

METALEPTEA

THE NEWSLETTER OF THE



ORTHOPTERISTS' SOCIETY

President's Message

By **MICHAEL SAMWAYS**
President

An amazing gift to the Orthopterists' Society!

The late Dr. Ted Cohn generously donated US\$1,240,000 to the Orthopterists' Society. This funding will be used to encourage young researchers to undertake exciting new research through The Ted Cohn Research Fund. This was the wish of Ted, twice Past President of the Society, and truly dedicated researcher with a strong belief in fostering the field of Orthopterology.

Ted was always a man of considerable vision and unparalleled dedication. He was a philanthropist and, coupled with this, a great sense of humour along with a wonderful, positive outlook on life. This outstandingly generous gift to the Orthopterists' Society will be aimed principally at sup-



porting all aspects of Orthopterology, from applied orthopterology, through genetics and development to ethology, ecology and conservation, and on any taxa that are Orthoptera *sensu lato*.

Particular support, but not exclusively, will be given to Orthopterists who do not otherwise have access to funds for research.

This gift will have significant positive impact on the field and will enable us all to be a truly global society with a great sense of common purpose.



Theodore J. Cohn, Montellier, France 2001 (Photo Credit: P. Naskrecki)

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

[1] PRESIDENT'S MESSAGE

[2] SOCIETY NEWS

[2] *The Theodore J. Cohn Research Fund: Call for applications for 2015*

[2] *Orthoptera Species File Grant Solicitation*

[3] *Symposium Announcement: Orthopteroids set to steal the spotlight at ESA, 2014*

[4] *Ould Babah is a new president of CLCPRO*

[5] *Book Announcement: A Guide to the Cockroaches of Australia By David Rentz*

[5] REGIONAL REPORTS

[5] *India by ROHINI BALAKRISHNAN*

[6] OS GRANT REPORTS

[6] *Focus on Euryphyminae (Acrididae), Africa's Endemic Agile Grasshoppers by CORINNA S. BAZELET*

[8] *Evolutionary recycling of sex chromosomes in Neotropical Melanoplinae by ELIO R. D. CASTILLO*

[11] *My Resilient and Surprising Colony of Orthoptera by ALEXANDRA PROKUDA*

[12] BOOK REVIEW

[12] *Book Review: Rowell, C.H.F. 2013. The Grasshoppers (Caelifera) of Costa Rica and Panama by SAM W. HEADS*

[14] CONTRIBUTED ARTICLE

[14] *Locust and grasshopper outbreaks in Empangeni sugarcane, Kwazulu-Natal, South Africa by ADRIAN BAM*

[17] *Scarce Songs by TIM GARDINER*

[18] EDITORIAL

The Theodore J. Cohn Research Fund: Call for applications for 2015 (Deadline : March 31, 2015)

By **MICHEL LECOQ**

Chair, Theodore J. Cohn Research Fund Committee

Fellow Orthopterists,
I have the pleasure to announce a new call for 2015. I remind you that this research grant is primarily in support of graduate students and young scientists for significant basic research in Orthoptera (*s.l.*).

Thanks to the generous donation of the late Dr. Theodore J. Cohn (see President's message), it is now possible to fund research grants for up to \$1,500 per grantee. Particular support, but not exclusively, will be given to Orthopterists who do not otherwise have access to funds for research.

The proposals should be in the following format and restricted to the indicated number of pages:

DESCRIPTION (one page)

1. TITLE

2. SIGNIFICANCE, stressing the new ideas and aspects of the proposal, expected contribution to theory, relation to previous work, etc. (applicants should emphasize the nature and significance of their proposal to provide

the judges with the basis for weighing different projects, especially in fields outside their expertise)

3. RESEARCH PLAN, including the particular orthopterans to be studied, methods, logistics, etc.

4. TIMETABLE, even if approximate, to give the judges some idea of feasibility.

CURRICULUM VITAE (half page) including name, full address, present position or years in graduate school, education, number of papers published or completed, citation of selected publications pertinent to the proposal to aid the judges.

BUDGET (half page) including justification of items where appropriate (i.e. why special equipment is necessary unless clearly obvious), other funding for the project, etc. Overheads cannot be provided for on Society grants.

The Committee prefers proposals applicable to broad biological problems, even though the actual research may be narrower in scope. Proposals

also should include clearly stated hypotheses and aims, and the nature of the evidence to be gathered to test the hypothesi(e)s and possible outcomes.

Proposals from graduate students must include a simple recommendation from their major professor or advisor. Those not affiliated with an educational or research institution should indicate where the work is to be done.

A short report will be required from the successful applicants. It will be written for our newsletter *Metaleptea*, and be suitable for both orthopterist and non-specialist readers.

Proposals should be submitted to the Chair at the following address:
Michel Lecoq (lecoq@cirad.fr)

I hope this year, as usual, we will receive many exciting research proposals from our young colleagues. It's always fascinating, for the Committee members, to analyse all the proposals, reflecting a large activity on Orthopteroids all over the world... and difficult to choose because all these proposals are generally of high quality.



Orthoptera Species File Grant Solicitation

By **MARIA MARTA CIGLIANO**
Orthoptera Species File Officer

The Orthopterists' Society in cooperation with the Illinois Natural History Survey has provided funding for work in support of the Orthoptera Species File ([http://orthoptera.](http://orthoptera.speciesfile.org/)

[speciesfile.org/](http://orthoptera.speciesfile.org/)). Members of the Orthopterists' Society are invited to apply. Applications should be sent to **María Marta Cigliano (cigliano@fcnym.unlp.edu.ar)**.

Grants are available for a project as

defined by the applicant. The project must involve benefit to the Orthoptera Species File or to a Species File for another group within Polyneoptera. The usual benefit is the addition of images (photographs of the habitus and diagnostic details of type

specimens, other reliably identified museum specimens, and/or living individuals), sound recordings and/or geo-referenced specimen records in the database. Projects may be proposed for periods of one to three years.

Funding availability for 2015 will be US\$27,000. All requested information must be submitted by **November 15, 2015** to receive full consideration.

The proposals should be in the following format:

**1. DESCRIPTION:
TITLE**

SIGNIFICANCE (highlighting the new data that will be added to OSF, preferably to taxa currently lacking images, sound recordings, distribution records, etc.)

OBJECTIVES, METHODS and ACTIVITIES
TIMETABLE

2. CURRICULUM VITAE

3. BUDGET (including justification of trips to museums, field work, equipment, etc.)

Proposals from graduate students should include a simple recommendation from their professor or advisor.

Preference will be given in relation to the amount of data added into OSF, i.e. as the expected contribution to the considered taxa (dependent on already existing data). Preference will be also given to applicants who develop a proposal that is related somehow to a taxonomic research project, and demonstrate knowledge of the taxa involved. The methods, e.g. techniques for capturing images will be likewise considered.

Important: A short financial and tasks report will be required from the grantees once the funding period is finished.

Symposium Announcement:

Orthopteroids set to steal the spotlight at ESA, 2014

By **DEREK A. WOLLER**
University of Central Florida
Orlando, FL, USA



Good news, fellow Society members! I am pleased to announce that there will be a symposium focusing on orthopteroids in

their myriad diversity at this year's Entomological Society of America (ESA) conference (Nov. 16-19, 2015) in Portland, Oregon. Believe it or not, it has been a decade since Hojun Song put together a symposium on Orthoptera, the last time this group was specifically represented at an ESA meeting and something we felt it was high time to change. By "we", I mean myself (Dept. of Biology/Song Lab, University of Central Florida (UCF), asilid@gmail.com) and the three colleagues who have collaborated with me on this endeavor: Tyler Raszick (Dept. of Entomology/Sword Lab, Texas A&M University, tjraszick@gmail.com), Ricardo Mariño-Pérez (Dept. of Biology/Song Lab, UCF, pselliopus@yahoo.com.mx), and Jo-Vonn Hill (Mississippi Entomological Museum, Mississippi State Univer-

sity, jgh4@entomology.msstate.edu).

