ISSN 2372-2517 (Online), ISSN 2372-2479 (Print)

METALEPTEA

THE NEWSLETTER OF THE ORTHOPTERISTS' SOCIETY

President's Message

By DAVID HUNTER
President
davidmhunter100@gmail.com

Dear Society members,

Like almost everyone, we have had to endure severe limits on activities because of the COVID-19 coronavirus. Many of you have had to work from home, which works for some, but not for others and many have not been able to work at all. Let's hope things start to return to "normal," so we can get on with what we really enjoy doing, though what the "new normal" will be like is far from certain. This issue of *Metaleptea* has examples of what we have all had to do during the limitations and lockdowns of various kinds. In my case, I have found time to catch up on the list of jobs around the house and yard that Denise generously updates for me at regular intervals—including washing the windows of all the dust and smoke left from the fires here in Australia earlier this year—under close supervision of our miniature Schnauzer, Ruby, of course!

It is with great pleasure that I announce that Tony Robillard from the National Museum of Natural History in Paris has agreed to be our new Managing Editor for the *Journal of Orthoptera Research*. Special thanks to our current Managing Editor Corey Bazelet, whose tireless efforts over the past five years has led to increasing accessibility of our journal being open access as part of Pensoft. Meet Tony on page 2!

As you can see from our Treasurer's Report, the economic uncertainties have led to a decline in our investments, but we have had substantial gains during the past 4 years, so we still have more than we had at the end of 2014, the year of the late Ted Cohn's generous gifts to our society. Over the past few years, we have been

TABLE OF CONTENTS

(Clicking on an article's title will take you to the desired page)

setting aside some of the gains into a reserve bond fund that has retained its value, so that we now have $75,000 in bond and cash reserves that can cover expenses.

In addition to reports on what we have been doing in the face of COVID-19, I bring to your attention a short report by Roger Farrow on the effects of Australia's devastating summer (December-February) fires on some of our less common grasshoppers. And there is the continuing threat of desert locust bands and swarms from India/Pakistan to Africa at the same time as COVID-19 is spreading.

The many reports in the current issue of *Metaleptea* demonstrate the continuing success of work on Orthoptera and related insects: it is with great pleasure that I present another excellent *Metaleptea*, thanks once again to the tireless efforts of Hojun Song and Derek Woller!

Tony Robillard: our new Managing Editor of the *Journal of Orthoptera Research*

By DAVID HUNTER
President
davidmhunter100@gmail.com

Tony Robillard, from the National Museum of Natural History (MNHM, Paris), has agreed to be our new Managing Editor of *Journal of Orthoptera Research*. Tony works on the evolutionary biology and taxonomy of crickets, particularly investigating the evolution of acoustic communication using orthoptera as a study system. His plenary presentation at our Congress in Agadir last year outlined some of his interesting work: "Evolution of systems of communication in Crickets: a multidisciplinary exploration in space and time."

Tony brings a wide range of expertise to the editorship of *JOR* and our current Managing Editor (Corey Bazelet) and Tony will work together for the remainder of the year as a period of transition. The plan is for Corey to be largely responsible for the June issue of *JOR* as that is well underway and Corey has suggested that she and Tony work together on the December issue to allow Tony to learn in more detail the processes involved. We sincerely thank Corey for her tireless efforts in moving *JOR* to the open access Pensoft platform that has led to an increase in citations of *JOR* articles. Many thanks both to Corey and to Tony as they work together during this editorial transition period for the *Journal of Orthoptera Research*.

The 2020 Theodore J. Cohn Research Grants Funded

By MICHEL LECOQ
Chair, Theodore J. Cohn Research Fund Committee
mlecoq34@gmail.com

Dear fellow Orthopterists,

Despite the global health crisis caused by Covid-19 which has disrupted everyone's working conditions, we received this year 24 research proposals from Cameroon, France, Greece, India, Israel, Japan, Kenya, Mexico, New Zealand, Poland, Singapore, Slovakia, and USA. As usual, many well written projects, concerning all groups of Orthoptera, and many interesting ideas. As usual, the task of the Committee was not easy. We finally selected – according to their merit… and to our financial possibilities – 10 research projects for a total of $14,879. Below is the list of the successful candidates (by alphabetical order of surname) and the title of their research project:

- **Jessica Briggs** (USA) - The neurological response of Australian black field crickets under variable acoustic environments.
- **Amy Byerly** (USA) - Spatial and temporal patterns of gene flow in a field cricket hybrid zone.
- **James Gallagher** (USA) - Linking song characteristics to wing morphology in a newly discovered cricket morph.
- **Tan Ming Kai** (Singapore) - Are some individuals more flamboyant than

others? Personality in Eneopterinae crickets.
- **Tatsuru Kuga** (Japan) - Effect of the conspicuous sound produced during flight for escaping on the survival rate in *Acrida cinerea* (Orthoptera: Acrididae).
- **Keren Levy** (Israel) - The use of crickets as a bioindicator for artificial light at night
- **Sona Nuhlickova** (Slovakia) - Delineation of notoriously difficult species complexes: testing of novel genetic approaches on the example of two sibling species in the Central Europe
- **Howon Rhee** (New Zealand) - The effects of wildfires on population trends and genetic diversity of the Madeiran Green BushCricket (*Psalmatophanes barretoi*)
- **Apostolos Stefanidis** (Greece) - CODE- Conservation of Orthoptera Diversity in central Epirus, Greece
- **Raunak Sen** (India) - Sexual isolation and speciation in crickets

I would like to emphasize that, if the aim of these grants is to help students and young researchers, these contributions are also a chance for our society. They allow us to observe the vitality of research on Orthoptera, the diversity of ideas and proposals, the enthusiasm of our young students. These grants also contribute to enriching our *Metaleptea* newsletter with more and more excellent articles presenting the results obtained. They are a real asset for our society.

On behalf of the committee, I would like to thank all of our candidates for their participation. Congratulations to those who have been selected and good luck to all for continuing their work.

The next call will be in early 2021 and we strongly invite MSc/PhD students, and post-docs from around the world to submit their research proposals. I remind all that the only requirement is that the applicant be a member of the Orthopterists' Society in good standing.

Treasurer's Report

By **PAMELA MIHM**
Treasurer
p.mihm@regencyapartments.com

I hope this finds all of you healthy. The COVID-19 pandemic has affected everyone throughout the entire world and the Orthopterists' Society is no exception. The value of the Society's investments as of March 31, 2020 ($1,361,374) fell 16.52% compared to the value on December 31, 2019. The current value is still ahead of the amount the Society received as a bequest from Theodore Cohn. The Society's funds are invested in a variety of types of investments including stock funds and bond funds. Traditionally, the bond funds are less risky, and this proved true during this time; the value of the bond funds have actually increased. During early 2018 and again in September 2019, we transferred $30,000 from stock funds to the bond funds and the $60,000 transferred is now worth nearly $65,000. While we still do not know the complete economic fallout from the pandemic, I am pleased to report that, overall, the investments have increased in value since we received the March 31, 2020 statements. With prudent spending, the Society's economic future is still bright.

A call for DNA-grade specimens to reconsruct a comprehensive phylogeny of Ensifera

By **HOJUN SONG**
Department of Entomology
Texas A&M University, USA
hsong@tamu.edu

Dear Colleagues,

In the last issue of *Metaleptea*, I made a call for DNA-grade specimens to reconstruct a molecular phylogeny of Ensifera. I have been contacted by several colleagues who have expressed their willingness to donate specimens, and I truly appreciate their support.

