

METALEPTEA

THE NEWSLETTER OF THE



ORTHOPTERISTS' SOCIETY

President's Message

By **MICHAEL SAMWAYS**President
samways@sun.ac.za

In this age of decline of biodiversity worldwide, it is essential that we have in place sentinels of change. We require organisms to measure deterioration of landscapes, but also their improvement. Improvement can be through land sparing (the setting aside of land for the conservation of biodiversity in an agricultural production landscape) and land sharing (the combining of production and conservation within agricultural fields). We also need to measure optimal stocking rates for domestic livestock.

It is fascinating how researchers around the world are finding that grasshoppers are excellent sentinels for signalling how well we are doing in terms of land of land stewardship. Grasshoppers are good indicators of land quality, whether set-aside patches in an agricultural matrix or how well we are integrating conservation and production for a sustainable future. They are also telling us how well we are managing the landscape. It is not just the number of species that give us this picture, but the proportional abundance of individuals in the different species. This is because the various species not only have particular life styles and habitat preferences, but also different tolerances to landscape change. There are some patterns emerging globally that have similarities in responses by the various grasshopper assemblages across the world. Not surprisingly, the identity of the



focal species varies with area, but the cross section of life history types is remarkably similar.

What this means, apart from the enormous practical value of grasshoppers, is that we need to keep abreast of taxonomy, simply because we must have actual identities. It is immensely valuable to describe new species of Orthoptera generally, not only because they are among the most fascinating animals on the planet, but also because they have enormous value in steering conservation in a most useful direction. We can all play a role here and describe species that we have found to be clearly new species to science.

We also have an ideal vehicle for doing this, and that is the *Journal of Orthoptera Research*, which now has a long pedigree. On this note, we welcome on board Dr. Corey Bazelet as the new Editor of *JOR*. Corey has had an exemplary career, combining various fields of orthopterology. She has produced some fine publications in ecology, conservation, and biogeography. Interestingly, she has also

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

[1] PRESIDENT'S MESSAGE

[2] SOCIETY NEWS

[2] *New Editor's Vision for JOR* by CORINNA S. BAZELET

[3] *Orthopteroids set to steal the spotlight once again at ESA, 2015* by DEREK A. WOLLER

[4] *Open Call for Proposals for Symposia, Workshops, Information Sessions at ICO 2016* by MARCOS LHANO

[5] *Announcing the publication of "Jago's Grasshoppers & Locusts of East Africa: An Identification Handbook"* by HUGH ROWELL

[8] REGIONAL REPORTS

[8] *India* by ROHINI BALAKRISHNAN

[9] T.J. COHN GRANT REPORTS

[9] *Evaluating call variation and female decisions in a lekking cricket* by KIT KEANE

[11] *On the origin of the New World Pyrgomorphidae* by RICARDO MARIÑO-PÉREZ

[13] *On the "forgotten" genus Diponthus Stål: one of the most diversified genera of Romaleini (Acridoidea, Romaleidae) from South America* by MARTINA E. POCCO

[15] *Locust odorant receptor LmigOR1 is involved in sensing food odors* by YINWEI YOU

[16] CONTRIBUTED ARTICLES

[16] *Arizona Records of Campylacantha olivacea (Scudder) (Orthoptera: Acrididae)* by ROBERT A. BEHRSTOCK and PATRICK H. SULLIVAN

[18] *Orthopteroids in the exhibition "Zoology in the Mexican Art"* by RICARDO MARIÑO-PÉREZ

[19] EDITORIAL

made a huge contribution, along with Piotr Naskrecki, to the taxonomy of grasshoppers and katydids in southern Africa.

Corey has as one of her aims for *JOR* to get it recognized as an es-

tablished international journal with Thomson Reuters Web of Science recognition and, eventually, an impact factor rating. I appeal to all orthopterists to support her in this endeavour so that we may look forward to a

journal that is not only read by all orthopterists but also by those in other fields who seek to learn more about Orthoptera.

New Editor's Vision for *JOR*

By **CORINNA S. BAZELET**

Editor, *JOR*

cbazelet@sun.ac.za

For those who are not yet aware, as of July 2015, I have taken over from Sam Heads as editor-in-chief of the *Journal of Orthoptera Research (JOR)*. First and foremost, I would like to thank Sam Heads, the Orthopterists' Society board members, Nancy and Glenn Morris, and everyone else who has supported me to make this transition as smooth as possible. I greatly appreciate your vote of confidence in my abilities to fulfill the functions of a successful editor, and I look forward to much fruitful collaboration and continued success of *JOR*.

My first acts as editor have been to ensure that there are no gaps in editorial or review processes, so that we will have a strong issue ready for publication in December, 2015. I have also taken stock of the current state of *JOR* – its strengths and weaknesses – and, with the help and consultation

of many people, come up with a list of priorities for the future direction of *JOR*.

JOR has been published continuously since 1992, and has, to date, published 566 research articles and reviews. In 2001 (Volume 10), publication moved from one issue per year to two, published in June and December. On average, 25.5 research articles per year have been published since *JOR*'s inception (Fig. 1).

JOR is the only journal publishing work specifically on the Orthoptera, Phasmatodea, and Mantodea insect orders, with Caelifera as the subject of just over half of all articles (Fig. 2A). Research topics are widely varied, and range from taxonomy and systematics (most common, 38% of all articles), to various aspects of ecology (24%), to rearing and sampling methodologies (least common, 2%; Fig. 2B).

After much deliberation with the OS board and various members (special thanks to Michel Lecoq and Michael Samways for valuable input on this topic), it is clear that without an ISI rating and impact factor, the future of *JOR* is uncertain. Therefore, my main focus as editor will be to achieve an ISI

rating for *JOR*. In order to do this, a few guidelines are clear: 1) *JOR* must be published regularly and on time – I will be working closely with Nancy Morris to ensure that regular publication deadlines are met; 2) *JOR* must contain high quality and oft-cited science; 3) *JOR* must occupy a unique niche and not duplicate efforts of an existing ISI rated journal (see Fig. 2B); and 4) *JOR* should publish authors who are internationally diverse, in order to ensure that the journal is of interest on a global scale (see Fig. 2C).

Some criteria are already met while others present a challenge. In order to ensure regular publication, it is crucial that we have a healthy backlog of submitted manuscripts and that editors, reviewers, and authors perform their activities thoroughly and in a timely fashion. Nancy Morris and I will instate deadlines along each step of the editing process, and I kindly request that each member comply with these timelines to the best of their ability.

Getting an ISI rating for *JOR* will be a team effort and I am hopeful that, together, we can ensure the future success of *JOR*. I would like to thank each person who has, so far, contributed to *JOR* in the role of editor, reviewer, or author. Most importantly, I would like to call on each OS member to submit manuscripts for publication in *JOR*. Small-scale, Orthoptera-specific research projects, empirical observations, or in-depth analyses, which will enhance our understanding of Orthoptera biology,

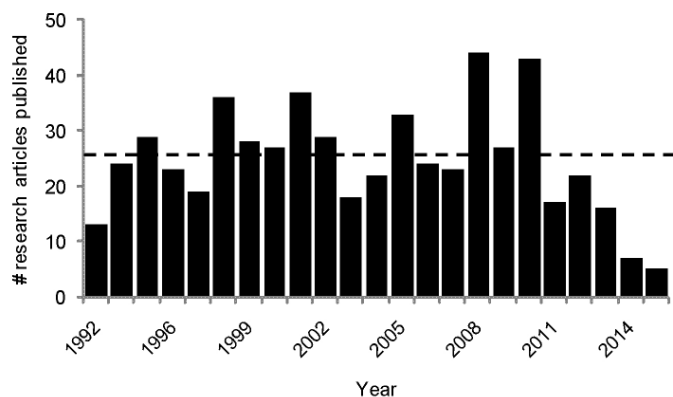


Figure 1. Bar graph showing the number of research and review articles published per year in *JOR* since 1992 (excluding letters and corrigenda). Dashed line indicates the mean number of articles per year from 1992-2014.

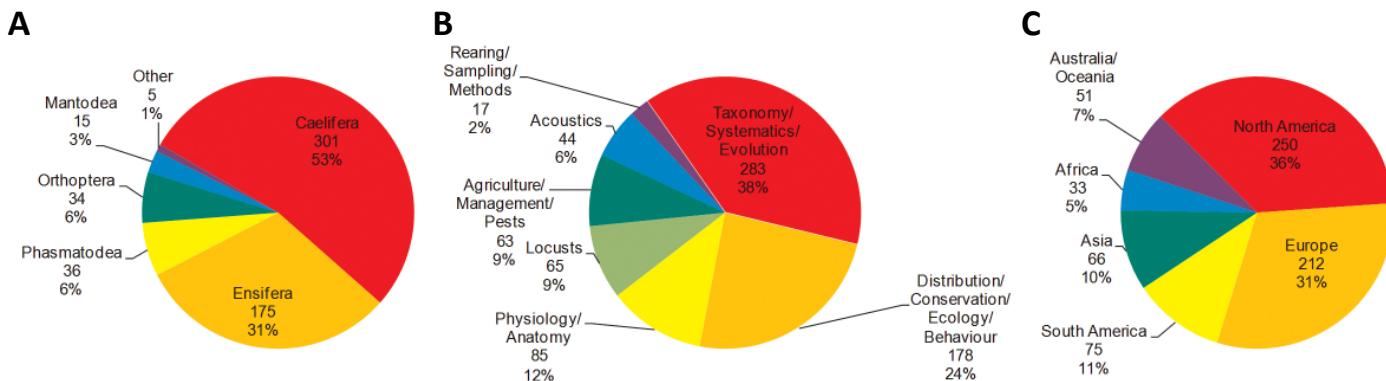


Figure 2. Distribution of articles published in *JOR* from 1992-2015. (A) By taxon covered (n = 566). “Orthoptera” includes both Caelifera and Ensifera as well as paleo-taxa, and “Other” includes Blattodea, Dermaptera, and Dictyoptera. (B) By generalized biological discipline (n = 735, because many articles can be classified under more than one discipline, e.g. articles on locust control are classified as both “locusts” and “agriculture/management/pests”). (C) By region of origin of author(s) (n = 687, because many articles were co-authored by authors from different countries). An author’s country was counted each time they submitted an article instead of once per author. Number and percentage of articles indicated.

are particularly appropriate for publication in *JOR*. Author guidelines for submission can be found at this link: <http://140.247.119.225/OrthSoc/JOR.html> and for manuscript submission, please follow this link: <http://www.utm.utoronto.ca/~utmjor/>. If you have any questions about the suitability of work for publication in *JOR*, please

do not hesitate to contact me.