The symposium will be held on Tues., 11/18 from 1:30 to 5:30 PM in a room that has yet to be assigned, so please check the ESA schedule as soon as you receive one. The event will consist of 13 invited talks of varying lengths and, in addition to containing a variety of orthopteroid topics, will also include a good mix of seasoned researchers and up-and-coming students. Additionally, the Society has agreed to fund an after-symposium dinner for the speakers that all are welcome to attend with the location to be determined, so please stay tuned for that announcement after the symposium.

We truly hope that everyone who comes to this year's ESA meeting will also be able to attend at least a portion of our symposium. A big turnout will go a long way in convincing the ESA leaders to highlight orthopteroids more often in the future. In fact, we think it'd be wonderful if someone

else in the Society ran with the idea again next year and organized another symposium. If you'd like advice on how to do that or if you have any questions prior to the event, feel free to contact one of us using the e-mail addresses listed above.

For your perusal, the line-up for the symposium is as follows:

1. Know your orthopteroids: An introduction to the subjects of this symposium

Tyler Raszick, Texas A&M University, College Station, TX

2. Faster than cichlids? Rapid diversification in *Neoconocephalus*

Katy Frederick-Hudson, University of Missouri, Columbia, MO

3. Systematics of Sphenariina (Orthoptera; Pyrgomorphidae)

Oscar Salomon Sanabria-Urban, UNAM FES_Iztacala, Tlanepatlá, Mexico

4. What we could learn from a phylogeny of Blaberoidea

Dominic Evangelista, Rutgers, The State University of New Jersey, Newark, NJ

5. Some like it hot, some like it cold: Thermal tolerance in Australian alpine grasshoppers

Rachel Slatyer, Michael Nash and Ary Hoffmann, University of Melbourne, Parkville, Australia

6. Edible orthopteroids: The Mexican case

Ricardo Mariño-Pérez, University of Central Florida, Orlando, FL

7. Combining nutrition and community ecology of grasshoppers to benefit ecosystems and people

Paul Lenhart, University of Kentucky, Lexington, KY

8. Talking back to the night: Vibrational communication in the New Zealand Giant Weta (Anostomatidae: Deinacrida)

Daniel R. Howard, Augustana College, Sioux Falls, SD

9. Project Mantodea: An update on the phylogeny and revision of two praying mantis clades (Earless Neotropicals and the Hymenopodidae)

Gavin J. Svenson, Cleveland Museum of Natural History, Cleveland, OH

10. DNA barcoding to determine the diets of prairie grasshoppers

John Barone¹, Kevin Burgess¹, Scott Whitley¹ and JoVonn Hill², ¹Columbus State University, Columbus, GA, ²Mississippi State University, Mississippi State, MS

11. Cryptic diversity within the North American Jerusalem crickets (Orthoptera: Stenopelmatidae): Influences of acoustic signaling and habitat heterogeneity

Amy Vandergast, U.S. Geological Survey, San Diego, CA

12. Lessons from the embiopteran silk road

Janice Edgerly-Rooks, Santa Clara University, Santa Clara, CA and Bennett Addison, Arizona State University, Tempe, AZ

13. Acoustic communication in *Neconocephalus*: From ion channels to phylogenetics

Johannes Schul, University of Missouri, Columbia, MO

Congratulations, Ould Babah!

The new president of “Commission de lutte contre le Criquet pèlerin dans la Région occidentale (CLCPRO)”

The regional representative of the Orthopterists’ Society in North Africa and the Sahel, Dr. Mohamed Abdallahi EBBE (Known as Ould Babah)

was elected President of the Desert Locust Control Commission (Western Region) (CLCPRO). Ould Babah was elected President of CLCPRO during the 7th Session that was held in Nouakchott (Mauritania) from June 22 to 26, 2014 in conjunction with the 9th Meeting of the Executive Committee. The CLCPRO, whose secretariat is provided by FAO, has 10 member countries, namely Algeria, Burkina Faso, Libya, Mali, Morocco, Mauritania, Niger, Senegal, Chad and Tunisia. These countries contribute annually to the operation of the board with a budget of €630,000. CLCPRO coordinates and develops surveillance

and control activities against the Desert Locust within these ten countries through a regional cooperative framework. This preventive locust control programme includes, among other things, monitoring the Desert locust situation, the development of plans to manage the locust risk, training, research and environmental studies. A regional system to finance the locust control programme is also being developed by CLCPRO.

For more information, please visit our WebSite CLCPRO <http://www.clcpro-empres.org/> or contact the sec-



retariat: Dr Mohamed Lemine Hamouny (AGPM) <MohamedLemine.Hamouny@fao.org>

(translated from French
by David Hunter)

Book Announcement:

A Guide to the Cockroaches of Australia

By David Rentz

There are over 500 described species of cockroaches found in Australia (including some of the largest and smallest in the world). Every country has native cockroaches, and they can be so diverse and beautiful that they are often mistaken for beetles or other bugs. Some have colourful spots and stripes that you may not associate with the name 'cockroach'.

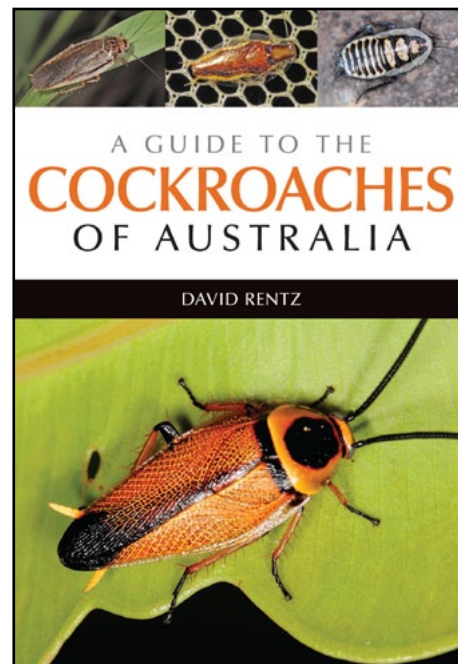
But it is not just the prettier cockroaches that should be appreciated. Native cockroaches play an important role in most ecosystems across Australia. They return leaf litter to the soil, and are a satisfying meal for

many insect-feeding lizards and birds. A Guide to the Cockroaches of Australia looks in detail at their morphology, habitats and ecology, and explains how to collect and preserve them. Importantly, it will allow pest controllers, students and researchers to reliably identify most of the common pest species as well as the non-pest cockroaches.

(taken from the publisher)

CSIRO Publishing
\$49.95 (paperback)
328 pp. ISBN: 9780643103207

You can purchase this book from:
<http://www.publish.csiro.au/pid/6710.htm>



Regional Reports - What's happening around the world?

India

Recent work on the taxonomy of Indian crickets: a report

By **ROHINI BALAKRISHNAN**

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The classic work of L. Chopard on the cricket fauna of India culminated in the publication of the major taxonomic work on the Grylloidea of India (Chopard, 1969). Since then, however, there have been no major taxonomic revisions attempted of most gryllid groups in India. Although the Indian subcontinent is one of richest in terms of diversity of the Phalangopsidae, there have been few studies on this group since Chopard. In this context, the paper by Desutter-Grandcolas and Jaiswara (2012) on Indian phalangopsids represents a major step forward. In this paper, the authors

provide diagnostic features and criteria for Indian phalangopsid genera based on morphology and genitalic characters and, most importantly, a taxonomic key to these genera. Two new genera, *Opiliosina* Desutter-Grandcolas and *Speluncasina* Desutter-Grandcolas have also been erected. Five new species have been described: *Kempiola flavipunctatus* Desutter-Grandcolas (n. sp.), *Opiliosina meridionalis* Desutter-Grandcolas (n. gen. n. sp.), *Phalangopsina bolivari* Desutter-Grandcolas (n. sp.), *P. chopardi* Desutter-Grandcolas (n. sp.), and *P. gravelyi* Desutter-Grandcolas (n. sp.). This work provides an important foundation for future studies on Indian Phalangopsidae.