With a summer field season coming up in the northern hemisphere, although we are still impacted by COVID-19, I would like to ask our members once again to consider donating specimens when you do go out and collect ensiferans.

Just to remind you, my project is titled, "NSFDEB-NERC: MULTIDISCIPLINARY APPROACH TO BIOACOUSTICS: Integrating phylogenomics, biophysics, and functional genomics to unravel the evolution of hearing and singing in katydids, crickets, and allies" (NSF DEB-1937815). This international collaborative project aims to study the evolution and genetic basis of acoustic communication, capitalizing on the most speciose and ancient lineage of the extant singing insects, the Ensifera (katydids, crickets, and relatives).

One of the main objectives of the project is to produce a comprehensive phylogeny of Ensifera based on 1,600

species and 1,000 loci, the largest phylogenetic dataset ever compiled for this group, which will serve as a robust comparative framework for studying the evolution of acoustic communication. This taxon sampling represents 10% of the known species diversity in Ensifera.

I am interested in any ensiferan specimens from anywhere in the world. Some species might be very common and easy to collect from your part of the world, but chances are, I have probably not been to where you live and, thus, I do not have those species. Also, if you are working on some taxonomic projects and would like to know where your group is placed within the phylogeny of Ensifera, please don't hesitate to write to me. I am very interested in talking to you.

For preserving specimens for DNA work, I would prefer the whole specimen killed directly in 95-100% ethanol. Please include collecting information and if you are able to identify to species, that would be absolutely wonderful.

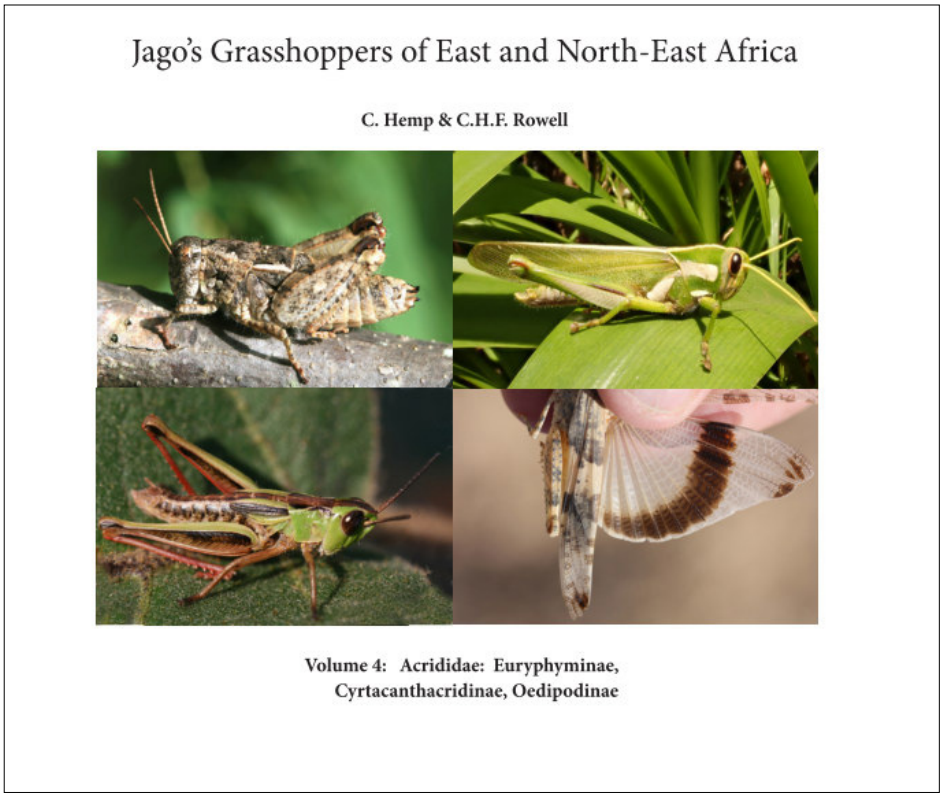
In addition to any ensiferan specimens you might be able to contribute, I am particularly interested in adding more Gryllacrididae, Anostostomatidae, and Rhaphidophoridae, as well as some of endemic Tettigoniidae and Gryllidae specific to biodiversity hotspots.

So, please consider contributing to this project, and send me an email at hsong@tamu.edu if you have specimens to donate or have specific questions. I'd be happy to cover shipping costs, of course. I would also love to hear from you.

Thank you so much for your help!

"Jago's Grasshoppers of East and North East Africa" volume 4 now available!

The fourth volume of "*Jago's Grasshoppers of East and North East Africa*" by Hugh Rowell and Claudia Hemp is now available to purchase from on-demand printing site Blurb. This volume focuses on Acrididae subfamilies Euryphyminae, Cyrtacanthacridinae, and Oedipodinae, and it represents an important contribution to our field. For the rationale and history behind this publication, please see Hugh Rowell's article in *Metaleptea* 35(3). To order, please visit the following links:



Volume 1: Pneumoridae, Pyrgomorphidae, Lentulidae, Pamphagidae and Dericorythidae: http://www.blurb.com/b/7826846-jago-s-grasshoppers-of-east-and-north-east-africa

Volume 2: Acrididae: Teratodinae, Hemiacridinae, Spathosterninae, Tropidopolinae, Calliptaminae, Oxyinae, Coptacrinae, and Eyprepocnemidinae: http://www.blurb.com/b/7789277-jago-s-grasshoppers-of-east-and-north-east-africa

Volume 3: Acrididae: Catantopinae: https://www.blurb.com/b/8845563-jago-s-grasshoppers-locusts-of-east-and-north-east

Volume 4: Acrididae: Euryphyminae, Cyrtacanthacridinae, and Oedipodinae: https://www.blurb.com/b/9995517-jago-s-grasshoppers-of-east-and-north-east-africa

Regional Reports - What's happening around the world?

North America

By KATHLEEN KING
USDA-APHIS-PPQ, Wyoming, USA
butterfliekisses2u@hotmail.com

Here are a few interesting things happening in the entomology/orthopteran world in North America.

First, the Entomological Society of America (ESA) will hold their next meeting November 15-18, 2020 in Orlando, Florida. Attendees are in for a special treat of two plenary speakers on Sunday evening, November 15: Chavonda Jacobs-Young, Administrator of the U.S. Department of Agriculture's Agriculture Research Service, and Ray Wheeler, Senior Scientist and Plant Physiologist at NASA. Program Symposia were announced February 28, and Section and Member Symposia as well as Workshop and Organized Meetings were announced April 17. As in previous years, a symposium focused on Polyneoptera ("Small Orders, Big Ideas: Polyneoptera") has been selected and speakers are being gathered currently.

Second, The National Grasshopper Management Board held their annual meeting in Denver, Colorado from February 4-6, 2020. The meeting comprised stakeholders, researchers, and state and federal cooperators involved with grasshopper and/or Mormon cricket management in the 17 contiguous western states of the United States. Members of the U.S. Department of Agriculture (USDA) Plant Protection and Quarantine (PPQ) presented policy updates while each state involved in the program presented field activity reports highlighting 2019 surveys and treatments. Presentations were given on concurrent research on grasshopper chemical management developments, biopesticides, forecasting grasshopper populations, damage thresholds, climate impacts, and even the potential to harness sound frequencies to manage grasshoppers. Industry members presented on chemical control options and availability of chemicals. Wyoming PPQ led a roundtable discussion on treatment strategies and decision making involved in those strategies. February 6 was reserved for the PPQ-only meeting where PPQ specific topics were reviewed and discussed. For more information about the National Grasshopper Management Board visit https://sites.google.com/site/ngmborg/.