Furthermore, I would like to welcome all suggestions and feedback for how to improve *JOR* by emailing me directly: cbazelet@sun.ac.za. In the near future, I plan to contact members on an individual basis to invite submissions and to request feedback, and I will appreciate your input. I will

also welcome any recommendations or ideas for special issues. Finally, I thank everyone in advance for their continued support of *JOR*, and hope that together we will succeed in elevating *JOR* to the next level of ISI-rated scientific journals.

Orthopteroids set to steal the spotlight once again at ESA, 2015

By **DEREK A. WOLLER**
 Department of Entomology
 Texas A&M University
asilid@gmail.com

Fellow Society members, I come bearing good news! I am pleased to once again announce that there will be a symposium focusing on orthopteroids in their myriad diversity during this year’s Annual Meeting of the Entomological Society of America (ESA) (Nov. 15-18) in Minneapolis, Minnesota. I helped run a similar orthopteroid symposium at last year’s ESA and it was a resounding success, so I decided to put on another one with a new theme and talks that focus on the merging of at least two scientific fields (both within entomology and outside): “Orthopteroids: A Nexus of Synergy Between Scientific Disci-

plines and Innovative Partnerships”.

The symposium will be held on Tuesday, November 17th from 1:30 to 5:30 PM in the Minneapolis Convention Center, room 204 AB (subject to change – please check the official schedule on Tuesday). The event will consist of a 5 minute introductory talk about orthopteroids followed by 11 invited talks of varying lengths covering a number of fascinating topics from a good mix of seasoned researchers and graduate students. There will also be an after-event celebration at a near-by eatery (location to be determined) that all attendees are welcome to join, so please stay tuned for that announcement after the symposium.

I truly hope that everyone who

comes to this year’s meeting will also be able to attend at least a portion of this symposium. Audience size goes a long way in convincing ESA leaders to continue to highlight orthopteroids in the future. If anyone else is interested in running a similar symposium at a conference of their choice and would like advice, or if you have any questions prior to the event, feel free to contact me.

The line-up is as follows:

(presentation ID #'s correspond to the official ESA schedule)

Presentation id# 97854 (1:35 PM)
Derek A. Woller (asilid@gmail.com) and Hojun Song, Texas A&M University, College Station, TX

The phylogeography of an intriguing group of xerophile grasshoppers (Acrididae: Melanoplus: The Puer Group)

Presentation id# 97856 (1:45 PM)

Sydney Brannoch (skp72@case.edu) and Gavin J. Svenson, Cleveland Museum of Natural History, Cleveland, OH
The utility of female genitalia characters in Mantodea

Presentation id# 97857 (2:05 PM)

Matan Shelomi (mshelomi@ice.mpg.de) and Yannick Pauchet, Max Planck Institute for Chemical Ecology, Jena, Germany
From Proteobacteria to Phasmatodea: Partnering with the 1KITE project to time a horizontal gene transfer event

Presentation id# 97859 (2:25 PM)

Tyler Raszick (tjraszick@gmail.com), Gabrielle Corso, Gregory Sword and Hojun Song, Texas A&M University, College Station, TX
What's happening in hoppers: Explorations of the acridid alimentary canal

Presentation id# 97866 (2:45 PM)

Sean Schoville (sean.schoville@gmail.com), University of Wisconsin, Madison, WI
Phylogenetic roots of the Grylloblattodea and implications for past environmental change

Presentation id# 97870 (3:05 PM)

Janice S. Edgerly (jedgerlyrooks@scu.edu)¹, Thomas Libby² and Robert J. Full³, ¹Santa Clara University, Santa Clara, CA, ²U.C. Berkeley, Berkeley, CA, ³University of California, Berkeley, CA
Adaptations for tube living produces a silly (but fast) backwards gait in Embioptera

Presentation id# 97871 (3:40 PM)

S. Bradleigh Vinson (bvinson@tamu.edu)¹ and Hong Liang², ¹Texas A&M University, College Station, TX, ²Texas A&M, College Station, TX
Manipulation of cockroaches: Why and how

Presentation id# 97877 (4:00 PM)

Yu Zeng (dreavoniz@berkeley.edu)¹ and Robert Dudley², ¹University of California Berkeley, Berkeley, CA, ²University of California, Berkeley, Berkeley, CA
The evolution of flight in stick insects (Phasmatodea)

Presentation id# 97878 (4:20 PM)

William Brown (William.Brown@fredonia.edu), State University of New York at Fredonia, Fredonia, NY
The evolutionary ecology of sexual cannibalism in praying mantids

Presentation id# 97883 (4:40 PM)

Spencer T. Behmer (s-behmer@tamu.edu), Texas A&M University, College Station, TX
The curious case of the post oak grasshopper

Presentation id# 97885 (5:00 PM)

Andrew C. Mason (amason@utsc.utoronto.ca), University of Toronto, Scarborough, ON, Canada
Following the cues: Flies, crickets, phonotaxis, and technology

Open Call for Proposals for Symposia, Workshops, Information Sessions at ICO 2016

By **MARCOS LHANO**

President, ICO 2016
entomology@gmail.com

Dear friends,
It is with great pleasure that I invite you to attend the 12th International Congress of Orthopterology. The Congress will be held in the city of Ilhéus, Bahia, Brazil, from the 30th of October to the 3rd of November, 2016.

The Local Committee would like to invite all orthopterists to contribute to the ICO and is announcing a call for proposals for the following categories: "Symposium", "Workshop" and "Information Session." Proposals must be submitted on or before the **15th of November, 2015** and should contain the requested information listed below. Decisions will be made by the **30th of November, 2015** and

will be selected according to the relevance of the theme, novelty of the topic, and controversial nature of the proposed issues.

The overall theme of the congress is *Orthoptera in a Changing World* and the program will include theme-related Plenary Lectures, Plenary Symposia, and Workshop and Information Sessions as well as poster presentations. We strongly encourage proposals from individuals and groups on a specific topic of interest, such as: behavior & communication, ecology & conservation, systematics & taxonomy, functional genomics, phylogeography & speciation, physiology, morphology, and development, biotechnology in locust control, grasshopper and locust control, and



integrated pest management.

If your proposal is accepted, all speakers will be required to submit an abstract during the call for abstracts. It is also the responsibility of the symposium/workshop/information session organizer to make sure that all speakers register for the ICO.

The categories are:

- "Symposium" – A symposium is

designed to be a focused session in which speakers present a common theme, issue, or question, and will be two hours in length. Presentation length must be between 15 and 25 minutes. Time for discussion must be included in each presentation, and, at a minimum, the last 10 minutes of the symposium must be left open for discussion. The maximum number of speakers is seven per symposium and each should come from different institutions.

- “Workshop” – A workshop is more interactive than symposia and often has an educational/technical component, and will be two hours in length. Presentation length must be between 20 minutes and 30 minutes. Time for discussion must be included in each presentation, and, at a minimum, the last 20 minutes of the workshop must be left open for discussion. The maximum number of speakers is five per workshop.
- “Information Session” – This session is a novelty at the ICO and is dedicated to short courses, and could be four to eight hours in length (always 2 hours per day for each one, distributed across the four days of the ICO). We invite you to offer training in topics of key relevance to orthopterology

for students or any other professionals. Preference will be given to proposals that address tools or concepts that course participants can easily share with others. Topics related to photography, sampling methods, software, data analysis, database, preparing manuscripts, etc. are all welcome.

Proposals must be submitted by email and must contain the following information in a .pdf file:

1. *Category (Symposium, Workshop, or Information Session)*
2. *Title*
3. *Organizer(s) name, affiliation, and complete contact information, including email address*
4. *Justification and description (maximum one page)*
5. *List of speakers (name, affiliation, and complete contact information, including email address) and presentation titles (not required for individual proposal for the Information Session)*
6. *Logistic requirements (e.g., a room with internet access, computer, etc.)*

It is the responsibility of the organizers of symposia, workshops, and information sessions to obtain funding for their own expenses and those of their invited speakers or invited participants. The Local Organizing Committee are not responsible for obtaining funds to support speaker travel

to the meeting and cannot guarantee that any support will be available. Preference may be given to proposals for which organizers can demonstrate that funds are likely to be available. To submit a proposal according to the call instructions and requirements, please address all the information to: entomology@gmail.com (you will receive a email receipt after).

Also, if your working group would like to organize a Special Meeting, please do not hesitate to contact us and provide all relevant information on or before the **15th of November, 2015**. The ICO 2016 organization will try to accommodate all appropriate requests, but available time slots are limited.

Important dates for your agenda:

- Deadline for submissions of Symposium, Workshops, and Information Sessions as well as Special Meeting submissions: **15th of November, 2015**
- Deadline for abstract submissions: **31st of July, 2016**
- 12th International Congress of Orthopterology: **30th of October to 3rd of November, 2016**

As President of the ICO 2016 organization, I am delighted to cordially invite you to join us and contribute in order for our congress to be successful.

Announcing the publication of “Jago’s Grasshoppers & Locusts of East Africa: An Identification Handbook” edited by C.H.F. Rowell, C. Hemp, & A. Harvey

By **HUGH ROWELL**
hugh.rowell@gmail.com

It is with great pleasure that I can announce that the first Volume of the long-awaited “Grasshoppers and Locusts of East and North East Africa: an

identification handbook” is available for purchase from Blurb publishers. Orders can be placed at the following website: [http://www.blurb.com/bookstore/invited/5843069/ff03ee-](http://www.blurb.com/bookstore/invited/5843069/ff03ee-494aa825d665b2fab4f75de7a371e-75b2a)

[494aa825d665b2fab4f75de7a371e-75b2a](http://www.blurb.com/bookstore/invited/5843069/ff03ee-494aa825d665b2fab4f75de7a371e-75b2a). The price is approximately \$70, including freight, for 238 richly illustrated pages. Dr. Song has asked me to explain to the readers of *Meta-*

lepte the circumstances that led to this work being published in this way at this time. I think the easiest way to do this is to reproduce below the Forward that we, the editors (Hugh Rowell, Claudia Hemp and Andrew Harvey), wrote for this volume.