In a more recent paper, Jaiswara and Desutter-Grandcolas (2014) examined and re-described the genus *Pteroplistes*, whose taxonomic affinities have been controversial, and its only

known Indian species, *P. platycleis*. They also described two new species of this genus from southern India, *P. kervasae* Jaiswara (n. sp.) and *P. masinagudi* Jaiswara (n. sp.).

Additionally, an update on cricket species of the subfamily Trigoniidae found in the North-Western Indian state of Rajasthan, including a new record of the genus *Natula* from this state, was provided by Mal et al. (2014).

References

Chopard, L. (1969) The fauna of India and adjacent countries. Orthoptera. Volume 2. Grylloidea. Baptist Mission Press, Calcutta.

Desutter-Grandcolas, L. and Jaiswara, R. (2012) Phalangopsidae crickets from the Indian Region (Orthoptera, Grylloidea), with the descriptions of new taxa, diagnoses for genera, and a key to Indian

genera. Zootaxa 3444: 1–39.

Jaiswara, R. and Desutter-Grandcolas, L. (2014). Revision of the genus *Pteroplistes* in India, with the description of two new

species *Pteroplistes kervasae* Jaiswara, n. sp. and *Pteroplistes masinagudi* Jaiswara, n. sp. (Orthoptera, Grylloidea, Pteroplistinae). Zootaxa 3814: 96–108.

Mal, J., Nagar, R. and Swaminathan, R. (2014). Record of *Natula matsuurai* Sugimoto (Orthoptera: Gryllidae: Trigonidiinae) and other sword-tailed crickets from India. Zootaxa 3760: 458–462.

The Orthopterists' Society Grant Reports

Focus on Euryphyminae (Acrididae), Africa's Endemic Agile Grasshoppers

By **CORINNA S. BAZELET**
Stellenbosch University
South Africa

In South Africa's Kgalagadi Transfrontier Park, an arid acacia savannah wedged as a panhandle between Botswana and Namibia, in the early mornings of early summer, hours before ground temperatures reach their peak, large populations of *Euryphymus kalahariensis* Barker, 1984 bask, feed and mate on the dry, sandy soil. This euryphymine grasshopper is small and robust, easily camouflages into the ground, and displays black inner femora and bright yellow hind tibia as part of its sexual display. Despite the early hour, not only is *E. kalahariensis* the most abundant insect in its environment, but its movements are surprisingly agile, raising questions about physiological adaptations and evolutionary processes which allowed for this generally inhospitable ecological niche to be so suitably filled. Traveling South from Kgalagadi through South Africa's arid Great Karoo semi-desert, similar highly localized pockets of different species of Euryphyminae can be found, all sharing the same agile behaviour and association with arid habitats.

Despite their charismatic behaviour and appearance, Euryphyminae is among the most poorly known subfamilies of the Orthoptera. Superficially resembling Calliptaminae, Dirsh (1956a) first described Euryphyminae as a distinct subfamily on the basis of the strikingly different shape of their epiphallus and male

cercus. Fifty-four species in 18 genera are known to occur in South Africa alone, with approximately 5 additional genera and 40 species occurring elsewhere in sub-Saharan Africa (Eades et al. 2014). Euryphyminae has distinct centers of endemism in southern African arid regions, including two of the world's biodiversity hotspots, South Africa's Cape Floristic Region and Succulent Karoo biomes. Both hotspots are Mediterranean-type ecosystems noted for their extremely high levels of plant diversity (Myers et al. 2000) and proportionately poorer, but still speciose and endemic, invertebrate fauna. Despite their fascinating habitat, no behavioural or ecological studies have focused on the Euryphyminae, no DNA sequences are deposited in GenBank, and the most recent taxonomic studies were a review of Namibian and Angolan species and a revision of the genus *Rhachitopsis* in the 1990s (Naskrecki 1992, 1995).



Figure 1. *Pachyphymus carinatus* (A) and *P. namaquensis* (B). (Photo credit P. Naskrecki)

Needless to say, much work is needed in order for us to better understand these fascinating organisms.

To begin to chip away at the black box that is the Euryphyminae, Dr. Piotr Naskrecki and I conducted a revision of *Pachyphymus* (Bazelet & Naskrecki 2014), the most easily identifiable genus of Euryphyminae, notable for its double hump-shaped pronotal crests when viewed laterally,


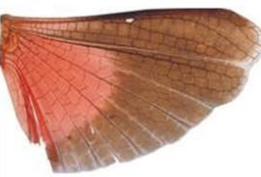




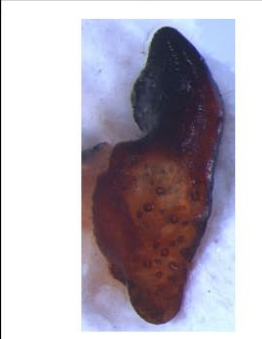
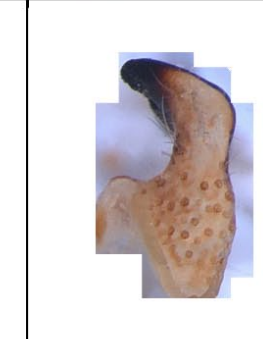
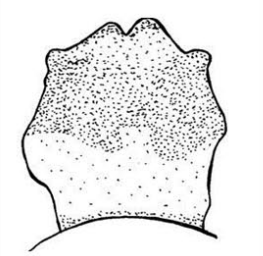
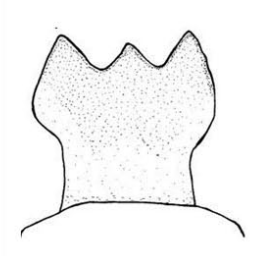
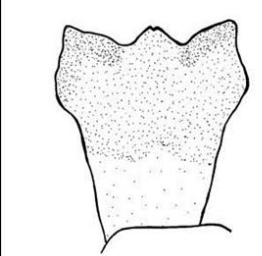
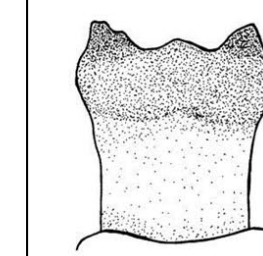
	<i>carinatus</i> Dirsh, 1956	<i>crutulifer</i> (Serville, 1838)	<i>namaquensis</i> Bazelet & Naskrecki, 2014	<i>samwaysi</i> Bazelet & Naskrecki, 2014
Hind wing				
Male cercus				
Female subgenital plate				

Figure 2. Table illustrating the principal diagnostic differences between the four species of *Pachyphymus*.

reminiscent of a camel’s humps (Fig. 1). No other species of Euryphyminae possesses such a pronotum, and as a result, members of this genus are often confused with *Trilophidia* (Oedipodinae). Prior to this study, two species of *Pachyphymus* were described: *crutulifer* was originally described as *Calliptamus crutulifer* (Serville, 1838) but was later redescribed by Uvarov (1922) who erected the genus *Pachyphymus*; and *carinatus* described by Dirsh (1956b). Dirsh (1956b) also provided a general diagnosis of the two species belonging to the genus and identified morphological characters which could be used to differentiate them.

As a first step to revising the genus, we gathered all *Pachyphymus* specimens housed in South African museums (~200 specimens) as well as two specimens which Naskrecki collected and photographed in the field (Fig. 1).

Despite our best efforts and numerous collecting trips, we were never able to collect more fresh specimens. Based on all available specimens, we were able to identify and describe two new species: *samwaysi*, named for Prof. Michael Samways, current president of the Orthopterists’ Society, and *namaquensis*, named for the Namaqualand region of South Africa, where this species exclusively occurs. We also revised the key morphological characters which Dirsh (1956b) used for his initial diagnosis. Whereas Dirsh (1956b) found the degree of rugosity of the pronotum, and height and shape of the pronotal ‘crests’ to be diagnostic, we found these to be highly variable within species. Instead, we found the single most diagnostic character to be the color and degree of infumation of the hind wing, with shape of the male cercus and female subgenital plate also helpful for diagnosis (Fig.