Figure 1. The *M. punctulatus* specimen shortly after being caught from Harman and Brust publication.

Third, *Melanoplus punctulatus* (Scudder) (Acrididae) was found in northeastern Wyoming recently (Fig. 1). This find is a state record for Wyoming and a range extension for *M. punctulatus*. Alexander J. Harman and Mathew L. Brust published an article describing the find and detailing what is known about this species of grasshopper. The article can be found here: https://doi.org/10.3157/061.145.0105

Fourth, the USDA Science and Technology Phoenix Lab's Rangeland Grasshopper and Mormon Cricket Management Team (Derek A. Woller and his teammates), after overcoming numerous pandemic-related obstacles, departed for their annual field season on May 18 for the rangelands of New Mexico to set up and run several large and small-scale field experiments with grasshoppers. The goals of these experiments are to develop better, cheaper, greener methods of grasshopper and Mormon cricket management. This year, experimental treatments with large-scale plots will be applied using both an airplane and Unmanned Aircraft Systems (UAS) while small-scale plots will use field cages and focus on biopesticide baits.

Figure 2. The Rangeland Grasshopper and Mormon Cricket Management Team (the usual trio and two summer interns) gearing up to start another long day of setting up 40 acre field plots for upcoming aerial treatment experiments on rangeland habitats in New Mexico.

Latin America

By MARTINA E. POCCO
CEPAVE, CONICET - UNLP
División Entomología
Museo de La Plata, UNLP
La Plata, ARGENTINA
martinapocco@fcnym.unlp.edu.ar

Certainly, this is a very special report. Just a few months ago we could not imagine that the entire world would be affected by such a sad situation due to the COVID-19 pandemic. We all are living difficult and uncertain times, some regions in better conditions while, unfortunately, some others strongly affected and living critical circumstances. Everybody has been forced to adapt their daily routines trying to face this new reality as best as we can. In our region, Latin America, the lockdown/quarantine has been adopted differently, varying from partial to strict lockdown depending on each country. In Argentina, we are under a nationwide total lockdown (preventive and mandatory social isolation), with few exceptions, since March 20, and restrictions have been gradually lifted at least for some activities. At the end of April, the government allowed some other activities in most of the country, except for the big cities.

Our scientific community is working hard in the fight against this new coronavirus. More than 70 institutions from our National Scientific and Technical Research Council (CONICET) and the Universities are cooperating with the health system in several ways, providing medical supplies (masks, respirators, test kits, among others), technological equipment, as well as funding projects involving different aspects of this problematic. One of the initial national measures adopted was the creation of a "Coronavirus COVID-19 Unit" by the Ministry of Science, Technology and Innovation, CONICET, and the National Agency for the Promotion of Research, Technological Development and Innovation, aimed at providing the technological development, human resources, infrastructure, and equipment required to diagnosis and research on COVID-19.

In regards to teaching activities, the universities implemented online platforms and resources for virtual teaching, and even though it requires a bit more effort from both students and professors, I think the feedback is in general positive. Most of the orthopterists from Argentina are involved in teaching activities, and therefore, part of our time is dedicated to these activities, interacting with students through videoconferences and trying to help them as much as possible. In relation to our research tasks, the universities and CONICET have allowed lab access, although limited, to only those researchers who conduct essential activities and services considered by government decree. In my case, I have been authorized to take care of the colony of locusts and grasshoppers at CEPAVE institute. Aside from this, most of the work is done at home, with constant online communication among colleagues and advisors.

In this region, at the time Argentina entered the nationwide lockdown, our field season had not finished. Therefore, our field collecting trips planned to be conducted in March/April to North Argentina had to be cancelled due to the restrictions and the prohibition to travel within the country, and consequently postponed to next year. This situation is similar for all the orthopterists from the Museum of La Plata and CEPAVE who all are working on manuscripts and other pending activities that can be done at home, being always in contact and working with **María Marta Cigliano** and **Carlos Lange**, who are very far from here, stranded abroad! In early March, María Marta travelled to Australia for the annual meeting of Catalogue of Life, and Carlos joined her in New Zealand, planning to be there just for a few days! Since the situation was getting worse all over the world, both countries, Argentina and New Zealand, established the lockdown and, of course, the airports were closed. Since then, they are living in a small coastal town, Tairua, two hours from Auckland. Fortunately, they managed to adapt quickly to their new conditions, and they are successfully working from there. Aside from all the scientific activities and projects that María Marta leads, she is also a professor at the University, and she is also giving virtual classes.

María Marta is also in contact (meetings through videoconference) with the OSF (Orthoptera Species File) team from La Plata. Since the Museum of La Plata is closed to public and also to researchers (with a minimum access for some workers and curators of the collections), the team is working at home without problems, updating the database and working on the new platform (TaxonWorks). **Holger Braun** (Museo de La Plata) mentioned that "they are working on issues related to the future import to TaxonWorks, at the same time completing and correcting data in OSF." He is also working on the Catalog of Tettigoniidae from Argentina & Uruguay, and he "wanted to do fieldwork in another one or two provinces with few records in the early southern-hemisphere autumn (perhaps Corrientes and Formosa). Also wanted to look around La Plata and the city of Buenos Aires for individuals of *Anisophya*, *Conocephalus*, and *Neoconocephalus*, to verify and clear up identifications of certain species. Partly accomplished before the lockdown, but now mostly postponed to next year. An interesting *Anaulacomera* specimen collected five days before the lockdown (calling song recorded more than a month ago) recently died during the quarantine, and is stored in the freezing compartment of the fridge for future identification." In relation to his work on several manuscripts on Argentine and Ecuadorian katydids: "halted without access to specimens and stereomicroscope in the laboratory."

Here in Argentina, we all have similar stories regarding our ongoing projects, under the impossibility to conduct several activities such as laboratory essays, examination of specimens, fieldwork, among others, and we all are trying to continue working on manuscripts (writing, reading literature, editing images and plates, etc.) as best as we can.