EDITORS' FORWARD (2013)

Our late friend and colleague Nicholas Jago retired in 1996 from the Natural Resources Institute (the NRI; formerly known as the Anti-Locust Research Centre (ALRC) or the Centre for Overseas Pest Research (COPR), originally an arm of the British Ministry for Overseas Development), and started to complete his last scientific project, a handbook for the identification of the acridoid grasshoppers of Eastern Africa. He was uniquely qualified for this task, having spent his all professional life working in grasshopper systematics and control, mostly in Africa or working with the African fauna. He himself had resided and worked for years in Ghana, Tanzania, and Mali, and had travelled and collected extensively in other East and West African countries. Further, he had a large professional acquaintanceship among field workers on Orthoptera, both in francophone West Africa and also in NE Africa, in Sudan, Ethiopia, Somalia, and Eritrea (mostly expatriate British entomologists of his own generation, many of them his colleagues at the NRI), and could draw on their experience and records too. His project was ambitious, aiming to cover the three major countries of E. Africa (Kenya, Tanzania, Uganda), plus N.E. Africa: Ethiopia, Eritrea, and Somalia.

Sadly, Nick was not able to complete his project. He compiled a list of the relevant taxa, amassed some distribution records for them, started a bibliography, and wrote specimen treatments for many species, but tragically he developed a condition similar to Parkinson's disease and was rapidly disabled. He died in a hospital in 2005. Andrew Harvey, one of Nick's long-time friends and colleagues, helped him with the work during his illness, and ultimately became the repository for Nick's materials. Unfortunately, Andrew's professional career then took him for years to Afghanistan, where he had neither the opportunity nor the



facilities to continue the project. Importantly, however, he compiled tables of the geographical coordinates of the collection localities of many species, which have largely served as the basis of our distribution maps.

The late Theodore ("Ted") Cohn, then President of the Orthopterists' Society, was keenly interested in Nick's project from the outset, and had promised both private and societal financial support for it. At the Society's meeting in Antalya, Turkey, in 2009, he approached Hugh Rowell and asked him to revive Nick's project and to see it through to completion, and again offered support for it. Rowell, at that time, was fully engaged in finishing a handbook on the grasshoppers of southern Central America and could promise only to assess the African project when that was completed. Andrew, Ted, and Margaret Jago supplied him with the materials that Nick had already generated. It was immediately obvious that the handbook, as envisaged by Nick, demanded more expertise than Rowell alone could supply – he was acquainted with the grasshoppers of most of Uganda and parts of Kenya, but the rest of the geographical scope of the handbook was unfamiliar. Rowell then invited and recruited Claudia Hemp, who has worked for many years on the grasshoppers of the Kilimanjaro region and the Eastern

Arc mountains of Kenya and Tanzania. This combination of editors promised some competence for the East African countries, but we reluctantly decided that N.E. Africa could not be included to the extent that Nick had planned. None of us had personal experience of that fauna, and the political situation in that region now precludes field work by expatriate scientists. Where Nick's keys or discussion included N.E. African taxa, we have left them intact, as the information is potentially of use to subsequent workers, but we have not further researched the taxa from that region, and our illustrations of them are necessarily confined to museum specimens, which often give a poor idea of the living animal.

Owing to the work of the locust control organisations, inspired by Sir Boris Uvarov and the Anti-Locust Research Centre, acridoids are arguably the most intensively-studied group of their size in the region with regard to taxonomy and ecology. As such, they provide a ready tool for the study of biogeography, habitat change, and many aspects of biodiversity and community ecology.

What are the requirements of an identification handbook? We feel that it needs:

- A list of all the species recorded to date, and to give their current taxonomic status.
- Dichotomous keys to families, sub-

- families, genera, and species
- Recognition notes for the individual species, including illustrations of their habitus and their distinguishing characters; ideally, nymphal morphologies would be included too.
 - Where possible, a summary of the natural history: the preferred environment, phenology and reproductive habits, and the food-plants if known.
 - Distribution maps, showing the localities at which the species has been recorded in the past.

Within the limits of our possibilities, we have tried to provide these desiderata. Some of them are covered by the qualifications and knowledge of the literature that the editors bring to their job. Others (especially the illustrations and the distribution maps) entail a lot of extra work. To a large extent, the biology of most East African grasshoppers, and the identification of their nymphs, is still unknown. To save time, we decided to rely primarily on colour photographs for our habitus illustrations; drawings are arguably superior for some purposes, but take too long to prepare for this project. Unless otherwise indicated, all the photographs and drawings are by the editors. Our photographs of museum specimens are so indicated.

We have supplemented Jago's original layout with an added summary chapter on the climate and vegetation of East Africa. This was kindly provided for us by Dr. Andreas Hemp, Bayreuth University.

Obviously, persons with some previous experience of entomology or of grasshoppers will find this book easier to use than complete novices, but we hope it will be useful to the latter group as well.

In addition to the above, I would like to explain to the membership why we took the somewhat unusual step of publishing this work in a print-on-demand publishing house. As every scientist knows, only what is published counts – i.e., is useful to future scientists. Our Society, in fact, has rather few publications: The *JOR* is our flagship, but there is also little *Metaleptea*, and the occasional volume of the *Publications on Orthopteran Diversity (POD)*.

The latter have traditionally been the results of major efforts by a member of the Society in his or her special area of interest. It may surprise the membership to learn that there is no financial support from the Society for the *POD*'s – this is not due to active discrimination, but to the sad fact that we do not have enough funds. All previous volumes in this series have been financed either by their authors, or with donations from benefactors, most often from the late Ted Cohn, our lamented and very generous ex-President. Up to now the procedure has been to contract with a publisher for a fixed number of copies. These are then delivered to the Society, and have to be stored and mailed to buyers as orders slowly come in over the years. Obviously, this ties up a significant amount of funds, requires space and administrative time, and if sales do not meet expectations, can waste a considerable amount of money. Further, it requires the author either to foot the bill, or to find a benefactor – neither is easy. Print-on-demand publishers, such as Blurb, are a recent development of the age of digital printing; the author has to do all the page setting and layout, and merely supplies the publisher with a PDF, from which books are printed individually on receipt of an order. This obviates several of the traditional difficulties – there is no need to guess the size of the market, to invest money in a bulk purchase of hundreds of copies, or to store them, and the publisher covers the (not inconsiderable!) costs of packing and freight. The disadvantage is that the price per copy is higher, as the publisher takes a cut (of up to 100%) on each volume sold. The quality of the final product, however, is gratifyingly high. In the case of Jago's Handbook, which is planned to run into several volumes, there was no hope of useful support from the Society, so print-on-demand was the only way to produce this work.

The newly published first volume

covers all the non-acridid grasshopper families in East Africa – the Pneumoridae, Pyrgomorphidae, Lentulidae, Pamphagidae, and Dericorythidae. The rest of the series will cover the acridid subfamilies, and Volume 2, with the Teratodinae, Calliptaminae, Coptacridinae, Hemiacridinae, Oxyinae, Tropicopolinae and Euryphyminae is already underway. We hope it will appear sometime next year (2016). For these two volumes, Nick Jago had written at least some of the genus and species treatments – our job as editors was simply to revise and extend this text, find or create the necessary illustrations and photographs, and to make a page layout. Future volumes, covering big groups, such as the Catantopinae, Gomphocerinae, Acrididae and Oedipodinae, will not have this advantage, and will demand a lot more research on our part to create a comparable text coverage. Nick Jago had originally planned to have a consortium of orthopterists author each volume – these were his colleagues at the NRI, each with one or more speciality subfamilies. Sadly, however, the NRI ceased its acridological activities in the '90s, and George Popov and Nick himself are no longer with us. The remaining NRI orthopterists, Andrew Harvey, Mark Ritchie, John Grunshaw, and Stuart Green, all of whom had contributed important revisions of the East African fauna, are now dispersed into other activities and professions, and no longer in a position to participate actively in this project.

I'm happy to report that we have been able to obtain from their generous owners many excellent photographs of African grasshoppers for our purposes – but we will need a lot more, and I appeal to all readers who have such materials to contact me. We especially like good close-ups of living insects in their natural surroundings – photos of pinned museum specimens give a poor idea of the real animal. All materials we use are, of course, acknowledged in the text.

Our work to date has given us a lively appreciation of how thin our knowledge of much of the African fauna really is – we are constantly coming across problems that could only be resolved by new collections and/or a major new revision of the group in question, which we ourselves will not be able to carry out. Young systematic orthopterists certainly need have no fear of running out of worthwhile and demanding projects in the future.



A Microcosmic Marvel

In 2014, one of my lab's former graduate students, Steven Gotham, found this deceased *Schistocerca americana* nymph at the bottom of one of our rearing cages. A fungus of some sort had apparently grown on the body, but whether or not it came from inside and merely expressed itself fully upon termination or found and colonized the body is unknown to me. My lab rears multiple species of *Schistocerca* for various avenues of research and, periodically, wild specimens are brought in to increase genetic diversity of the lab-reared populations, but they are first kept in a quarantine room for some time before merging. This fungus only made a single appearance, to my knowledge, but I'd still be interested to know what it might be if anyone out there has any ideas. I have always found fungi to be quite intriguing, but have not yet found the time to learn more about them, particularly those related to insects. (Derek A. Woller, asilid@gmail.com)

Regional Reports - What's happening around the world?

India

By **ROHINI BALAKRISHNAN**
Indian Institute of Science
India
rohini@ces.iisc.ernet.in

Bushcricket acoustic-vibratory duets and a seed-caching cricket from India

The past few weeks saw the publication of some exciting and novel findings from India on the behaviour of both bushcrickets and field crickets. Rajaraman et al. (2015) reported a novel case of multimodal duetting in a pseudophylline bushcricket species, *Onomarchus uninotatus*, wherein the primary female response to male acoustic calling songs is a whole-body tremulation that alternates with individual male chirps, constituting an acoustic-vibratory duet. The vibrations resulting from the tremulation are transmitted along the substrate, constituted by branches of *Artocarpus* trees, which are the primary host

plants of this species. In playback experiments, male *O. uninotatus* were shown to pay attention to and use these vibrational signals to locate females. Acoustic-only duetting during pair formation is well-documented in several grasshopper and katydid species and katydid males and females may also exchange vibratory signals at close range (Bailey, 2003). In addition, males of some katydid species in the neotropics are known to alternate between acoustic and vibrational signaling (Belwood and Morris, 1987; Römer et al., 2010).