2). However, while the four species were easy to diagnose, there were also series of specimens with intermediate characters which were collected from convergence points where distribution ranges of two species met, possibly indicating recent or ongoing hybridization or speciation.

If *Pachyphymus*, the most easily recognizable euryphymine genus could include two previously undescribed species, then it is reasonable to assume that many more species of the Euryphyminae await diagnosis and description. While this study represents just the tip of the iceberg of what remains to be discovered about the Euryphyminae, efforts to study them are made more difficult by their extreme agility and narrow spatial and temporal windows of distribution. Although the list of what remains to be studied in the Euryphyminae is longer than the list of what we already

know, one thing which seems clear is the need to act now, as climate change has been shown to have a significant impact on arid regions including centers of endemism of the Euryphyminae (Foden et al. 2007).

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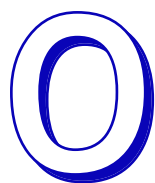
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Evolutionary recycling of sex chromosomes in Neotropical Melanoplinae

By **ELIO R. D. CASTILLO**
 Instituto de Biología Subtropical
 CONICET-UNaM
 Laboratorio de Genética Evolutiva
 Argentina



Orthoptera are a fascinating group of insects in multiple ways. My own research focuses on the evolutionary relationships of South American acridoid grasshoppers with emphasis in the Melanoplinae. In this respect, evidences from different research areas, such as taxonomy, morphometrics, molecular genetics, and cytogenetics are of relevance for the understanding of the evolutionary history of these species, which is my main objective. In this report I will summarize some cytogenetic characteristics of melanoplinae and highlight their biological relevance.

Pioneering cytogenetic research has shown that acridid grasshoppers display an apparent karyotypic stability, with the vast majority of species exhibiting a standard (and presumably ancestral) acro-telocentric karyotype ($2n=23\text{♂}/24\text{♀}$; $FN=23/24$) including an XO/XX chromosomal sex determination mechanism. Nevertheless, evo-

lutionary structural modifications of the standard karyotype due to different types of chromosomal mutations have occurred along their history. There are instances of reduction in chromosome number with no morphological variation of chromosomes, presumably due to tandem fusions, an unusual kind of chromosome mutation (i.e., *Dichroplus pratensis* with all-telocentric $2n=19/20$ or some species of *Trimerotropis*). Reduction of the number of chromosomes without change in the fundamental number (FN) through centric fusion has also occurred and is manifested as fixed interspecific differences (either autosomal or involving sex chromosomes, see below) or, more frequently, polymorphisms. Intraspecific variation due to polymorphic centric fusions (i.e. *Dichroplus pratensis* Bidau & Martí 2002, and *Dichroplus fuscus* Taffarel et al. 2014) or pericentric inversions (i.e. *Trimerotropis* spp Guzmán & Confalonieri, 2010) are important sources of chromosomal variation in

natural populations. Besides, some species have proved to be excellent experimental models to study how chromosomal rearrangements occur and affect critical features of the genetic system, e.g recombination (Castillo et al 2010a, b; Castillo et al. 2014).

One of the most important components of chromosome variation in Acrididae is constituted by neo-sex chromosome systems, which arose independently from standard XO/XX systems within several lineages. In Acrididae, species karyotypes show a trend toward the fixation of centric fusions; the cytogenetic evidence in an important number of melanoplinae supports this premise, showing species with derived karyotypes and neo-sex chromosome mechanisms (Bidau & Martí 2001; Castillo et al. 2010 a,b; Bidau et al. 2011). In general terms, when there is centromeric breakage of the X chromosome and an autosome, and subsequent fusion occurs, a neo-sex chromosome arises (Castillo et al.

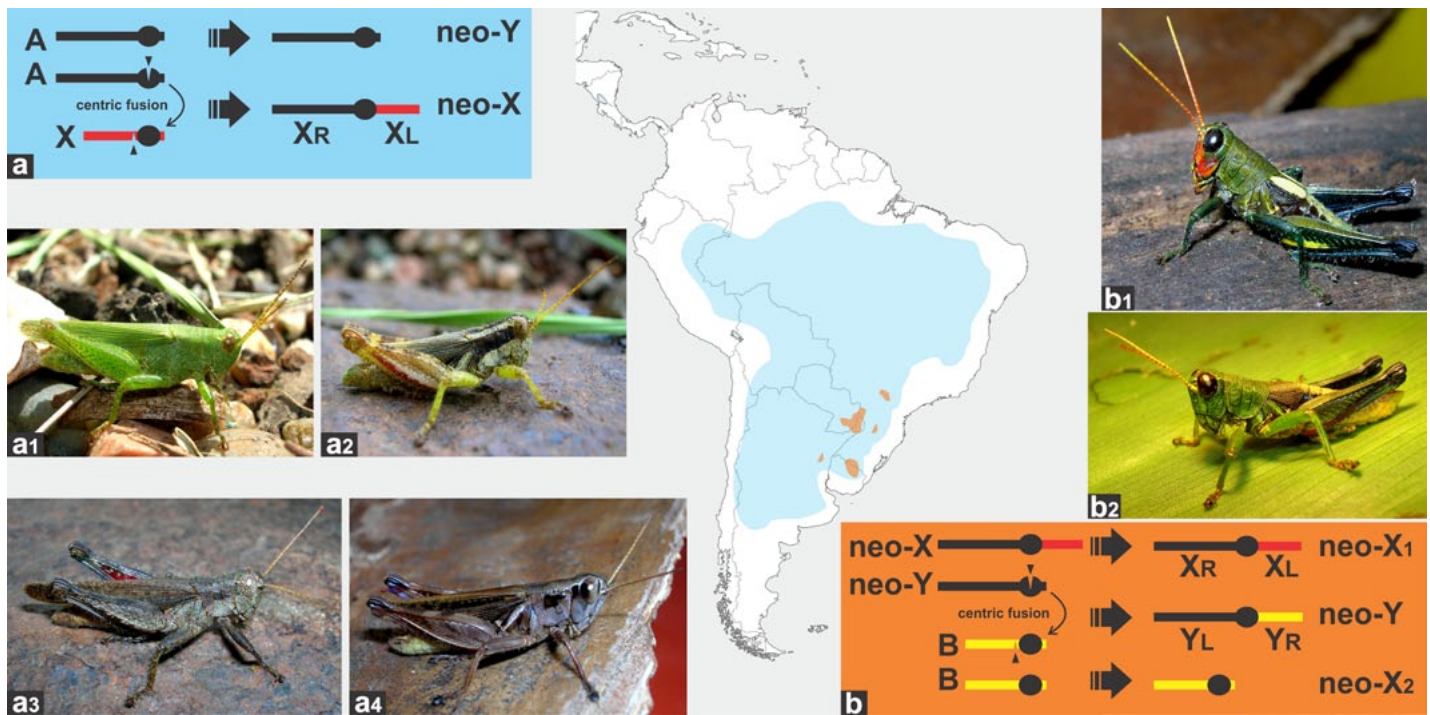


Figure 1. Schematic view of neo-sex chromosome formation produced by centric fusion a) between an Autosome (A) and the X chromosome. Male individuals of a1 *Atrachelacris unicolor*, a2 *Ronderosia malloi*, a3 *Ronderosia forcipata*, a4 *Dichroplus obscurus*; b) between the neo-Y and another autosome, giving rise to a neo-X1X2Y complex sex-chromosome mechanism. Male individuals of b1 *Dichromatos schrottkyi*, b2 *Dichromatos lilloanus*. The South America map shows the potential distribution of melanopline species with neo-XY (in blue) and with complex sex chromosome mechanisms (in orange).

2010 b). This neo-X chromosome is formed by the XL arm (the ancestral X chromosome) and the XR arm (the ex-autosome), and the homologue of the fused autosome is now called the neo-Y (Fig. 1a). While the mechanism of the physical chromosome rearrangement per se is not difficult to understand, the evolutionary implications of this phenomenon require a more detailed study. In recent publications we have had the opportunity to accurately describe and discuss several interesting cases (Castillo et al. 2010 a,b; Bidau et al. 2011; Castillo et al. 2014).