Simultaneously to the Health Emergency due to COVID-19, as in other

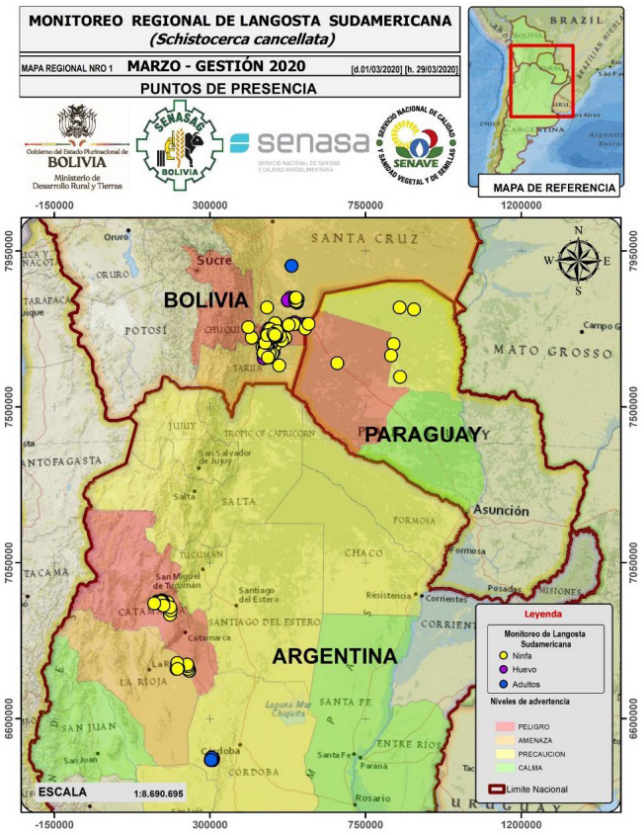


Figure 1. Status of the locust *Schistocerca cancellata* and warning levels in Argentina, Bolivia and Paraguay, March 2020. Source: Medina, Espinoza & Rojas. Informe Regional Langosta Sudamericana, SENASA Argentina, SENASAG Bolivia, SENAVE Paraguay, Marzo 2020.

parts of the world with the problematic of locust plagues, Argentina as well as neighboring countries, continues under a Phytosanitary Emergency due to the South American locust, *Schistocerca cancellata*. Fortunately, there are no major problems and the situation seems to be under control. However, if the plague continues to develop in Bolivia and Paraguay, invasions into Argentina could occur in the next months. Regarding the activities related to the management of this locust plague, **Héctor Medina** from **SENASA** (**Argentina**) mentioned that "since the region (Argentina, Bolivia and Paraguay) is under the Phytosanitary Emergency due to this plague, the monitoring and control of locusts are considered essential activities. However, closure of routes and towns/cities and restrictions to circulate make difficult to carry out field monitoring and control under normal conditions within the region. Therefore, in Argentina, part of the field information is being gathered from surveys of farmers and authorized officers from the "Programa Nacional de Langostas y Tucuras (SENASA)," which are in constant communication to continue working on the management plan." The state of the plague (March 2020) reported by SENASA (Regional Management Plan) according to the warning levels: most of the country is under "Caution" situation, Catamarca province is under "Danger" situation (adults), and La Rioja (groups of nymphs and adults) under "Threat" (SENASA, 2020) (Fig. 1). Swarms were detected early this year in Salta province, limited to Bolivia, and later there was a migration towards neighboring countries (Bolivia and Paraguay) (SENASA, 2020).

Regarding other countries of Latin America, of course the situation and measures implemented to prevent or face the spread of the COVID-19 differ according to each country. In general, in most countries of Latin America a social isolation and lockdown have been decreed, although with different degrees of restrictions. Orthopterists from Uruguay, Brazil and Mexico kindly shared their stories on how they are dealing with this issue, mainly in relation to their Orthoptera research activities.

In **Uruguay**, a social isolation or quarantine was strongly recommended, but not mandatory. In comparison with other countries of the region, there were fewer restrictions, and even though universities were closed, researchers were able to conduct field trips. In this context, **Klaus Riede** (Montevideo, Uruguay) wrote an interesting note on the situation in Uruguay and his field work during this period. Please see his note entitled "Leaky lockdown and fieldwork in Uruguay" in this issue.

On the other hand, the neighboring country of **Brazil** is, sadly, being strongly affected by this pandemic. **Pedro G.B. Souza-Dias** (Rio de Janeiro, Brazil) mentioned that "the University (UNRJ, Universidade Federal do Rio de Janeiro) and the MNRJ (Museu Nacional do Rio de Janeiro) are closed since March 16, although working with very few people (just the basic services as security). At that time I was on a field expedition in Ceará that was interrupted due to the pandemic, and luckily we could anticipate our tickets to Rio. I returned on March 20 in one of the last flights from there, and I am at home since then. The University labs that work on medical/biomedical issues are working, helping in the fight against COVID. At MNRJ we donated masks, gloves, and alcohol to the university hospital. We also sent our molecular machinery to support the virology lab at UFRJ. New buildings are being constructed in a new campus of MNRJ, where the research, teaching, and collections buildings will stay. The destroyed Palace will not host collections anymore, it will be for exhibitions and events only. The works are reduced, but not completely stopped. Now we are worried with funding, it is a very bad times for rebuilding a museum. I have two undergrad students and they are at home. I don't know when I will see them because they use public transport to go to MNRJ. Our instructions are to avoid public transport, and so they will go to MNRJ when it is safe. Maybe during the second semester because we "lost" our first semester, all disciplines and activities were canceled. All the researchers, curators, students and technicians from MNRJ are at home. I go to MNRJ once a week to check the collections. I have a lot of things to do, and I brought specimens and a stereomicroscope to my home. Now I have a small home-laboratory and I am trying to adapt myself to a new routine. But most of my work now is on computer, editing photos, writing manuscripts, and participating in remote meetings. I have also two online talks scheduled for next month, but I have no idea how it

will work."

Another story comes from **Mexico**, where the situation seems to be, in general, similar to other countries of Latin America, under quarantine since March 16, although with no mandatory social isolation. Since universities were closed, our colleague from Mexico, **Salomón Sanabria-Urbán**, mentioned that he is "working with online teaching activities since then, and the field trips were cancelled in most of the universities from the center of the country. The access to labs for research activities were also affected by the restrictions. Therefore, I am mostly working at home without access to the lab. Consequently, our research projects and activities are somewhat delayed. In addition, the increase of the costs of supplies and services is forcing us to reconsider goals and directions of our ongoing projects."

In general, for most of the orthopterists from our region the impact on research activities is rather similar, trying to do the best under these difficult times.

Acknowledgements: Thanks to Klaus Riede, Héctor Medina, Holger Braun, Salomón Sanabria-Urbán and Pedro G.B. Souza-Dias for kindly sharing their stories. Also thanks to María Marta Cigliano and Carlos Lange who, despite being stranded abroad since two months ago, continue working and guiding us with great enthusiasm.

Japan

By HARUKI TATSUTA
Faculty of Agriculture
University of the Ryukyus
Okinawa, JAPAN
htatsuta@agr.u-ryukyu.ac.jp

I hope all of you are keeping well, in spite of pandemic COVID-19. The situation in Japan is somewhat terrible – we cannot enjoy field survey and have to stay inside at least until the end of May. Entrance into university buildings is not permitted in principle. We do not know when we are able to restart our research activity. Every day I am burying myself in preparing remote lectures and hope to go back to reality as soon as possible...

Now I remember the last international meeting in Morocco – how time flies! I attended the OS board meeting in Morocco for the first time as regional representative. Perhaps some members are much familiar with former representative, Seiji Tanaka, not me! Actually, we have held a meeting in the last conference of the Entomological Society of Japan. This conference was held at Hirosaki University, at which some famous Japanese entomologists, such as Sinzo Masaki and Yoshikazu Ando taught in the old days. Although Prof. Masaki died at the age of 89 in 2017, he was particularly noted for his success in climate adaptation and photoperiod mainly for crickets and raised many students. Prof. Ando is hale and hearty and offered a unique talk about the credibility of weather forecasting based on the placement of mantis ootheca. Dr. Tanaka has graduated from the lab of Prof. Masaki and also gave an exciting talk there too. He retired from his workplace last year, but still continues several projects on locusts. I asked him to offer some topics from his recent interests, which is included in this issue. Hope you enjoy them!