This case, however, to the best of our knowledge, is the first report of an acoustic-vibratory duet between the sexes and the first reported case of female tremulatory signals in pseudo-



Onomarchus uninotatus male

phylline bushcrickets. The observation raises many interesting questions: why do non-calling females, rather than males, use tremulation signals? Are they, in fact, at higher risk of predation than apparently conspicuous calling males? A study published earlier this year (Raghuram et al., 2015) indicates that female katydids in this rain forest community may indeed be at higher risk of bat preda-

tion than calling males and that flying may be riskier than calling. This could explain why females avoid moving and respond to males with tremulatory signals. But this then raises further questions on how such a communication system could work. *Onomarchus unnotatus* is a tree canopy species, with typically one, or, at best, two, calling males to a tree, suggesting that females would have to fly long distances to find and/or sample males. If females do not move much, then males will have to fly around more, given that tremulation signals are restricted in range and cannot transmit across trees! A lot remains to be understood about this fascinating communication system.

A second exciting finding published by Sidhu and Datta a few weeks ago is of seed-caching by a true cricket species of the genus *Tarbinskiellus* (formerly *Brachytrupes*). In a study examining seed dispersal and germination of tree species in the tropical forests of North-East India, it was found that seeds of three tree species were cached in underground burrows by crickets of the genus *Tarbinskiellus* during the wet season. The average cache size was two seeds and a fair proportion of these seeds were viable and even germinated in these burrows, raising interesting questions on the role of insects in enabling dispersal and germination. The only other case of an orthopteran insect aiding seed dispersal and germination was

the report that the weta *Hemideina crassidens* consumes fleshy fruits of several New Zealand plant species whose seeds survive the gut passage and indeed have higher germination rates (Duthie et al., 2006). It will be interesting to examine whether *Tarbinskiellus* has a positive impact on seed germination in these forests as well as elucidate the role of seed-caching in the life history of this cricket species.

Other papers concerning Orthoptera of this region include a couple of taxonomic papers on a new species of the bushcricket genus *Isopsera* and a new distribution record of the katydid *Anelytra eunigrifrons*. In addition, there is an article on the willingness of humans to eat insects, including orthopterans, in India and the USA!

Publications (2015)

Rajaraman, K., Godthi, V., Pratap, R., & Balakrishnan, R. (2015). A novel acoustic-vibratory multimodal duet. *The Journal of Experimental Biology*, doi:10.1242/jeb.122911

Raghuram, H., Deb, R., Nandi, D., & Balakrishnan, R. (2015). Silent katydid females are at higher risk of bat predation than acoustically signalling katydid males. *Proceedings of the Royal Society of London B: Biological Sciences*, 282(1798), 20142319.

Sidhu, S., & Datta, A. (2015). Tracking seed fates of tropical tree species: evi-

dence for seed caching in a tropical forest in North-East India. *PLoS One*, 10(8), e0134658.

Nagar, R., Mal, J., & Swaminathan, R. (2015). A note on the new species of the genus *Isopsera* (Orthoptera: Phaneropteridae: Phaneropterinae) from India. *Zootaxa*, 3964(1), 95-100.

Nagar, R., Mal, J., & Swaminathan, R. (2015). New record of *Anelytra* (*Anelytra eunigrifrons* Ingrisch, 1998 (Orthoptera, Tettigoniidae: Conocephalinae, Agraecini) from India. *Zootaxa*, 3926(3), 439-444.

Ruby, M. B., Rozin, P., & Chan, C. (2015). Determinants of willingness to eat insects in the USA and India. *Journal of Insects as Food and Feed*, 1(3), 215-225.

Other cited papers

Bailey W. J. (2003). Insect duets: their mechanisms and underlying evolution. *Physiological Entomology* 28, 157-174.

Belwood, J. J. and Morris, G. K. (1987). Bat predation and its influence on calling behavior in neotropical katydids. *Science* 238, 64-67.

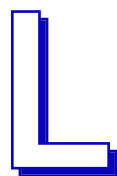
Duthie, C., Gibbs, G., & Burns, K. C. (2006). Seed dispersal by weta. *Science*, 311(5767), 1575-1575.

Römer H., Lang, A. and Hartbauer, M. (2010). The signaller's dilemma: A cost-benefit analysis of public and private communication. *PLoS ONE* 5(10), e13325.

Theodore J. Cohn Research Grant Reports

Evaluating call variation and female decisions in a lekking cricket

By **KIT KEANE**
University of Tulsa, USA
Kristopher-keane@utulsa.edu



Lekking is a mating system where males aggregate to display for choosy females, but provide no resources beyond gametes. Among the Orthop-

tera, lekking has only previously been described in one species, the prairie mole cricket (*Gryllotalpa major* (Fig. 1), see Hill 1999), though it is a mating system that likely occurs in several mole crickets (*Gryllotalpa*

and perhaps some *Gryllus* species as well. The absence of direct benefits available in lekking systems presumably causes females to base their mating decisions on the indirect fitness of male gametes. Yet how do females



Figure 1. Typical male calling pattern and photo of *G. major* in the lab.

evaluate a male's "good genes" and how accurate are their mate choices?

During the spring, *G. major* males aggregate into leks throughout the southern tallgrass prairie of the USA. For up to ~1hr per evening, males produce advertisement calls from underground burrows that they often maintain for several weeks (Fig. 1). Females fly overhead and presumably choose males during flight, subsequently landing within 1-2 meters of a male burrow opening and entering on foot.

Preliminary research reveals extensive variation in male call characteristics within populations. While no statistically discernable differences occur between divergent, but similarly-sized populations, we were curious to test whether differences exist between leks of different size, in which females might be expected to exhibit varying levels of choosiness.

Methods

During the 2015 calling season we studied five separate leks (three small, one medium, and one large) at the Tallgrass Prairie Preserve in north-central Oklahoma. Every active male burrow was flagged and fitted with a screen pyramid trap to catch any females attracted (used as a measure of male attractiveness). About 30 out of ~90 total males were recorded each night using Sony digital voice recorders. Data analysis in this report focuses on four days where most males were observed calling (Apr. 15-18, 2015).

Results and Findings

We found no clear patterns in maximum chirp rate, but males in one of the small leks called at a much higher average dominant frequency for the subset of dates analyzed (ANOVA performed for each day separately, Apr. 15: $P=0.024$, Apr. 16: $P=0.048$, Apr. 17: $P=0.058$, Apr. 18: $P=0.15$, see Fig. 2). Differences in soil temperature between leks are unlikely to drive this pattern because no significant correlation between soil temperature and male dominant frequency is observed ($P=0.07$, Pearson product-moment correlation test). Additionally, there is more frequency variation in the smaller leks on all four days tested, though only one case is significant (Apr 15, $P=0.03979$). The null model would predict the larger population to be more variable, as is the case for chirp rate. Our tentative results fit better with the concept of density-dependent female choosiness (Bleu et al. 2012).

In line with this hypothesis, significantly more females were present at the smaller leks, especially at the high-frequency Short Loop lek. In general, we would expect females to prefer lower frequency if it signals a larger male, but we did not find a significant correlation between mass and

dominant frequency for a subset of 11 male crickets ($P=0.8226$, Pearson product-moment correlation). However, a significant relationship has previously been found between body length and dominant frequency for *G. major* (probably a more accurate method for determining body size, see Howard & Hill 2006). A question we hope to address in the future is whether females originate on the lek where they are caught or if they travel extensively between leks.

Our data do not show consistent relationships between male attractiveness and any particular call characteristic, which is not surprising. One factor that tends to wash out any of these correlations in the field is limited female sampling—a phenomenon occurring in every system to a certain extent.

Further research and analysis will ultimately help us to understand the tradeoffs of alternative mating decisions in both males and females and provide a fuller explanation for the variation in behavior that we see.

References

Bleu, J., Bessa-Gomes, C., & Laloï, D. (2012). Evolution of female choosiness and mating frequency: effects of mating

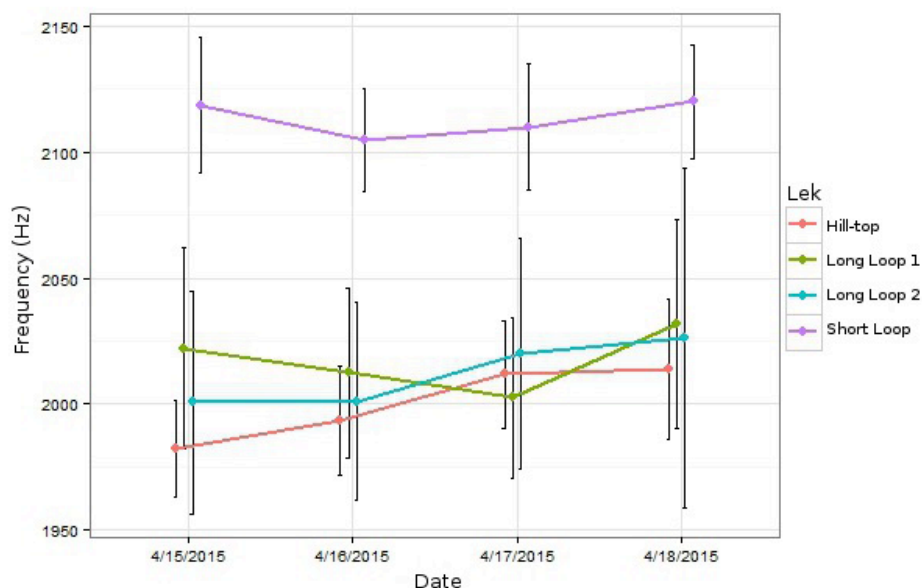


Figure 2. Average dominant frequency among leks across several days. Error bars show standard error of the means.

cost, density and sex ratio. *Animal Behaviour*, 83, 131-136.