Acridid neo-sex chromosomes allow the addressing of one of the most exciting issues in evolutionary biology, that of the emergence and divergence of sex chromosomes. In general, classic theory of sex chromosome evolution proposes as the starting point, the appearance of a sex-determining gene in a pair of ordinary autosomes. Later on, sex determining and/or sex-related genes begin to be inherited together due to abolition of recombination near

the new sex region, which drives the XY divergence process (Charlesworth et al. 2005, Kejnovsky et al. 2009). While this is so in most of the studied models, in Orthoptera the events could follow a different path (Castillo et al. 2010 a,b; Bidau et al. 2011, Castillo et al. 2014). Neotropical Melanopline species are ideal models for the study of sex chromosome evolution because many cases of neo-sex chromosomes at various evolutionary stages are known (Hewitt 1979, Castillo et al. 2010 a,b). The amazing diversity of neo-XY chromosome systems in this group is due mainly to X-A centric fusions that occurred repeatedly in the evolutionary history of several lineages (Bidau & Martí 2001, Mesa et al. 2001; Castillo et al. 2010 a,b; Castillo et al. 2014). Probably however, the most important feature of South American Melanopline neo-sex chromosomes is that several evolutionary instances defined by particular cytogenetic properties have been identified (Castillo et al. 2010 b). Only a few species show a small

degree of differentiation, indicative of a recent origin, where the neo-Y still conserves high homology with the XR arm of the neo-X. Recently arisen simple neo-sex chromosome systems will be initially represented by a sex pair, which still conserves almost the whole of the homology, synaptic ability, and possibility of free recombination along the fused autosome (XR) and its homologue, the neo-Y (e.g. *Oedaleonotus enigma* Hewitt & Schroeter 1968). On the other end of the cytogenetic spectrum, there is almost complete loss of homology between Y and XR, evidenced by an extremely reduced synaptic region, exclusive distal meiotic association, accumulation of repetitive heterochromatic sequences in the Y, and eventually the possibility to fix complex structural rearrangements (examples of this “terminal” stage are *Ronderosia bergii* [Sáez 1963, Cardoso & Dutra 1979] and *Dichroplus vittatus* [Bidau & Martí 2001]).

Between these two cases, a continuous spectrum of neo-sex chromosome

conditions revealing different evolutionary strata are found (White 1973, Hewitt 1979, Castillo et al. 2010a, b). Some examples can be mentioned as follow: *Dichroplus obscurus*, *Atrachelacris unicolor*, *Ronderosia forcipatus*, *R. malloi*, *Eurotettix minor*, *Zoniopoda iheringi*: the sex pair of these species is formed by a metacentric neo-X, product of the centric fusion of the ancestral X and an autosome while the homologue of the translocated autosome becomes the telocentric neo-Y. Despite the same mechanism proposed for the neo-sex chromosome system of these species, the neo-sex pair involved different pairs of autosomes, at least at the generic level. An example of a highly evolved neo-XY system was studied in *Dichroplus silveiraguidoi*. This species is unique in being $2n=8$ (see above) and the only one known in which the neo-X is telocentric, the neo-Y being very small and acrocentric (Sáez 1957). Due to this extraordinarily re-arranged karyotype it is very difficult to infer the evolutionary history of the sex chromosomes (Cardoso et al. 1974, Cardoso & Dutra 1979). *Dichroplus vittatus* and its close relative *D. maculipennis* have complex neo-XY systems, which are not interpretable in classic terms (Bidau & Martí 2001; Mesa et al. 2001; Castillo, Martí & Bidau, unpub.) An unusual origin of neo-sex chromosomes was recently proposed for *Boliviacris noroestensis* (Castillo et al. 2014).

In a further leap of complexity, a neo-XY system may undergo a conversion into an X1X2Y system through a Y-autosome fusion if a second pair of telo/acrocentric autosomes is available to become incorporated into the sex chromosome mechanism (Fig. 1b) (White 1973, Hewitt 1979, Castillo et al. 2010 a,b). Although much less frequent than typical neo-XY chromosomes the majority of these complex systems correspond to Neotropical species of restricted geographic distribution (Castillo et

al. 2010 b). All neo-X1X2Y species belong to genera in which neo-XY mechanisms are frequent (i.e. *Ronderosia*, *Scotussa*), or all known species share this type of sex chromosomes (*Dichromatos*). Since X1X2Y mechanisms derive from previous XY systems through centric fusion of the neo-Y with a second autosome (the unfused element becoming X2), it is probable that all known cases have originated from advanced XY systems. This is reasonable, considering that the probability of rapid occurrence of two sequential fusions is very low (Castillo et al. 2010 b).

The cytogenetic evidence suggests that the replacement of X0-XX for XY-XX was favored many times in Neotropical Melanoplinae. The high frequency of neo-sex chromosome determination systems, and their independent origins point to a higher incidence of chromosome rearrangement within this group. If this is so, are centric fusions (or other rearrangements involved in neo-sex chromosome formation) random chromosome restructures due to events of non-homologous recombination? Is selection involved in neo-sex chromosome maintenance in natural populations or is it genetic drift? (Veltos et al. 2008)

Differently from other insect groups, little is known about the intimate mechanism of sex-determination in Orthoptera and most derives from extrapolation of theoretical and empirical data of other biological systems (White 1973; Pannell & Pujol 2009; Kaiser & Bachtrog 2010). Thus, the main question in this respect is: are neo-sex chromosomes in Orthoptera subject to the classical path of sex chromosome evolution? All the cytogenetic evidence currently available points to a different path, for whose elucidation new molecular evidence is necessary, especially relating to neo-Y chromosome degeneration and the mapping of sex-determining genes in the new sex chromosomes in this particular group. Also, despite

descriptive studies of neo-XY chromosomes in Melanoplinae nothing is known about their meaning in evolutionary terms and their role in sex determination remains a mystery in Orthoptera. The description and understanding of neo-sex chromosomes' structure, meiotic behavior, and their origin in species of Orthoptera is a little-explored field and actually deserves more attention than it has received (Bidau et al. 2011).

Acknowledgments: I am very grateful to the Orthopterist's Society for partially supporting, through a research grant, this Ph.D. on the diversity of neo-sex chromosomes in Neotropical Melanoplinae.

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My Resilient and Surprising Colony of Orthoptera

By **ALEXANDRA PROKUDA**
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The summer during which I was supported by the Orthopterists’ Society things did not go as planned. My project was stalled and would later have to be completely overhauled due to the mechanical engineer’s difficulties in building the needed equipment. The females in the *Gryllus firmus* stock I had been working with did not seem to find the same males attractive as those in previous generations. Worst of all, the stock cages became overrun with Argentine ants looking for water and food in the near-desert southern California climate. Every day would bring new casualties in my stock cages with several individuals being swarmed by ants in each cage. Since most of the usual tricks of fumigation or insecticide spray would also harm my model species I had to

rely on improvised measures. Some of the grant money from the Orthopterists’ Society was used for water trays under the cages, bleach solution used as insecticide spray on the trails of ants outside the cages, caulk for plugging up ant entry ways, and a multitude of other devices in the war against the unwanted invaders.

Some of the crickets that were saved were used as the parent generation for a population to be used in a female preference study, also supported by the Orthopterists’ Society grant. Specifically I was looking into



the repeatability of female choice for the song of male crickets in *G. firmus*. *G. firmus* is a dimorphic species with short-winged and long-winged individuals. What was known from previous experiments in my lab is that females prefer the short-winged morph. The results from my repeatability



experiment, however, suggested that there was no preference for the shirt-winged morph in the stock population any longer. More importantly, there seemed to be assortative mating by wing morph with long-winged females significantly more often choosing long-winged males and with short-winged females showing a similar preference for short-winged males (although this result was not statistically

significant). These results suggest a few things: that the female preference has changed, the males' songs are somehow different, or that this was an artifact of the experimental design. I am currently running experiments that will elucidate the basis of the female preference and will help in either supporting or refuting some of these hypotheses. Based on personal observations so far, and a year after the initial experiment, the assortative mating behavior is still present and still puzzling.