North, Sahelian & West Africa

By AMINA IDRISSI
Universite IBN ZOHR
Agadir, MOROCCO
aminaidrissi@gmail.com

In Morocco, as elsewhere, a state of health emergency was declared in March 2020 and universities, research centers, schools, and public and private institutions were closed. The borders have also been closed.

After the amazement of the first days, on the point of teaching and research, many initiatives were taken, such as online courses, YouTube videos, webinars, and we left to discuss from home courses and research.

As far as congresses and scientific events are concerned, they have all been postponed. Fortunately, the XIII International Congress of Orthopterology took place in 2019, today it would have been unimaginable that it could have taken place and it would have been a great loss.

On the environmental level, as in many regions in the world, nature takes back its rights, and we see birds proliferate, animals (like wild boars) cross the roads more frequently and prowl around villages.

"Significant" reduction rates of air pollutants and a "noticeable" improvement in air quality have been recorded in Morocco during the state of health emergency marked mainly by the reduction, limitation of road and air traffic, and the downgrading of several industrial activities.

In this period of health emergency, the countries of the Horn of East Africa are experiencing a desert locust (*Schistocerca gregaria*) crisis during the coronavirus crisis. This locust crisis that has hit the countries of the Horn of Africa since 2018 has been on an unprecedented scale for more than 25 years. It was probably accentuated by the consequences of climate change that raged in the countries around the Red Sea in 2018 - 2019.

The countries of the Western desert locust breeding region in Africa, on the other hand, have been experiencing a relative locust lull since the beginning of 2017. According to weather predictions, there is a high probability that the resurgence of the desert locust in East Africa could generalize into a large-scale invasion.

The prevalence of other sedentary locust species in North and West

African countries has declined over the past two years due to the persistence of the drought. However, in the countries of North Africa, the area of proliferation of the Moroccan locust (*Dociostaurus maroccanus*) par excellence, control campaigns are intensifying in Morocco and Algeria. In Sahelian countries in West Africa, response campaigns against species of the Savannah locust complex have declined due to lack of resources.

From the research point of view, the themes developed, in particular, by CLCPRO, in partnership with research institutions, touch on aspects of the characterization of the biotopes of the gregarious desert locust areas, the experimentation of drones in the field of surveillance, the improvement of detection and control methods against the desert locust through the development of a locust prediction model, promotion of the use of biopesticides based on the entomopathogen *Metarhizium acridum* with a view to its approval in the countries of the region, carrying out research to improve the effectiveness of biological control as a barrier treatment and studying the impact of climate change on the habitats and behavior of the locust pilgrim.

Other universities and institutions (University of Fez and Agronomic Institute in Morocco) are interested in the bioecology of Orthoptera.

Central & Southern Africa

By VANESSA COULDRIDGE
Department of Biodiversity and Conservation Biology
University of the Western Cape
SOUTH AFRICA
vcouldridge@uwc.ac.za

As is the case elsewhere in the world, research activities in the southern African region have been severely curtailed by the global pandemic. Most countries have reacted swiftly to implement some form of lockdown to restrict movement, in anticipation of a looming health crisis that is expected to unfold in the coming months.

Here in South Africa, as well as in several other neighbouring countries, all universities and museums are currently closed until further notice, meaning that any type of laboratory work has had to be put on hold. Field work is also not possible due to a ban on travel and no access to any nature reserves or open spaces.

Despite these rather strict measures, there are, at present, relatively few cases of COVID-19 in most countries within the region, with the exception of South Africa, which currently has the highest number of infections on the continent. However, it is predicted that the worst is still to come and that infections will reach their peak somewhere around September, and so research activities are unlikely to resume for some time to come.

The effects on Orthoptera (as well as other animals) in the midst of this crisis are likely to be mixed. Many species have no doubt benefitted from reduced human activities and anthropogenic noises. On the other hand, the control of devastating locust swarms in parts of Africa is being negatively impacted as attention and resources are diverted towards health care.

East Europe - North and Central Asia

By MICHAEL G. SERGEEV
Novosibirsk State University and Institute of Systematics and Ecology of Animals
RUSSIA
mgs@fen.nsu.ru

Almost all countries of the region have got some problems with the virus SARS-CoV-2. As a rule, local orthopterists and their colleagues from universities and academic institutes stay in their homes and try to analyze old data, to write some texts and to prepare new projects (and, in some cases, continue to teach students distantly). Our young colleagues from Novosibirsk University try to finish their PhD dissertations. A few persons may visit their labs and use these opportunities to continue studies of Orthoptera, for instance, for identification of collections and field samples (Fig. 1). However, such opportunities are very limited, but almost all our colleagues are optimistic and hope to continue their studies during summer season.

During the lockdown, the last (third) part of the comprehensive "An annotated check-list of Orthoptera of Tuva and adjacent regions" by M. Sergeev, S. Storozhenko and A. Benediktov was published in "Far Eastern Entomologist" in March. This part includes taxonomical notes and distribution data concerning the several taxa of Caelifera, namely Gomphocerinae (Gomphocerini) and Locustinae (= Oedipodinae). Besides, a group of orthopterists from Novosibirsk

Figure 1. Orthopterists' joke: How to identify grasshoppers during the pandemic. (M.G. Sergeev)

University and Institute of Systematics and Ecology of Animals try to prepare a kind of the final report on the project "Remote sensing and digital

mapping as the basis for forecasts of locust and grasshopper outbreaks in Novosibirsk Region."

Unfortunately, in some areas of Central Asia, the pandemic has resulted in some problems with locust outbreak management, because in some cases funds were re-allocated for the virus control. However, a situation with possible pest species remains difficult. Dry and warm spring was favorable for local locust populations. In March and April, local populations of the Moroccan locust started (and continue) hatching. In many areas, the hopper density is relatively high. More than 13,000 ha were treated in Uzbekistan and Tajikistan in March.

Fortunately, the coronavirus lockdown allows us to get back to some unfinished projects, for instance, to publish a monograph about the Moroccan locust in the Caucasus, Central Asia and South Russia. In this context, Alexandre Latchininsky (FAO, Rome), Anastasia Fedotova (Institute for the History of Science and Technology, Russian Academy of Science, Saint Petersburg) and Michael Sergeev (Novosibirsk) began to discuss history of Russian and Soviet orthopterology (basic and applied) in the 19th and the first half of the 20th centuries, mainly associated with the Moroccan locust ecology, distribution and outbreaks. Dr. Fedotova found a lot of very interesting letters (*e.g.*, from several Russian orthopterists to Sir Boris Uvarov and some very impressive letters – in Russian (!) – from Malcolm Burr to Uvarov too). We also found some additional information from different sources that may be important for better understanding of development of orthopterology. One of the main results of these studies is that during very hard times orthopterologists (at least part of them) tried and try to be optimistic and cheerful. For instance, the famous Soviet entomologist Prof. Vasily Boldyrev (1883-1957) illustrated sometimes his letters to Uvarov by funny sketches and jocular comments. For many years Prof. Boldyrev studies ecology and behavior of different Orthoptera, including the very rare steppe bush cricket *Bradyporus multituberculatus* (Fischer de Waldheim) (Fig. 2). He used the image of its female in his drawing.