Hill, P. S. (1999). Lekking in *Gryllotalpa*

major, the prairie mole cricket (Insecta: Gryllotalpidae). *Ethology*, 105, 531-545.

Howard, D. R., & Hill, P. S. (2006). Mor-

phology and calling song characteristics in *Gryllotalpa major* Saussure (Orthoptera: Gryllotalpidae). *Journal of Orthoptera Research*, 15, 53-57

On the origin of the New World Pyrgomorphidae

By RICARDO MARIÑO-PÉREZ

Texas A&M University, USA
pselliopus@yahoo.com.mx

The family Pyrgomorphidae is comprised by 478 species in 150 genera grouped in 31 tribes belonging to two subfamilies. Despite such diversity, in the New World, only 30 species in 13 genera from 4 tribes are found. The tribes Ichthiacridini (3 genera; 10 spp.) and Ichthyotettigini (4 genera; 7 spp.) are exclusively distributed in Mexico. The tribe Omurini (3 genera; 4 spp.) is distributed exclusively in South America. The fourth tribe, Sphenariini, has a peculiar biogeographical distribution: 2 genera; 9 spp. in Mexico and Central America, 1 genus; 2 spp. in Dominican Republic, 3 genera; 3 spp. in Eastern Africa and Madagascar and 3 genera; 10 spp. in China.

Currently, there are two theories about the origin of New World Pyrgomorphidae (Fig. 1).

1. Kevan and Akbar (1964) stated that the family reached the

Americas at least two or three times from Southeast Asia. They justified this theory by the strong morphological resemblance of the genus *Yunnanites* and *Mekongiana* (China) with *Sphenarium* (Mexico).

2. The other theory by Amedegnato (1993) states that Pyrgomorphidae, together with Pamphagidae, Tristiridae and Lentulidae, originated in the southern continents. Particularly for Pyrgomorphidae, she thought they originated in Asia, then dispersed to Africa, and then, in minor degree, to South America. Both hypotheses were proposed by orthopterists with a lot of experience, but they have been never formally tested.

One of my dissertation chapters is about testing both hypotheses in a phylogenetic framework. During the last three years, I have collected DNA-grade material of the species *Sphenacris crassicornis*, *Sphenotet-*

tix nobilis, *Pyrgotettix pueblensis* and some species of the genus *Sphenarium* from Central and Southern Mexico. I have also obtained DNA-grade specimens of the Central America species *Prosphena scudderi* and the South American species *Algete brunneri* and *Omura congrua*. During June, 2014, Dr. Hojun Song, Brigido Hierro-García, and I were able to collect *Jaragua oviedensis* in Dominican Republic. During 2015, my colleague Salomon Sanabria-Urbán was able to collect the always hard to find *Ichthyotettix mexicanus*. Fortunately, Dr. Hojun Song has DNA-grade material from the non-New World Sphenariini genera (*Rubellia* and *Mekongiella*) that, together with at least another 12 species from Africa, Asia and Australia, will be used as the outgroups.

Despite all these successful trips I was still missing the area of Northwestern Mexico. In 2014, a project to collect in that area was funded by the Orthopterists' Society. During 10 days in July-August 2014 my colleagues, Steven Gotham, Jorge Humberto Medina-Durán, and I travelled from Mexico City to the Baja California Peninsula in order to search for species of the genus *Ichthiacris*. Kevan (1990) reviewed the genus and provided several localities for all the species, which is mainly distributed in the Baja California Peninsula. For historical reasons, this peninsula is a very isolated and low populated area (7 people per km²). The road infrastructure was scarce and there was only a main highway that runs through the Peninsula. With this in mind, we decided to look for the pyrgomorphs at the localities provided

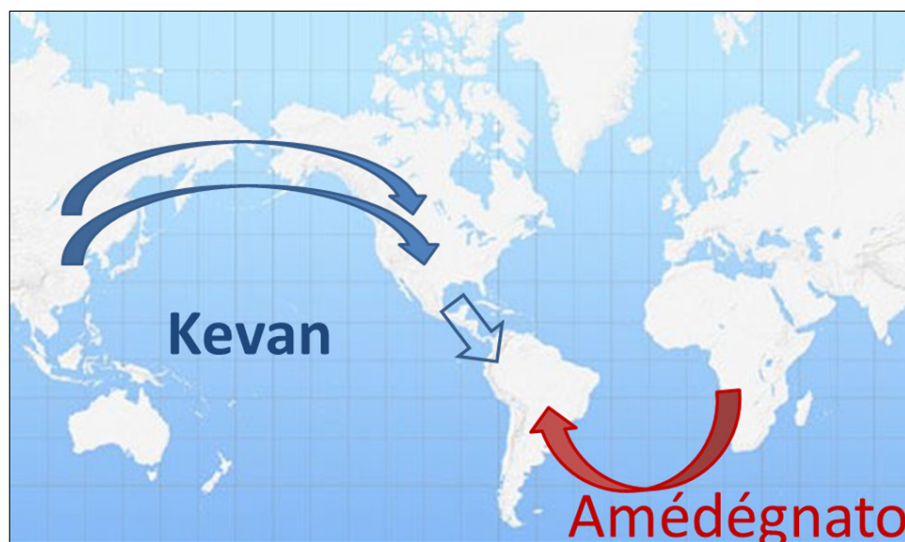


Figure 1. Hypotheses on the origin of New World Pyrgomorphidae. Kevan (blue) and Amédégnato (red).



Figure 2. Baja California landscape.

by Kevan (1990) because several of them were close to the very few secondary roads. The great majority of the localities were visited during the 1970's and 1980's and although they lack GPS coordinates, the localities' information was very accurate. We were able to find in a new map a lot of them and we made a route in order to visit the most in the least amount of time.

The first four days of the trip were very disappointing because, although we visited around 30 localities, the pyrgomorphs never appeared. Sometimes we drove hours without seeing any people (Fig. 2). In certain areas, gasoline was sold in small containers by local people because the closest gas station was hundreds of km away. Also, local people told us that compared to previous years, 2014 had been, until then, a very dry year (the

hurricane "Odile" hit the Peninsula some weeks later and thousands of people were out of communication for days without electricity and cellphone signal as it was the strongest hurricane in 45 years). It was on the fifth day, in a grassy spot, that my colleagues found some immature grasshoppers and immediately I realized they were pyrgomorphs. For the next hour we swept as if it was the last hour of our lives and we successfully collected some other nymphs and male and female adults of *Ichthiacris* (*Ichthiacris*) *rehni* Bolívar, 1905 (Pyrgomorphidae: Orthacridinae: Ichthiacridini) (Fig. 3). For the first time in days I was able to enjoy dinner. The next day our bad luck returned and it was not until the seventh and last day that in a thorny shrub area we collected females of a second species of *Ichthiacris*.

Of course we collected other orthopterans, such as members of genus *Schistocerca* and several species from the subfamilies Gomphocerinae, Oediopodinae, Leptysminae and Melanoplinae. In the end, although we did not collect as much as we were expecting, the main objective of the trip was accomplished. All the species collected were preserved in 100% ethanol at -80°C freezer at Song Lab in College Station, Texas, USA for future research.

Currently, I am in the process of analyzing the molecular data and soon I will be able to answer these questions: a) Does the New World Pyrgomorphidae form a monophyletic group? b) Is the origin of the New World Pyrgomorphidae Asia/Pacific or Africa or both?

Acknowledgments: To the Orthopterists' Society for financial support to conduct the trip to Baja California. Salomón Sanabria-Urban (UNAM) provided some DNA-grade specimens. Dr. Hojun Song provided all the material for field work.

References

- Amedegnato, C. 1993. African-American relationships in the acridians (Insecta, Orthoptera). The Africa–South America connection. (ed. W. George & R. Lavocat). 59–75.
- Kevan, D.K.M. 1990. Revision of the Mexican Pyrgomorphidae (Orthoptera: Acridoidea): A Reappraisal of the Genus *Ichthiacris* I. Bolívar, 1905, with Descriptions of Three New Species from Baja California, Mexico. Proceedings of the



Figure 3. Male of *Ichthiacris rehni* (2/VIII/2014).

On the “forgotten” genus *Diponthus* Stål: one of the most diversified genera of Romaleini (Acridoidea, Romaleidae) from South America

By **MARTINA E. POCCO**

CEPAVE – CONICET
Museo de La Plata, FCNYM – UNLP
Argentina
martinapocco@fcnym.unlp.edu.ar

The tribe Romaleini *sensu lato* includes the largest and most colorful representatives within Acridoidea, comprising 168 species in 39 genera, mostly distributed in the Neotropical Region, with few members reaching the south of the Nearctic region (Eades et al., 2015). Regarding the economic importance in South America, some species of Romaleini have been reported as pests of agriculture, such as *Tropidacris collaris* (Stoll), the widespread *Chromacris speciosa* (Thunberg), and *Zoniopoda tarsata* (Serville) (Carbonell et al., 2006; Cigliano et al., 2014). From an

ecological perspective, several species display aposematic coloration and gregarious behavior in their immature stages. Additionally, body color polymorphism is frequently found among species of Romaleini, and the occurrence of color gradients along the geographic distribution range has been also mentioned in *C. speciosa* (Roberts & Carbonell, 1982) and *Z. tarsata* (Carbonell, 2007). *Tropidacris collaris* is also a species of highly variable color and this variation is determined mostly by ecological conditions, which, in turn, may have geographical causes (Carbonell, 1986).

Among the most diversified genera of Romaleini occurring in South

America, *Diponthus* Stål is the only one that has never been revised taxonomically. This genus, endemic to southern South America (central and northern Argentina, Uruguay, southern Brazil, south-eastern Paraguay and south-eastern Bolivia) originally included 22 nominal species, of which 19 were considered as valid at the time I started the study of this group. Bearing in mind that the genus *Diponthus* is well-represented in number of species, covering a relatively wide geographic area in southern South America, and the conspicuousness of most of the species of this genus (colorful insects with contrasting patterns of stripes and spots), it is

curious that it has been “forgotten” for a long time. Fortunately, Prof. Carlos Carbonell, an outstanding orthopterist who has made invaluable contributions to the Neotropical Acridoidea, was interested in addressing the study of this group. As I was fascinated by romaleids, my advisor Dr. María Marta Cigliano, along with Prof. Carbonell, thought that it would be a good idea that I conduct this study



Figure 1. A, Santa Rosa, La Pampa, Argentina. B, La Cumbre, Córdoba, Argentina. C, 25 km S. Gral. Güemes, Salta, Argentina. D, Laguna Yema, Formosa, Argentina.