Book Review:

Rowell, C.H.F. 2013. *The Grasshoppers (Caelifera) of Costa Rica and Panama.*

The Orthopterists' Society Publications on Orthopteran Diversity, 611 pp.
ISBN: 98-0-615-90904-2, \$25(US).

By **SAM W. HEADS**

Illinois Natural History Survey
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Naturalists have long been fascinated by Central America. The astonishing faunal and floral diversity of the region along with its biogeographical and evolutionary importance, make it a mecca for biologists of all disciplines. The allure of Central America has afflicted a number of orthopterists throughout history, including such famed individuals as Henri de Saussure, Lawrence Bruner, Albert Morse and Morgan Hebard. In terms of biogeographical significance, the isthmus of Panama and the neighboring tropical forests of Costa Rica are among the most interesting areas in the region. Various orthopterists have studied the fauna of this part of Central America over the years and there is now a significant body of literature on the Orthoptera of the area (including, of course, *Katydid of Costa Rica, Vol. 1* by Piotr Naskrecki, published by the Society in 2000). Nevertheless, the study of Orthoptera in this fascinating and extremely bio-

diverse part of Central America is still in its nascent stages and monographic treatments of the fauna will continue to be both necessary and valuable.

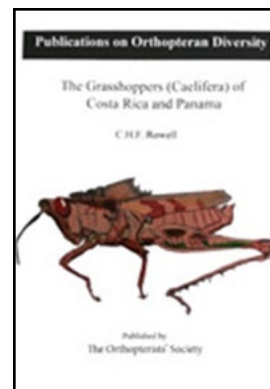
Enter C.H.F. Rowell's recently published volume, *The Grasshoppers (Caelifera) of Costa Rica and Panama*, the latest in the Society's Publications on Orthopteran Diversity series, published in November 2013. The book is undoubtedly a landmark contribution not only to knowledge of the grasshoppers of southern Central America, but also to orthopterology as a whole. The volume is, at 611 pages, comprehensive, authoritative, generously illustrated, and certainly an essential addition to the library of any orthopterist with interests in Neotropical grasshoppers.

The book begins with a short dedication to the people of Costa Rica and Panama, closely followed by a combined preface and acknowledgements section. The rest of the introduction comprises a short section outlining the rationale behind the book and an explanation of its layout, etc. followed

by a brief review of the Caelifera and the component family-group taxa recognized by the author in his classification.

This includes Tridactyloidea, Tetrigoidea, Proscopioidea, Eumastacoidea, Pyrgomorphoidea, and Acridoidea. Curiously, no mention is made of the Pneumoroidea, Tanaoceroidea or Trigonopterygoidea, presumably because these taxa are not known from Costa Rica or Panama. Brief descriptions of the various family-groups are provided, which serves to provide context.

The introduction is followed by a glossary, which outlines the morphology of acridomorph grasshoppers. Here, Rowell outlines the terminology used throughout the rest of the book and provides clear illustrations of the



various structures. This will be of use to those readers unfamiliar with acridomorph structure. Unfortunately however, the author has missed the opportunity to illustrate the generalized structure of internal genitalia. Five paragraphs on p. 19 are devoted to a discussion of the phallic complex, though there are no supporting illustrations. This is a shame as these structures are so crucial to the taxonomy of Acridomorpha and the identification of genera and species. Indeed, the author states that, “being a complex structure, the phallic complex lends itself admirably to taxonomic use, and its extraction and preparation are among the most important manual skills of the grasshopper taxonomist” (p. 19). Therefore, the inclusion of some well-annotated illustrations of phallic morphology at this point, prior to the taxonomic treatments, would have been extremely useful. Illustrations of genitalia occur throughout the taxonomic treatments, but are generally not labeled. Thus, without a graphical introduction to these structures and their relationships to one another, the illustrations will be difficult for less familiar or non-specialist readers to interpret.

Following the glossary are the taxonomic treatments, which form the bulk of the volume. They follow a traditional arrangement, beginning with a definition of the suborder Caelifera and a key to the superfamilies present in southern Central America. Interestingly, the author actually does list Pneumoroidea, Tanaoceroidea, and Trigonopterygoidea here and mentions that their distribution lies outside of the focal area of his treatment. The author also criticizes the use of the name Acridomorpha. He states that, because of “inherent ambiguity” the term “cannot be recommended, even as a clade name” (p. 23). Here, I must disagree, as numerous studies have supported the monophyly of a clade comprising the superfamilies Acridoidea, Eumastacoidea, Pneumoroidea, Pyrgomorphoidea, Tanaoceroidea, and

Trigonopterygoidea to the exclusion of Tridactyloidea and Tetrigoidea. Indeed, Rowell’s own molecular work (with P.K. Flook) has supported these relationships. Given that all of the included superfamilies are grasshopper-like in gross morphology (in contrast to the diminutive and highly derived tridactyloids and tetrigoidea), the use of Acridomorpha as a name for this clade is both appropriate and useful. Regardless, the tridactyloids and tetrigoidea are explicitly excluded from the taxa treated in the book, which covers only those belonging to a monophyletic Acridomorpha, and implies that the author nevertheless accepts these relationships.

Following a useful key to the superfamilies present in southern Central America, each superfamily is treated in the following sequence: Eumastacoidea (beginning on p. 25 and including Eumastacidae and Episactidae); Proscopioidea (p. 47); Pyrgomorphoidea (p. 53); and, finally, Acridoidea (beginning on p. 57 and including Romaleidae, Acrididae, and their various subfamilies). The treatments are detailed, including diagnoses and descriptions as well as notes on distribution and natural history. Also included here are very useful field characteristics that will aid readers in recognition of the various genera in the field. There is an entry for each species with citation to the original description and an explanation of etymology as well as a diagnosis and brief description. In addition, every species is illustrated.

Color plates are included at the end of the volume following the references and species lists, but preceding the taxonomic index

and a note about taxonomic changes included in the book. In addition, black and white versions of the color habitus illustrations are interspersed with the text to aid the reader. The inclusion of the color plates at the rear of the volume and their duplication in black and white throughout the text adds over 90 pages to the total page count. However, the author states in the introduction to the book that this was done for economic reasons to reduce production costs. While it may seem duplicative, there is some benefit to having black and white versions of the habitus illustrations in line with the text descriptions for easy reference.

In summary, the book is an extremely useful taxonomic treatise on the Acridomorpha of Costa Rica and Panama and will undoubtedly be relevant for the foreseeable future as a benchmark reference in Neotropical orthopterology. The volume could have been further improved by the inclusion of more detailed geographical background; e.g. a discussion of different habitat types found in the region along with vegetation maps, and perhaps a discussion of the important geological history of the region. It would also have been nice to see the color plates integrated into the text,



A bunch of male *Paramastax rosenbergi* on a “spit wad” saliva and tissue put on a plant leaf to mimic bird droppings and attract butterflies. Quite a few spit wads attracted *Paramastax*. (Colombia: Risaralda Dept. Montezuma Rainforest Reserve and Eco-Lodge, Parque Nacional Tatamá 5.23008° N x -76.08368° W, 1,400 meters elev. 30 May 2014. Photo credit: R.A. Behrstock)

production costs notwithstanding. It is, nonetheless, an invaluable compilation of data concerning the region's

grasshopper fauna based upon knowledge gleaned from the author's many years of experience. I congratulate Dr.

Rowell on the excellent achievement and recommend the book wholeheartedly to the Society's membership.

Locust and grasshopper outbreaks in Empangeni sugarcane, KwaZulu-Natal, South Africa

By **ADRIAN BAM**
Stellenbosch University
South Africa

In the last six or seven years, there have been reports of acridid outbreaks with increasing severity in Empangeni, KwaZulu-Natal, South Africa.