Figure 2. Orthopterists' joke: The sketch by Vasily Boldyrev from his letter to Boris Uvarov (about 1928) [He rides *Bradyporus multituberculatus* (Fischer de Waldheim) and hopes to arrive London: "How on Earth I can arrive on this dastardly sluggish hopper? Trying for the eighth year in a row!" (translation by A. Latchininsky)] (A. Fedotova; Source: The National Archives, AY 20/70, pt 2 Correspondence on taxonomy 'B')

Australia, New Zealand & Pacific Islands

By MICHAEL KEARNEY
University of Melbourne
AUSTRALIA
m.kearney@unimelb.edu.au

It is disconcertingly easy to forget how dramatic the start of the year was in Australia, with catastrophic bushfires cloaking some of our major cities in smoke capping off an extremely dry winter and spring. This event and the current coronavirus pandemic have dominated recent orthopterist activities in Australia and New Zealand.

In November, there was an intense but productive field trip by Hojun Song, Anwar Hossain (PhD student), Steve Sinclair (botanist), and myself in eastern Australia, which focused on resampling sites from the field notebooks of Ken Key (Fig. 1). Key's field notebook collection is curated by the Australian National Insect Collection (ANIC). It comprises over 2,400 pages documenting 223 field trips undertaken between 1936 and 1989, with detailed descriptions of the habitat, plant species, and, of course, grasshoppers that he and his associates found. Our

Figure 1. Retracing Ken Key's collecting. Left to right: Hojun Song, Anwar Hossain, Michael Kearney, and Steve Sinclair

Figure 2. Orthopterists participating in the AES meeting. Left to right: Kate Umbers, David Hunter, Sonu Yadav, Ian Aitkenhead, Md. Anwar Hossain, Douglas Lawton, Michael Kearney, and Hojun Song.

resurvey considered three notebooks from the 1940s and was funded by a seed grant from the Australia Entomological Society (AES) to assess how useful it would be to repeat these surveys. The plan was to survey from Canberra to Brisbane, arriving in Brisbane in time for the 50th AES meeting. We had to choose between a coastal route (ash and fire) or an inland route (dust) and chose the latter. It was a very successful trip – we resurveyed 45 sites over six days and found some intriguing differences, but also many similarities to what the pioneering orthopterists saw 80 years ago, and we are in the process of writing up our findings.

In Brisbane at the AES meeting we ran a symposium on "Orthoptera as model organisms in ecology and evolution." A stimulating range of talks were given by the eight of us (Fig. 2), kicked off by a mini-keynote talk by Hojun on orthopteran evolution and ending with applied talks on pest species by Douglas Lawton and David Hunter. Sonu Yadev was awarded a student prize for her talk about the landscape genetics of alpine grasshoppers.

Roger Farrow (ex-CSIRO entomologist) reports that recent fires down the east coast and adjacent ranges have had a major impact on the survival of grasshopper populations. He says "the scale and intensity of these fires was enormous and no refuges were left at all. Recent visits to parts of Moreton National Park along the Nerriga road showed there to be an almost complete absence of grasshoppers and indeed of any insects at all. Apterous and brachypterous species like *Heidi*, *Psednura*, *Praxibulus*, and even *Phaulacridium* are totally absent. The host plants of species like *Psednura* (Restionaceae) have disappeared and will take months to resprout. The only method of survival of these and other species would have been from egg pods laid in the ground prior to the fires that started in December and burnt till February. My picture (Fig. 3) shows what is left of a patch of heathland, comprising *Calytrix* and *Baeckea* shrubs, beyond which is a knoll that was once impenetrable *Allocasuarina* thicket, a scene now typical of large areas of Moreton National Park. I imagine that the massive fires in Wollomi and elsewhere would have had the same impact. On more recent visits to the Park, some *Gastrimargus* were seen that probably flew in from outside the fire-affected area, a mere 10-20 km to the west, plus a single *Austroicetes*, also possibly a fly-in."

On a more positive note, I can report that the only remaining Victorian populations of the threatened matchstick grasshopper *Keyacris scurra* (Morabidae), in the vicinity of the town of Omeo, survived the bushfires.

Kate Umbers (Western Sydney University) has also checked on grasshopper populations after the fires and reports that "in March I visited the site at which I work on chameleon grasshoppers (*Kosciuscola tristis*) at Dead Horse Gap in Kosciuszko National Park and in that spot they are alive and well. Looking south from the site I can see the burn front over the next ridge. Too close for comfort. Further good news about this species is that they are about to be featured by Eggpicnic, the Sydney-based artists. In mountain katydid news, the only news is no news. Work on their population genetics to potentially identify isolated populations has halted under COVID-19, and options to use museum specimens are being explored in conjunction with ANIC. Lastly, I have almost been officially appointed as the co-chair for the IUCN Grasshopper specialist group with Axel Hochrich,

Figure 3. What's left after the bushfire

an exciting new position!".

Lockdown has obviously quashed most lab and field work, but this hasn't been entirely the case for my lab. Vanessa White and I have ended up with our colony of *Keyacris scurra* at our homes, and Matt Elmer and I have been able to do some "virtual field trips" in the form of transcribing more of Key's field diaries and geocooding them with the help of Google Earth. This is adding to the >400 pages already transcribed by Anwar Hossain, which he has been busy analysing as part of his PhD on grasshopper distributions. Meanwhile, David Hunter reports that "Ruby the Schnauzer says I am bored. I have had enough of this COVID-19 lockdown. This is my blanket and you can't have it" (Fig. 4).

Figure 4. David Hunter and Ruby the Schnauzer

Finally, some news from the "Far North" and "Top End" of Australia. David Rentz (Kuranda, Far North Queensland) has been completing a paper on new species of *Cooloola* with Geoff Monteith and starting a new eProject on the Katydids of Australia with Jessa Thurman, a grad student at UQ. And he also passed on one more good news story from Lyn Lowe (Darwin) to end this piece on, relating to grasshopper art: "Leichhardt's Grasshopper, *Petasida ephippigera* White, was painted on the wall fronting the street (main entertainment street in Darwin with restaurants, bars, and nightclubs etc.) (Fig. 5) of the Darwin Entertainment Centre, Mitchell Street Darwin."

Figure 5. Photograph taken by local Darwin Photographer Paul Arnold and was then painted by local Darwin Street Artist Jesse Bell in the year 2019.

China

By LONG ZHANG
Regional Representative
China Agricultural University, CHINA
locust@cau.edu.cn

Long noncoding RNAs (lncRNAs) are the largest class of noncoding RNAs with a length longer than 200 nucleotides and a lack of coding potentials. They are called "dark matters" in the genome with their roles remaining unknown to large extent. Recently, Professor Le Kang and Bing Chen's lab identified 14,373 highly reliable putative lncRNAs from 10,304 loci in the genome of the migratory locust (*Locusta migratoria*) that are expressed in the brains of nymphs (Li et al. 2020). They found that most lncRNAs displayed more rapid response of expression at the early stages of the time-course of locust isolation and crowding than protein-coding mRNAs. However, early changed lncRNAs employed different pathways in isolation and crowding processes to cope up with the changes in population density. This study provides a rich source of lncRNA candidates that may be involved in the regulation of locust phase change (Li et al. 2020).