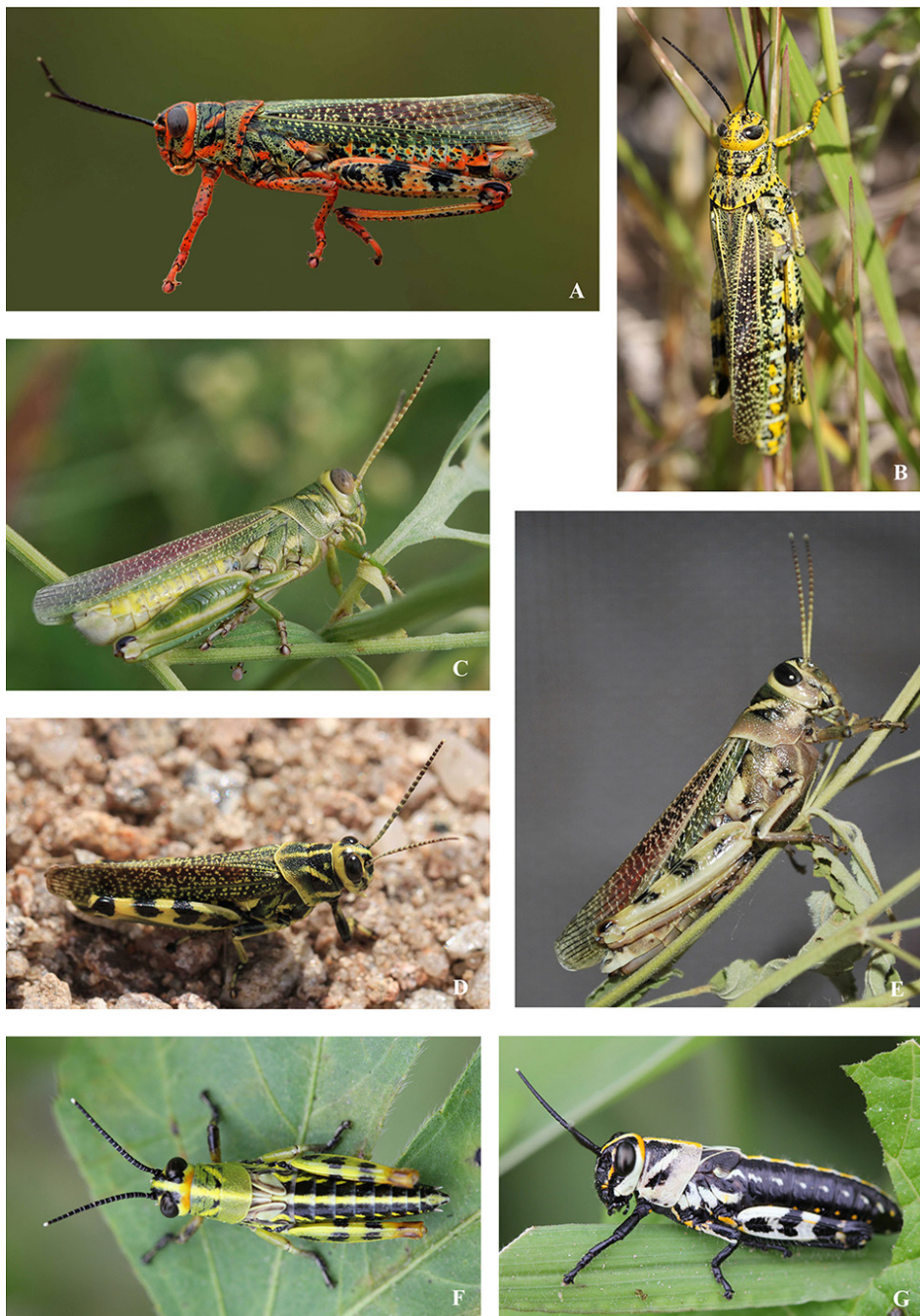


Figure 2. A, B, *Diponthus pycnostictus*: A, color morph reddish orange and dark grey, B, color morph yellow and dark grey. C-G, *Diponthus argentinus*: C, F, color morph green with yellow, adult (C), nymph (F); D, G, color morph black and yellow, adult (D), nymph (G); E, color morph greenish brown.

as part of my Ph.D. dissertation (Pocco, 2014). I became deeply involved in the difficult task of delimiting the species of *Diponthus*. One of the main problems encountered during the delimitation and identification of species was the presence of high intraspecific variation in many of them. As if that were not enough, I had a hard time “chasing” after specimens of *Diponthus* species in the field. I soon found

out that *Diponthus* species are rare! So, after several attempts and finally applying a strategy of dividing field work efforts among my advisors, Dr. Cigliano and Dr. Carlos Lange, we finally discovered the “secrets” of *Diponthus* species habitats, and, so, I was able to get fresh material from several species of this interesting group of grasshoppers!

Over a five-year period (2010-

2015), we conducted several field trips looking for *Diponthus* species all around central and northern Argentina, from November to April, which coincide with the presence of nymphs and adults according to the information available on the phenology of Romaleini species from Argentina. In order to optimize the time, we divided efforts to cover the largest possible area. Thus, when some of us were going to the northeast of Argentina, others were covering the northwest at the same time. Eventually, we travelled through different biogeographic provinces: Pampas, Paranense, Chaqueña, Yungas, Monte and Espinal (Cabrera & Willink, 1973) within the country, from grassland landscapes (Fig. 1A) to hills (Fig. 1B) to humid (Fig. 1C) and dry forests (Fig. 1D). In total, we made field collections in 12 provinces of Argentina. Happily, my luck was increasing over time!

As we were finding more and more specimens in the field, along with an exhaustive examination of the specimens of *Diponthus* from several museum collections, I was finding other “stones on the road”. While conducting the taxonomic revision of this genus, six nominal species [*D. permistus* (Serville), *D. argentinus* Pictet & Saussure, *D. pycnostictus* Pictet & Saussure, *D. communis* Bruner, *D. pictus* (Bolivar), and *D. schulzi* Bruner] among the twelve occurring in Argentina could not be easily distinguished because of the lack of differences in the diagnostic characters from tegmina venation, male terminalia and internal genitalia, and color patterns that were useful to identify the remaining *Diponthus* species. Most of the characters used to distinguish members of this group were either quantitative showing considerable overlap or consisted of differences in coloration. However, I observed that coloration varied geographically as well as within local populations. In order to solve this problem, I used morphometric techniques to clarify the taxonomic limits

and status of the six nominal species mentioned above. The results of this study constitute one of the chapters of my dissertation (Pocco, 2014).

In summary, we concluded that *D. pycnostictus* (Fig. 2A,B) can be defined by a unique combination of characters while the remaining nominal species represent different color morphs of a single taxon, recognized as *D. argentinus* (Fig. 2C-G). Furthermore, we concluded that in *D. argentinus* body coloration varies considerably across the geographic distribution range but without any noticeable color gradient correlated with the latitude.

Thanks to the difficulties in finding specimens of this genus I had the chance to really explore recondite and wonderful places in Argentina with beautiful landscapes and while often driving on isolated routes. We also had the pleasure of meeting nice kids from a native community in the north of Argentina who were interested in knowing what we were “doing with those nets”. After a few minutes, they came with a handful of *Diponthus* specimens! They also brought specimens of *Staleochlora viridicata* that they called “the fighter” (“la luchadora”), in reference to their defensive behavior. Of course, all these trips allowed me also to discover new species of Romaleini (e.g., two new

species of *Zoniopoda* at high altitude grasslands in the provinces of Córdoba and San Luis, central Argentina), and to obtain fresh material of several species that I am using for the studies that I am currently conducting on the phylogenetic analyses of *Diponthus* and the whole tribe.

Finally, I would like to express my gratitude to The Orthopterists’ Society, which provided funding through a research grant to conduct some field trips. Also, thanks to M.M. Cigliano for providing several photographs to illustrate this note.

References

Cabrera, Á.L. & Willink, A. (1973) Biogeografía de América Latina. Monografía 13. Serie de Biología. Secretaría General de la Organización de los Estados Americanos, Washington, DC, EEUU, 120 pp.

Carbonell, C.S. (1986) Revision of the neotropical genus *Tropidacris* (Orthoptera Acridoidea, Romaleidae, Romaleinae). Proceedings of the Academy of Natural Sciences of Philadelphia 138: 366–402.

Carbonell, C.S. (2007) The genus *Zoniopoda* Stål 1873 (Acridoidea, Romaleidae, Romaleinae). Journal of Orthoptera Research 16: 1–33.

Carbonell, C.S., Cigliano, M.M. & Lange, C.E. (2006) Especies de acridomorfos

(Orthoptera) de Argentina y Uruguay/ Acridomorph (Orthoptera) species of Argentina and Uruguay. Publications on Orthopteran Diversity, The Orthopterists’ Society, La Plata, 300 pp.

Cigliano, M.M., Pocco, M.E. & Lange, C.E. (2014). Acridoideos (Orthoptera) de Importancia Agroeconómica. Biodiversidad de Artrópodos Argentinos vol. 3. S. Roig-Juñent, L.E. Claps & J. J. Morrone (Eds.), INSUE, San Miguel de Tucumán, pp: 11-36.

Eades, D.C., Otte, D., Cigliano, M.M. & Braun, H. (2015) Orthoptera Species File Online. Version 2.0/4.0, available online at <http://Orthoptera.SpeciesFile.org>.

Pocco, M.E. (2014). Romaleini (Orthoptera: Acridoidea) Neotropicales: biodiversidad, filogenia y biogeografía. FCNyM - UNLP. PhD Thesis. (Not published). 250 pp.

Pocco, M.E., Scattolini, M.C., Lange, C.E. & Cigliano, M.M. (2014). Taxonomic delimitation in color polymorphic species of the South American grasshopper genus *Diponthus* Stål (Orthoptera, Romaleidae, Romaleini). Insect Systematics & Evolution 45: 303-350.