In general, little is known about acridid outbreaks in sugarcane due to their sporadic nature. Therefore, in my M.Sc. project, undertaken in collaboration with Stellenbosch University and the South African Sugarcane Research Institute (SASRI), and supervised by Dr. Pia Addison and Prof. Des Conlong, I set out to identify morphologically and molecularly, all species associated with Empangeni sugarcane. Additional goals were to determine the ecology and population dynamics of the most important species and to provide baseline data for the development of an integrated pest management (IPM) plan against these crop pests.

A year-long population survey was conducted on a number of affected farms and adjacent grassland sites to determine the life cycles, population density, and composition of this acridid complex on these farms. Surveys showed that this complex comprised five species: *Nomadacris septemfasciata*, *Petamella prosterernalis*, *Ornithacris cyanea*, *Cyrtacanthacris aeruginosa*, and *Cataloipus zuluensis*. Observed damage was recorded throughout the year in order to correlate with species densities and it was found that damage was closely associated with two species, namely *Petamella prosterernalis* and *Nomadacris septemfasciata*, meaning that these

two species are the biggest threat to Empangeni sugarcane due to their higher densities and large body size. All five species are univoltine (one life cycle per year), but two different life cycle strategies were discovered: 3 species exhibit a winter egg diapause while 2 species exhibit a winter adult reproductive diapause, an important finding considering the knowledge intensive method of control which has been proposed. Population surveys revealed a large difference in species composition among farms (sugarcane sites) and among grassland sites. *Nomadacris septemfasciata* and *Petamella prosterernalis* showed a significant preference for sugarcane while species, such as *Cyrtacanthacris aeruginosa*, *Zonocerus elegans* and *Orthochtha* sp. seemed to prefer grassland sites.

Feeding potential trials were completed on the two most economically important

species, *Nomadacris septemfasciata* and *Petamella prosterernalis*. The results showed that *Petamella prosterernalis* had a significantly higher feeding potential (% leaf damage) compared to *Nomadacris septemfasciata* even though, in terms of dry weight and body length, individuals of this species are smaller. Feeding data were used to determine the voracity of these two species under laboratory conditions. *Petamella prosterernalis* eats roughly 1.83 grams of fresh sugarcane per day while *Nomadacris septemfasciata* eats approximately 1.16 grams per day. These results were then compared to

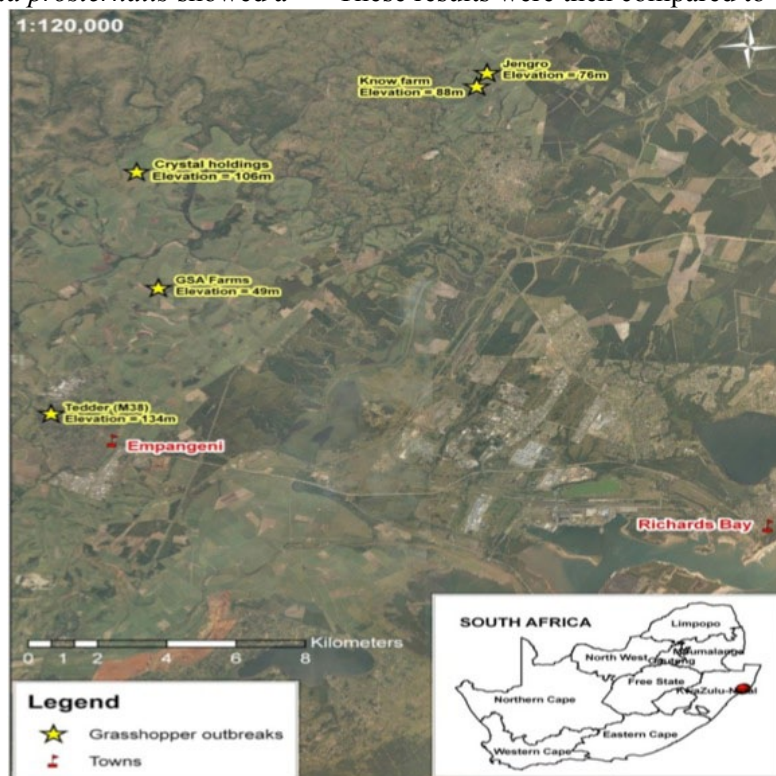


Figure 1. Map of Acridid outbreak area, indicating the location of the 5 affected farms

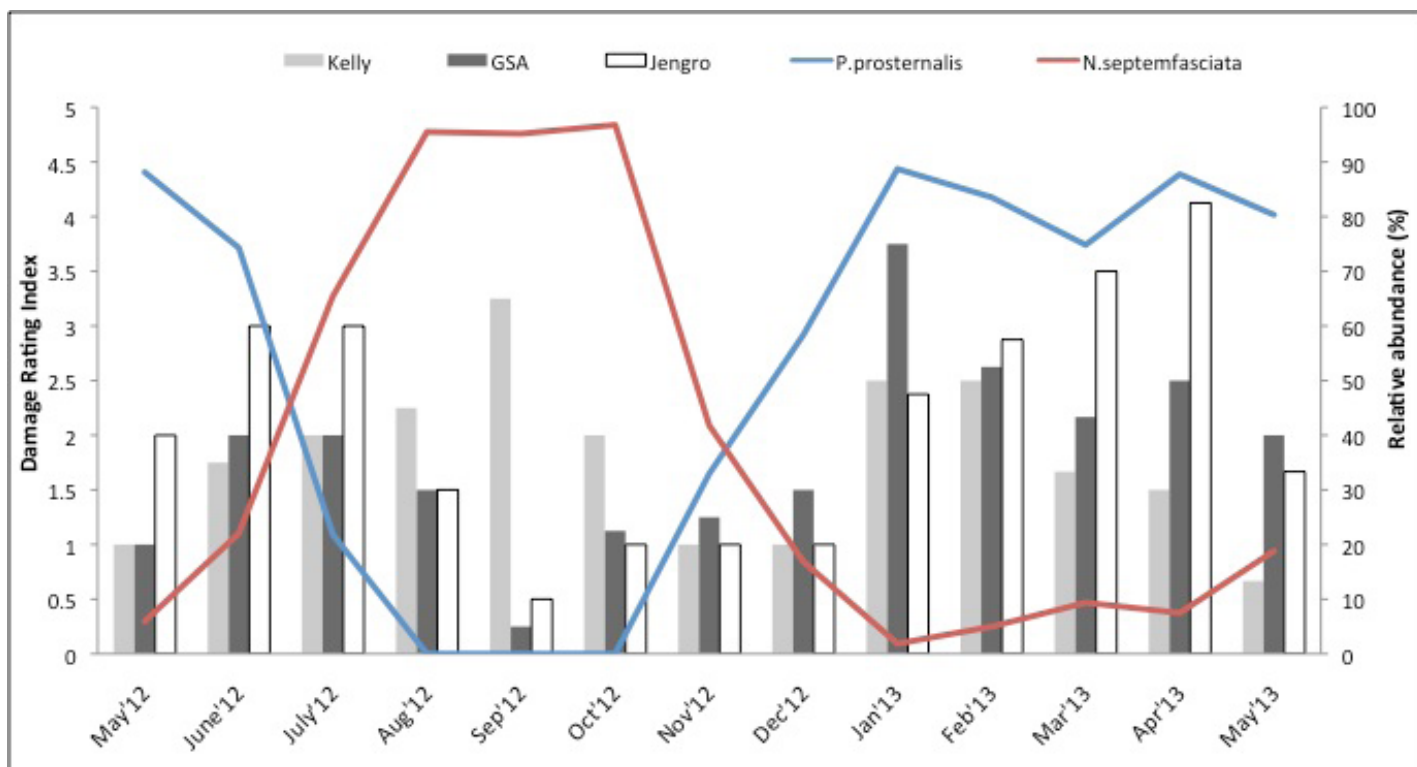


Figure 2. Comparison of the damage rating index at three locations on the primary axis in relation to relative abundance of two species on the secondary axis.

observed field damage data in order to gauge their accuracy and applicability within a field setting, which showed that although sugarcane field damage is significantly correlated with the population fluctuations of both these species, it is more closely associated with *Petamella prosternalis*, resulting in a correlation coefficient of 0.43 while *Nomadacris septemfasciata* had a correlation coefficient of 0.25.