In another study on locust lncRNA, colleagues in Professor Le Kang and Bing Chen's lab investigated how a specific lncRNA controls behavioral aggregation and swarming in the locust (Zhang et al. 2020). The neurotransmitter dopamine is crucial for the neuronal and behavioral response in animals. Phenylalanine hydroxylase (PAH) is involved in dopamine biosynthesis and behavioral regulation in the migratory locust. They discovered a nuclear-enriched lncRNA PAHAL that is transcribed from the coding strand of the PAH gene in the locust (i.e., sense lncRNA). PAHAL

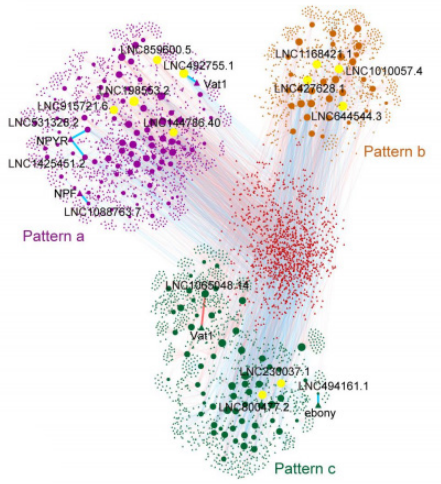


Figure 1. Functional prediction and hub lncRNA identification. Co-expression networks between lncRNA and protein-coding genes constructed in the time course of crowding by using Pearson correlation coefficient. The circular nodes and squares represent lncRNAs and mRNAs, respectively. The red and blue lines denote positive and negative correlations, respectively. The nodes in the network were divided into three modules, including Pattern a (violet), Pattern b (yellow), and Pattern c (green) modules, based on the lncRNA expression patterns. The lncRNAs with top-ranked degrees are colored yellow.

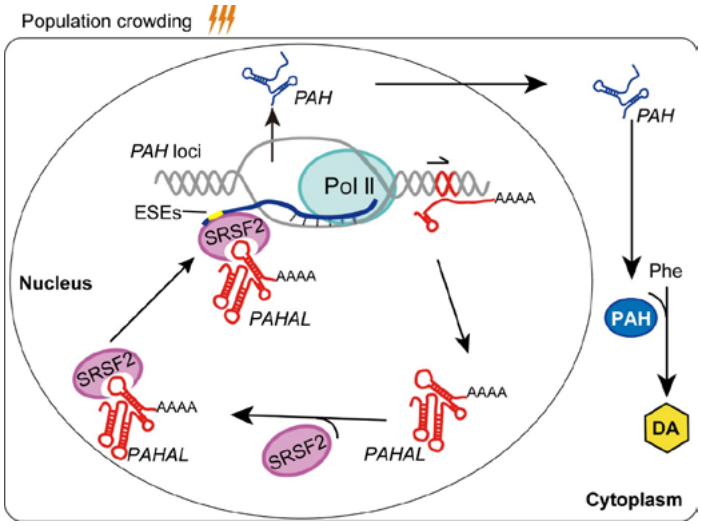


Figure 2. Working model for the feedback activation of *PAH* via *PAHAL*–SRSF2 interaction in the DA metabolic pathway. The sense nuclear lncRNA *PAHAL* is transcribed from the exon–intron region of *PAH* gene locus cued by population crowding. *PAHAL* then binds with SRSF2 at its 3′ end to form a RNA–protein complex. *PAHAL* guides the *PAHAL*–SRSF2 complex to bind with the ESE elements of the nascent *PAH* RNA and activates the *PAH* transcription. PAH catalyses phenylalanine into DA. The red genomic region in the *PAH* loci represents the *PAHAL* emanative fragment. The half arrowhead indicates the transcriptional direction of *PAHAL*.

positively regulated PAH expression and dopamine production in the brain. In addition, PAHAL modulated behavioral aggregation of the locust. Mechanistically, PAHAL mediated the transcriptional activation of PAH by recruiting SRSF2, a transcription/splicing factor, to the promoter-associated nascent RNA of PAH. These data support a model of feedback modulation of dopamine biosynthesis and locust swarming behavior via a lncRNA in the catecholamine metabolic pathway (Zhang et al. 2020).

References

Zhang X, Xu Yn, Chen B, Kang L. Long noncoding RNA PAHAL modulates locust behavioural plasticity through the feedback regulation of dopamine biosynthesis. PLoS genetics. 2020;16(4):e1008771. doi: 10.1371/journal.pgen.1008771.

Li T, Chen B, Yang P, Wang D, Du B, Kang L. Long Noncoding RNA Derived from LncRNA–mRNA Co-expression Networks Modulates the Locust Phase Change. bioRxiv. 2020:2020.04.11.036848. doi: 10.1101/2020.04.11.036848.

Theodore J. Cohn Research Grant Reports

Ecological and evolutionary diversification in Scotussae genus group (Melanoplinae: Dichroplini)

By **MARÍA CELESTE SCATTOLINI**
CEPAVE, CONICET-CCT
Museo de La Plata, División Entomología
La Plata, ARGENTINA
mcscattolini@gmail.com

I was honored to receive the Ted Cohn Award during the course of my PhD thesis, which allowed me to do a very important and needed field trip to collect fresh material of melanopline species for molecular analyses, as well as to survey the different ecoregions that inhabit the group of grasshoppers studied. My thesis focused on the diversity and distribution patterns of South American (SA) melanoplines, a very interesting group that occupies a broad range of habitats and are usually dominant in nearly all temperate grasshopper communities in the subcontinent. During my thesis,

Figure 1. Map indicating the area where the fieldwork was conducted in the southern Bolivian Andes during the fall of 2018.

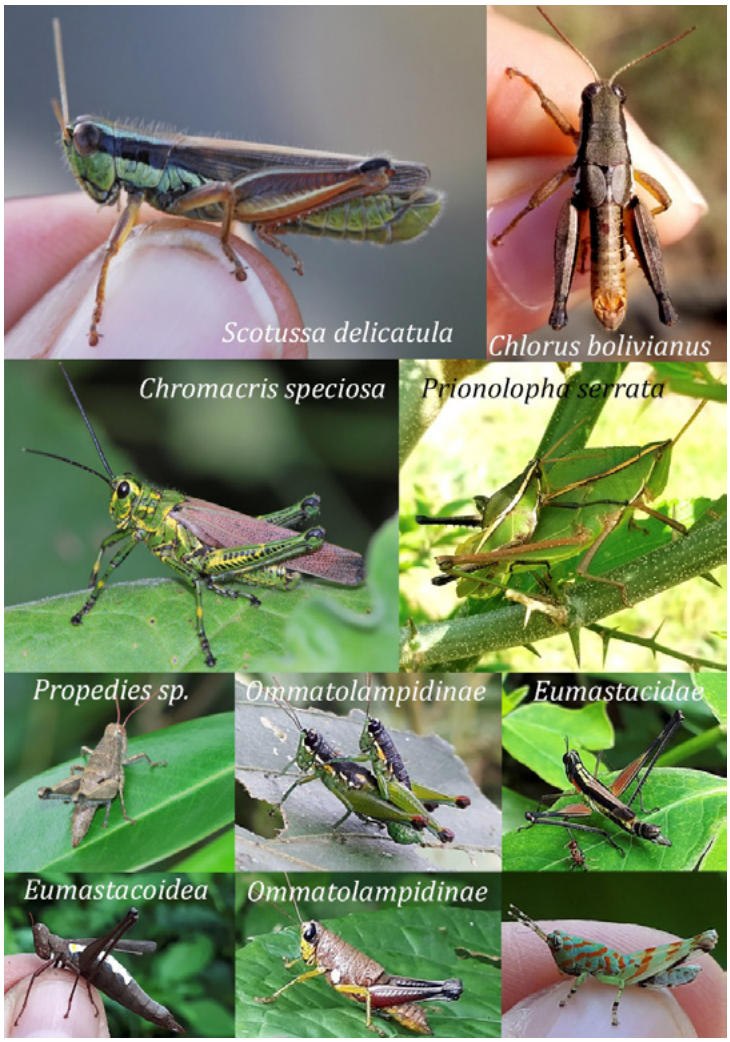


Figure 2. Some of the Orthoptera observed during the fieldwork.

