *Metaleptea*, please send articles, photographs, or anything related to orthopteroid insects to hsong@tamu.edu [please note that this is my new email] with a subject line starting with [Metaleptea]. As for the format, 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 2015, so please send me content promptly. I look forward to hearing from you soon!

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