Phase polyphenism in the red locust, *Nomadacris septemfasciata*, was investigated using three methods, including traditional morphometrics (Elytra/Femur (E/F) ratio), hopper colouration, and eye stripe data. The E/F ratio indicated that the majority of the Empangeni population sampled is in the transiens and gregarious phase with a mean E/F ratio of 2.01 and that they seem to be becoming more gregarious over time, with populations in 2012 having a mean E/F ratio of 1.20 and, in 2013, a mean E/F ratio of 2.01. Hopper colouration also indicates that populations are generally showing gregarious tendencies with the majority of hoppers

exhibiting gregarious type colouration. Eye stripe data showed that the majority of adult specimens observed had seven eye stripes, an indication of gregarious individuals. Geometric morphometrics, a relatively new, software-based technique, which has not been used in phase polyphenism studies before, was used as a means to accurately measure variations among populations of *N. septemfasciata* by measuring the variation in forewing shape according to allocated landmarks. The resulting shape variations were compared to traditional morphometrics in an attempt to relate the two techniques, so that geometric morphometrics can possibly be used as a tool to study phase polyphenism in locusts in the future. The results indicate that similarities in terms of location and gender exist between the two methods, however the exact same individuals should be used for both methods which will improve the accuracy of comparisons.

Identification (ID) keys were developed for these five species for both life stages using specimens obtained

from the field. The purpose of the ID keys was to provide a quick and easy identification guide for growers, extension officers, and researchers which would allow them to identify specimens in the field. The adult ID key was based on large and easily distinguishable morphological characters, such as forewing length, hind tibia colour, hind wing colour, and general body colour of the specimen. The only morphological characters for hoppers which were fairly easy to distinguish were antennae and overall body colour, therefore these traits



Figure 3. The red locust, *Nomadacris septemfasciata*, a well-known crop and pasture pest of southern Africa

were used to develop the hopper ID key.

This study, for the first time, identified the acridid complex causing damage to Empangeni sugarcane and provided a broad summary of the potential impact the complex has on the crop as well as what may be

causing them to occur in this area, such as optimal habitat conditions and sugarcane as a preferable host plant being two factors, which are likely to be having an influence. The findings of this study provide the baseline data needed in order to develop a more integrated and sustainable approach

to controlling these acridid pests. Understanding the biology of the species enables practitioners to make more effective management decisions, which is clearly needed as the current techniques being used have not solved the “grasshopper problem.”

Editor’s Photo Picks

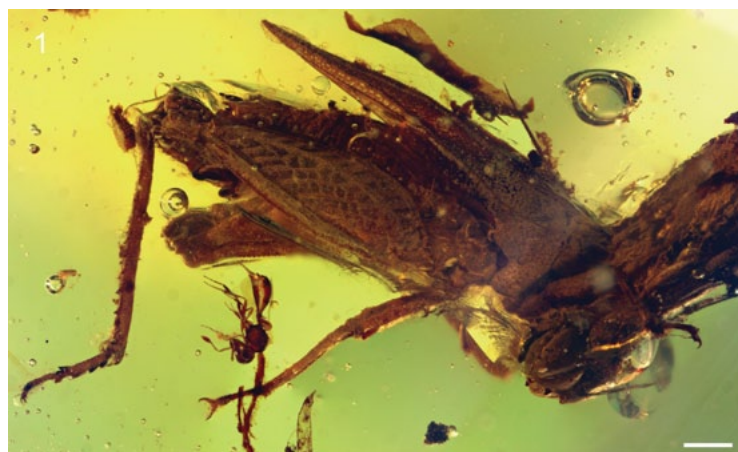


Ichthiacris (Ichthiacris) rehni Bolívar, 1905 (Pyrgomorphidae: Orthacridinae: Ichthiacridini) (left: male, right: female) Mexico: Baja California Sur: Near Ciudad Constitucion. August 1st. 2014. (Photo credit: Ricardo Mariño-Pérez)

Orthoptera in the News!



During the World Cup 2014 quarter-final between Brazil and Colombia, a giant grasshopper (*Tropidacris* sp.) landed on Colombia’s No. 10 James Rodriguez. (Photo credit: AP)



Sam Heads described a fossil tetrigrid, *Electrotettix attenboroughi*, from the Dominican amber. The new species was named after Sir David Attenborough and this received a lot of media attention. (Photo credit: Sam Heads)

Scarce Songs

By **TIM GARDINER**
Environment Agency
United Kingdom

On a short trip to the heathland and mire valleys of the New Forest in southern England I was fortunate enough to hear the stridulation

of four scarce orthopterans on a visit to Pig Bush near Beaulieu. I visited the valley mire on 21st July 2014 in sunny, hot weather and immediately heard the distinctive stridulation of the UK Red Data Book species, the large marsh grasshopper, *Stethophyma grossum*, and the Nationally Scarce bog bush-cricket, *Metrioptera brachyptera*, on the mire. From a drier area the wheeling stridulation of the Nationally Scarce woodland grasshopper, *Omocestus rufipes*, was heard and individuals were caught to confirm the identification; the white palps and red abdomen being key features to distinguish it from the more widespread common green grasshopper, *Omocestus viridulus*. In the distance a chorus of wood crickets, *Nemobius sylvestris*, (also Nationally Scarce) was heard in the late afternoon sunshine, completing the survey of a key site for scarce Orthoptera in the UK.

A haiku poem has been written to capture the essence of the experience



Nationally Scarce bog bush-cricket, *Metrioptera brachyptera*

when each stridulation was heard (for example, the repetitive beeps of a reversing vehicle provided an interesting contrast to the large marsh grasshopper song). The haiku do not follow the traditional 5-7-5 syllable pattern but take the accepted free-form approach with a cutting word (followed by a dash) to note the break in the poem.

bog bush-cricket
chuff chuff chuff –
the call of an unseen
bog bush-cricket

large marsh grasshopper
from mire myrtle
pop pop pop –
a vehicle reverses

woodland grasshopper
a free-wheeling
bicycle in the grass –
the hopper's deceit

wood cricket
wood crickets purr –
the ventriloquists
of a lonely glade



Mire valleys of the New Forest in southern England

Editorial

By **HOJUN SONG**
Editor, *Metaleptea*

When summer began, I had several goals to accomplish, such as finishing up several overdue manuscripts and generating tons of data for ongoing research. Instead, my summer was spent on a lot of travels, both planned and unplanned, as well as countless hours at my desk, responding to emails and trying to figure out a bunch of computer programs that were poorly made. And the goals I set out to achieve, well, let's just say I did not manage to finish even half of them...

However, I did take a collecting expedition to the Dominican Republic, which was such a refreshing trip. The purpose of this trip was to mainly collect the elusive pyrgomorph genus *Jaragua* for the dissertation research of my Ph.D. student Ricardo Mariño-Pérez. There are several *Schistocerca* species known from DR, which was another reason for the trip. This was my first time to DR, and I was blown away by its diversity in terms of various habitats and fauna. We (Ricardo and myself) were accompanied by a local grasshopper expert, Brigido Hierro, who works with the country's Ministry of Environment. During our two-week trip, we drove over 2,000 km and collected from several national parks, and we ended up with hundreds of valuable specimens. We did manage to collect the elusive *Jaragua*, although they were nymphs. It was made clear to me that the caeliferan fauna of DR, as well as other parts of the Caribbeans, certainly deserve a lot of attention, and I cannot wait to go back there in the near future.

As usual, this issue is full of interesting articles. We have several interesting reports from many parts of

the world as well as OS grant reports from several students. 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
- Interesting observations
- Highlights of your peer-reviewed

- publications
- Wish lists
- Photography techniques
- Collecting techniques
- Personal stories

To be published in *Metaleptea*, please send articles, photographs, or anything related to orthopteroid insects to song@ucf.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, 2015, so please send me content promptly. I look forward to hearing from you soon!

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