Roberts, H.R. & Carbonell, C.S. (1982) A revision of the grasshopper genera *Chromacris* and *Xestrotachelus* (Orthoptera: Romaleidae, Romaleinae). Proceedings of the California Academy of Sciences 43(4):43-58.

Locust odorant receptor LmigOR1 is involved in sensing food odors

By YINWEI YOU

China Agricultural University, China
yyw30000@163.com

Outbreaks of the locust, *Locusta migratoria*, has caused tremendous damages to crops and is still the greatest potential threat to crops in Asia, Africa, and other places. Taking into consideration the hazardous effects of using chemical pesticides for the control of locust plagues on ecological environment and food, we

need to explore alternatives to chemical pesticides. Locust plagues always relate to the locust’s behavior, such as aggregation, feeding and mating, and so on. Locusts locate partners and food sources primarily through olfactory cues, but the molecular mechanisms that underlie this recognition are unclear. The compounds designed to activate or block receptors of olfactory cues could function as attractants

for trapping or as repellents in helping to control locusts.

Odorant receptors, the membranous proteins on olfactory receptor neurons, are believed to play important roles in olfaction. We have identified 7 putative odorant receptors in locusts: LmigORco and LmigOR1~6. LmigOR1 is expressed in the basiconic sensilla and its expression level is higher than others (Xu et al. 2013).

Therefore, we hope to elucidate the function of *LmigOR1* with the key aim being to locate the ligands of an odorant receptor. Single sensillum recording and patch clamp are widely used to seek the ligands of insect odorant receptors, particularly for fly odorant receptors. Is there any other method which can be used to seek for the ligands and elucidate the function of an odorant receptor? Isogai et al. (2011) reported the possibilities that external chemical signals specific for certain olfactory receptors could be primarily explored by co-expression of immediate early genes (*IEGs*) with olfactory receptors in mammals. *Hr38*, an immediate early gene, can be used as a neural activity marker in the silk moth (*Bombyx mori*) and the fruit fly (*Drosophila melanogaster*). Using *Hr38*, they constructed a neural activity map of the fly brain that partially overlaps with *fruitless* (*fru*)-expressing neurons in response to female stimulation (Fujita et al., 2013). We speculate that there should be also some immediate early genes

in the locust that can be used as neural activity markers. We analyzed our cDNA library and found an immediate early gene: *LmigEgr1*.

Next, we used RNA *in situ* hybridization to explore the function of *LmigOR1* by analyzing the co-expression of *LmigOR1* and *LmigEgr1*. RNA fragments of *LmigOR1* and *LmigEgr1* were labeled by Digoxigenin (DIG). Sections (12µm) were prepared at -24°C using a Jung CM300 cryostat (Leica, Nussloch, Germany). We selected locust body and feces extracts (locust volatiles, pheromone), ant body extracts (natural enemy odor), and wheat leaf juices (food odors) as stimuli. The results show that *LmigOR1* and *LmigEgr1* can be expressed in the same neuron after stimulation by wheat leaf juice for 2 hours, but are not expressed in the same neuron before stimulation by wheat leaf juice. They are also not expressed in the same neuron after stimulation either by locust body and feces extracts or by ant body extracts. These results indicate *LmigOR1*

should be involved in sensing food odors and not in sensing body volatiles and natural enemies. Therefore, we can infer that the function of *LmigOR1* is related to food-seeking behavior.

Our experiment demonstrates that *LmigEgr1* can be used as a neural activity marker in the locust. Next, we will continue to use this convenient method to seek the real ligand by using a single chemical as a stimulus.

References

- Fujita, Nozomi, Yuka Nagata, Takumi Nishiuchi, et al. 2013. Visualization of Neural Activity in Insect Brains Using a Conserved Immediate Early Gene, *Hr38*, *Current Biology*. 23, 1–8.
- Isogai, Yoh, Sheng Si, Lorena Pont-Lezica, et al. 2011. Molecular organization of vomeronasal chemoreception, *Nature*. 478(7368): 241–245.
- Xu, Haozhi, Mei Guo, Ying Yang, et al. 2013. Differential expression of two novel odorant receptors in the locust (*Locusta migratoria*). *BMC Neuroscience*. 14:50.

Arizona Records of *Campylacantha olivacea* (Scudder) (Orthoptera: Acrididae)

By **ROBERT A. BEHRSTOCK¹** and **PATRICK H. SULLIVAN²**

¹10359 S Thicket Place, Hereford, AZ 85615 USA (rbehrstock@cox.net)

²The Haden Collection, 35 Ramsey Canyon Road, Hereford, AZ 85615 USA (patolisa@cox.net)

C*ampylacantha olivacea* (Scudder) (Orthoptera: Acrididae) is widespread and often abundant in shrubby habitats from New Mexico and Colorado east to Illinois and Georgia (Richman et al. 2013, Brust et al. 2014). In southeastern Arizona it is only marginally present, represented by the more colorful *C. o. vivax*, which has been considered both a species (Eades et al. 2015) and a subspecies (summarized by Ferguson in BugGuide.2015). In Arizona, its known occurrences are limited to the vicinity of Portal, Cochise Co., west

of the New Mexico state line. Just to the east, it has been recorded in Hidalgo Co. in extreme southwestern New Mexico (Richman et al. 1993). We are aware of four previous Arizona records: An adult female was collected by David Lightfoot on 14 September 1977, c. 1-5 mi east of Portal. It was taken from Tarbush, *Flourensia cernua* (Asteraceae), on which it can be common in southern New Mexico. On 8 October 1977, George Ettershank collected *C. olivacea* near Portal (D. Lightfoot and G. Davis, pers comm.). Additionally, we examined two specimens in the research collection of the Southwest Research Station in Portal.

One was collected by Vince Roth at or near Portal on 9 October 1964. Another was taken by an unattributed collector on 1 November 1969 and the specimen label states five miles west of Portal. This places the collection site in oak-conifer woodland at an elevation of 1,737 - 1,859 m (5,700-6,100 ft.), a very unusual habitat for the species; we cannot rule out that it was actually taken five miles east of Portal where other individuals have been encountered. Since *C. olivacea* is not listed by Ball et al. (1942) for Arizona, these may represent the first records for the state.

On 18 October 2013, we visited the



Figure 1. *Camplyacantha olivacea* pair in copula. Portal Road, Cochise County, Arizona, U.S.A. 21 October 2013. Robert A. Behrstock/Naturewide Images.

Chiricahua Desert Museum located at the east end of Portal Road at New Mexico Highway 80, Hidalgo Co., NM (Lat. $31^{\circ} 52.237'$ Long. $-109^{\circ} 2.121'$); elevation 1,252 m (4,107 ft.). About 75 m east of the facility and ca. 150 m east of the New Mexico state line, we found *C. olivacea* on Snake-weed, *Gutierrezia* sp. (Asteraceae), a low, dense, fine-stemmed, yellow-flowering shrub that is common in Chihuahuan Desertscrub habitat. Individuals of *C. olivacea* were numerous; a dozen or more, including numbers of pairs in copula, were present on some plants.

Driving west, we encountered *C. olivacea* on the north side of Portal Road 0.39 km (0.24 mi) W of the New Mexico state line (Lat. $31^{\circ} 52.389'$ Long. $-109^{\circ} 03.181'$) at an elevation of 1,264 m (4,146 ft.). At least three individuals were collected as vouchers and a few others were observed.

On 21 October 2013, we revisited the Portal Road site. One pair of *C. olivacea* was photographed (Fig. 1) and collected. An additional pair, plus two males, and two females were seen. An hour spent checking patches of Snake-weed on Sulphur Canyon Rd., 6.3 km (3.9 mi) south of the Portal Road site yielded no additional *C. olivacea*,

highlighting its limited distribution.

Continuing westward on Portal Road, 21 October, we encountered *C. olivacea* at a second site 7.9 km (4.9 mi) west of the New Mexico state line (Lat. $31^{\circ} 54.842'$ Long. $-109^{\circ} 7.952'$) at an elevation of 1,437

m (4,714 ft.). The area was a mowed roadside with Velvet mesquite, *Prosopis velutina* (Fabaceae), Catclaw acacia, *Acacia greggii* (Fabaceae), Desert willow, *Chilopsis linearis* (Bignoniaceae), saltbush, *Atriplex* sp. (Chenopodiaceae), bursage, *Ambrosia* sp. (Asteraceae), pigweed, *Amaranthus* sp. (Amaranthaceae), and bunch grasses (Poaceae). One male was collected and an additional male observed.

These limited data are presented not only to confirm the presence of *C. olivacea* in Arizona, but to encourage the increased interest in Arizona's grasshoppers exhibited by photographers and naturalists. Presently, the 32 km (20 mi) wide San Simon Valley, surrounded by the Chiricahua, Dos Cabezas, and Pinaleño Mountains to the west, and the Peloncillo and Whitlock Mountains to the east, may represent the western edge of the distribution of *C. olivacea*. Immediately to the west of known Arizona locations, the Chiricahua Mountains, approximately 56 km (35 mi.) long, 34 km (21 mi.) wide, and rising to an elevation of approximately 1,800 m (6,000 ft.) above the surrounding valleys present a formidable barrier to the species' westward spread. Given the abundance of plants upon which

it is known to feed (e.g., Gutierrezia, Flourensia, Ambrosia, Artemisia), we expect *C. olivacea* will be encountered at additional Arizona locations in northern Cochise and adjacent Graham counties.

Other grasshoppers present at the collecting sites were common species of Mesquite Grasslands or Chihuahuan Desert scrub and included: *Brachystola magna*, *Hesperotettix viridis*, *Melanoplus lakinus*, *Phoetaliotes nebrascensis*, *Paropomala pallida*, *Aulocara femoratum*, *Ligurotettix plannum*, *Arphia pseudonietana*, *Leprus wheeleri*, *Trachyrhachys kiowa*, *Trimerotropis pallidipennis*, and *Tropidolophus formosus*.

Voucher specimens will be deposited in the University of Arizona Insect Collection (UAIC), Tucson.

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References

- Ball E.D., Tinkham E.R., Flock R., and C.T. Vorhies. 1942. The grasshoppers and other Orthoptera of Arizona. University of Arizona Agricultural Experiment Station Technical Bulletin No. 93: 255-373.
- Brust, M., Thurman, J., Reuter, C., Black, L., and A.J. Redford. 2014. Grasshoppers of the Western U.S., Edition 4. USDA APHIS Identification Technology Program (ITP). Fort Collins, CO. (Last accessed 10 June 2015). <<http://idtools.org/id/grasshoppers/>>.

Eades, D.C.; D. Otte; M.M. Cigliano & H. Braun. Orthoptera Species File. Version 5.0/5.0. (Last accessed 12 June 2015). <<http://Orthoptera.SpeciesFile.org>>.

BugGuide. 2015. Species *Campylacantha*

olivacea - Fuzzy Olive-Green Grasshopper. (Last accessed 8 June 2015). <<http://bug-guide.net/node/view/243306>>.

Richman, D.B., Lightfoot, D.C., Sutherland, C.A. Ferguson, D., and L. Black.

2014. A manual of the grasshoppers of New Mexico. New Mexico State University, College of Agricultural, Consumer and Environmental Sciences. (Last accessed 6 June 2015). <<http://aces.nmsu.edu/academics/grasshoppers/>>.

Orthopteroids in the exhibition “Zoology in the Mexican Art”

By RICARDO MARIÑO-PÉREZ

Texas A&M University, USA
pselliopus@yahoo.com.mx

As a museum lover, it is hard to pick which museum to visit due to time constraints. However, I always find the time to escape from routine and submerge in the worlds they offer. This time I was in Mexico City (which has more than 150 museums) and decided to visit the Popular Art Museum. As part of temporal exhibitions, this museum had one (July 18th-September 27th) called “Zoology in the Mexican Art.” To my surprise, the first thing you see when entering the room is an evolutionary tree of animals and plants. This graphic representation was divided according to the perception of different cultures from Mexico in three parts: water, land, and air. Orthoptera was placed in the “land” section (Fig. 1), but very close to the “air” section where Hymenoptera, Diptera, Coleoptera and Lepidoptera were placed. After this introductory room, the exhibition was followed by multiple rooms, some of which orthopteroids appeared. One installment that caught my eye was the one about “alebrijes”, which are sculptures of mystical creatures (appeared in a dream when its creator was ill) made of copal wood (*Bursera glabrifolia* and *B. bipinnata*) and hand-painted. These handicrafts are quite popular in Oaxaca State and they are a typical souvenir on the streets in Oaxaca City. Despite the fact that alebrijes are usually a combi-



Figures 1-7. 1. Some of the common names in Spanish for Orthoptera, 2. Mantid-like alebrije, 3. Another mantid-like alebrije, 4. Grasshopper-like alebrije, 5. Bone-carved grasshopper, 6. Paper-folded mantis, 7. “Chapulín” by Francisco Toledo, oil on canvas, 1980.

nation of different animals, I was able to identify some things that appeared to be “orthopteroid” according to my own interpretation. In Figures 2 and 3 are alebrijes resembling praying mantids and, in Figure 4, there is one that looks like a grasshopper. Both groups are well-known in Mexico and I am sure you will find the “orthopteroids essence” especially when paying attention to the legs.

Another installment with orthop-

teroids was composed of miniature elements. A grasshopper carved in bone is shown in Figure 5 and a praying mantis made from folded paper is shown in Figure 6. Despite the size, the details are remarkable. There were several other insects, such as ants, ladybugs, monarch butterflies and dragonflies (and of course tons of vertebrates). Finally, I saw an oil painting on canvas entitled “Chapulín” (grasshopper) painted in 1980 by Francisco

Toledo (1940-) that shows us the great importance that grasshoppers have had in Mexican culture (Fig. 7), especially in southern states, such as Oaxaca (where Toledo is from). By the time this article will be published the exhibition will be over. However, when in Mexico City, I encourage you to visit the permanent collection of this museum because you won’t be disappointed.

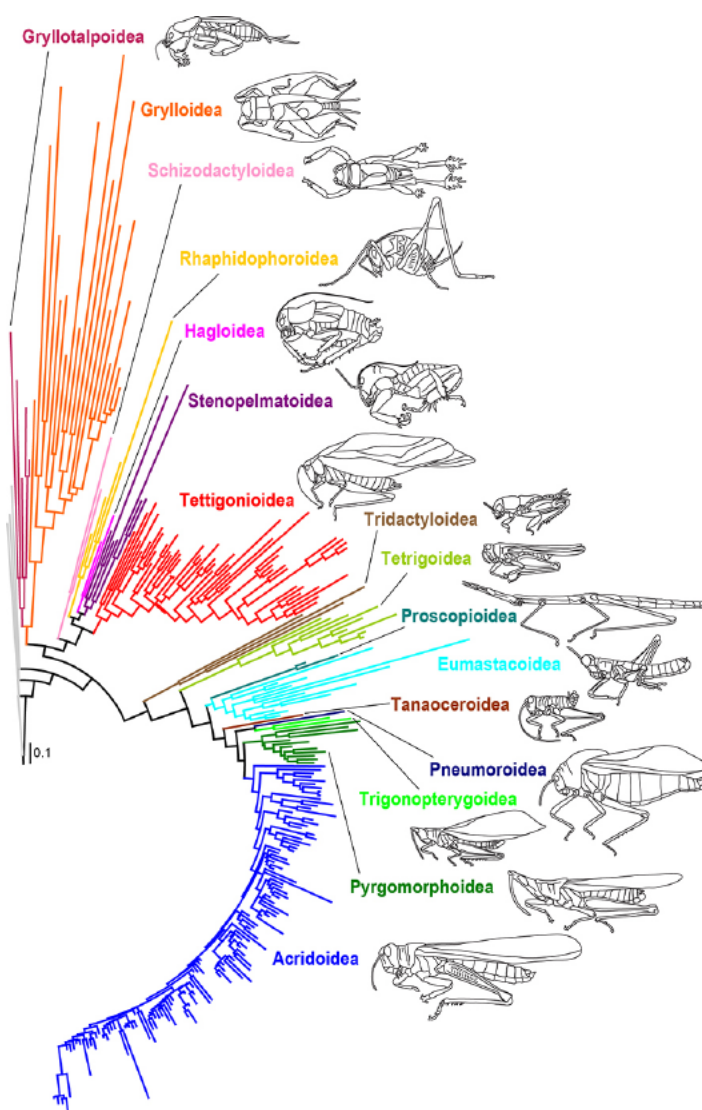
Editorial

By **HOJUN SONG**
 Editor, *Metaleptea*
 hsong@tamu.edu

I am writing this editorial in Dresden, Germany, where the biennial meeting on insect phylogeny just took place. I was invited to give a talk on my recent work on the phylogeny of Orthoptera. The meeting was an eye-opener for me. I am sure many of you know about a recent paper on the phylogeny of insects published in *Science*. That study was a culmination of a concerted research effort by an international team of insect systematists around the world. It was a phylogenomic analysis based on about 1,500 nuclear protein-coding genes generated from whole-body transcriptome data. The analysis included 5 orthopterans (*Gryllotalpa*, *Ceuthophilus*, *Tetrix*, *Prosarthria*, and *Stenobothrus*), which were found to be monophyletic. The position of Orthoptera within Polyneoptera was rather novel, but then the phylogeny of Polyneoptera is known to be notoriously difficult to resolve. I do not mean to discuss about the findings of the study since it’s been out for a while. I know that they are in the process of publishing more in-depth studies on different groups within insects, including the Polyneoptera, which will include about 50 orthopteran taxa. This is all good, and the data will be an excellent resource for

the systematics community for a long time.

However, I do want to talk about something that’s been deeply troublesome for me for quite some time. Unfortunately, the 1KITE consortium, which is behind the *Science* paper, does not include any orthopteran systematist. There are several reasons why this is the case, but the most important reason would be that there is a general lack of orthopteran systematists around the world today. I know there are excellent and productive groups, mostly focused on descriptive taxonomy, in South America, Europe, China, Russia, and Turkey, but when it comes to phylogenetics, the number of actively



The latest molecular phylogeny of Orthoptera based on mitochondrial genome and nuclear loci by Song et al. (2015). Although it is the most comprehensive work to date, the study included less than 1% of the known diversity within the order. It demonstrates that we have a long way to go in terms of understanding the phylogeny of Orthoptera.

working labs become embarrassingly small. Orthoptera is the most diverse order within Polyneoptera with more

than 25,000 described species and it is a fantastic model group for studying evolution! Understanding the evolutionary relationships among organisms is exceedingly important, and the previous generation of orthopteran systematists, such as Ander, Chopard, Uvarov, Rehn, Hubbell, Dirsh, Kevan, Roberts, Descamps, Jago, Amedegnato, and Cohn, was collectively very interested in understanding the phylogeny of Orthoptera. There are also giants in our field, such as Otte, Rowell, and Carbonell, who are retired but still active and care deeply about the phylogeny, but somehow in our field, that passion and curiosity has not been transferred in great numbers from the previous generation to younger systematists. Although small in number, there are many members of this new generation who are eager to learn more about their favorite orthopterans using modern tools to answer some of the most interesting questions in Orthoptera. Admittedly, however, orthopterists are lagging behind other major insect orders in terms of utilizing the latest technologies, such as NGS data and micro-CT. This is actually interesting because we are the leaders in modernizing taxonomy with our amazing Orthoptera Species File.

Let's change this trend. There are amazing groups of orthopterans that deserve a lot of attention. Let's all work together to revitalize our field one more time! I am personally committed to train the next generation of orthopteran systematists and I know there are other groups who are trying to do the same. This endeavor will have to be a community effort, working across continents and political and cultural boundaries. Our society is a tightly knit group and I believe that once we start moving together, we can achieve great things. What do you think?

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 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 January of 2016, so please send me your contributions by December 15, 2015. I look forward to hearing from you soon!

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Editor Metaleptea: Hojun Song, Department of Entomology, Texas A&M University, College Station, TX, USA. hsong@tamu.edu

Associate Editor Metaleptea: Derek A. Woller, Department of Entomology, Texas A&M University, College Station, TX, USA. asilid@gmail.com

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