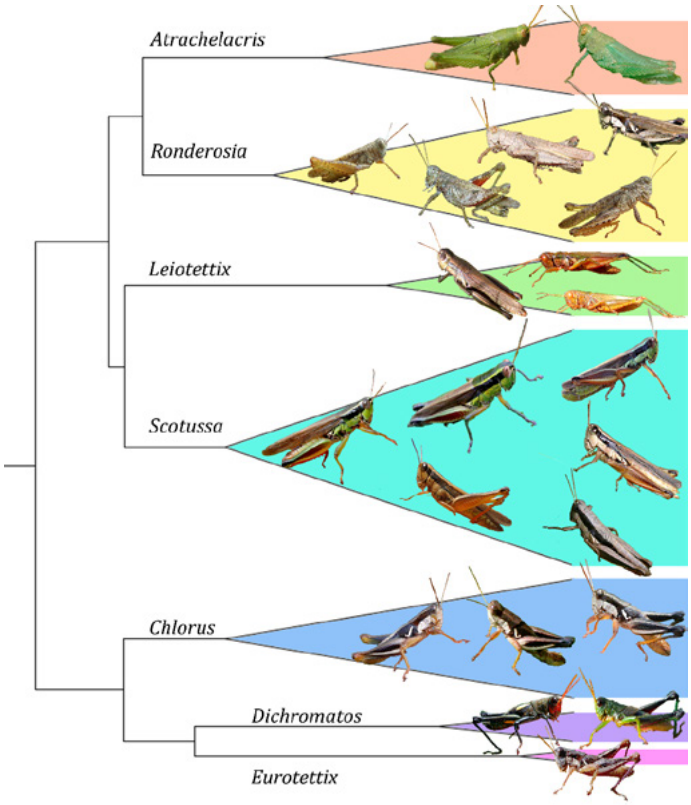


Figure 3. The Scotussae genus group phylogenetic tree with terminal branches collapsed depicting two main clades; one with exclusively brachypterous species (*Chlorus*, *Eurotettix* and *Dichromatos*) and the other with mostly macropterous species (*Atrachelacris*, *Ronderosia*, *Leiotettix* and *Scotussa*).

I surveyed areas mainly within Argentina and Uruguay, however this grant allowed me to also explore the southern Bolivian Andes. During the field trip to Bolivia, I visited very different environments inhabited by the melanopline grasshoppers that helped me to understand how the group adapts to different habitats. In this heterogeneous region we observed mostly apterous/brachypterous species that live in the open areas and/or in the ecotones of the forests. This is coincident with my research results, in which the Andes are characterized by apterous and brachypterous species with reduced niche breadths and narrow distributional ranges (Scattolini *et al.,* 2020). I also found that the Andes has the highest regional species richness, harbouring more than 60% of the SA melanopline genera; however, local species richness is rather low in this region. Moreover, in the analyses performed during my thesis we found that around 80% of SA melanoplines have reduced wings or are apterous (Scattolini, *et al.,* 2020).

A highly dissimilar pattern, compared to the one found for the Andes, was observed in La Plata Basin where we detected the highest local melanopline species richness for the subcontinent. This region encompasses the Humid Chaco, Pampas, Alto Paraná Atlantic Forest and Atlantic Rainforest ecoregions. This whole area harbors a similar proportion of apterous/brachypterous and macropterous melanopline species (Scattolini *et al.,* 2020) and the Scotussae genus group is a good example of this variability. This group comprises 48 valid species within 7 genera (Cigliano *et al.,* 2020), the main focus of my study. Southern Bolivia is also the westernmost distribution known for this group, for which we were able to collect materials to complement the phylogenetic analysis, including *Scotussa delicatula*, a species which was only known from the type specimens. Using this phylogeny as the study backbone, we performed niche similarity tests and niche models in order to unravel the biogeographic patterns of the group. We were then able to test the phylogenetic signal of the species with regards to their niche optimum and breadth, and were able to calculate the phylogenetic relatedness with the ecological and geographical diversification for the group.

The Scotussae genus group phylogenetic analysis rendered two main clades, one constituted by three genera (*Chlorus*, *Eurotettix* and *Dichromatos*) with exclusively brachypterous species and the other one constituted by the remaining four genera (*Atrachelacris*, *Ronderosia*, *Leiotettix*

and *Scotussa*), which have mostly macropterous species (Scattolini *et al.,* submitted). Our analyses let us infer that ecology would have a major role in the Scotussae genus group diversification, and that the evolution of climatic niches is not constant across the two main clades. Dispersal ability might alter a lineage's biogeographical and evolutionary trajectory since we observed that the brachypterous clade is probably affected by allopatric speciation while macropterous species would have diversified via sympatric speciation.

Finally, I would like to point out that this trip also allowed us to deepen our knowledge about the diversity and distribution of other groups of Orthoptera.

Acknowledgments

I want to thank the Orthopterist's Society for its financial support and the Society's Treasurer, Pamm Mihm, for all her help in the administrative matters. Also, thanks to Martina E. Pocco and Elio R. Castillo for their support in the fieldwork and laboratory work, without whom I would not have been able to do this amazing trip. I would also like to thank Martina for kindly giving me some photographs for this report.

References

Cigliano, M.M., H. Braun, D.C. Eades & D. Otte 2020. Orthoptera Species File. Version 5.0/5.0. <http://Orthoptera.SpeciesFile.org>.

Scattolini, M.C., Lira-Noriega, A. & Cigliano, M.M. 2020, Species richness, range size, and wing development in South American melanopline grasshoppers (Orthoptera, Acrididae). Ecological Entomology, DOI: 10.1111/een.12859.

Orthoptera Species File Grant Reports

From lowland sands and steppes to alpine grasslands - Taxonomy, bioacoustics and distribution of Orthoptera in Serbia and Montenegro

By **SLOBODAN IVKOVIĆ**
Trier University
Trier, GERMANY
s6slivko@uni-trier.de

Thanks to OSF grants support in 2019 we conducted several field trips in Serbia and Montenegro. The aims of these field trips were similar to those in the past 4 years:

1) to gather new distributional data on Orthoptera in Serbia and Montenegro
2) provide male songs and specimen photos to OSF
3) collect new fresh material for molecular analyses and taxonomic revisions.

The first field surveys were organized at the end of May on steppe habitats in northern Serbia, mainly in southern Banat area, where we collected new data on *Isophya costata* Brunner von Wattenwyl, 1878. During a several days of research, we succeeded in finding 5 new localities, thus now it is known from 11 localities in Serbia, but we can still expect that the species is present in more localities in central and northern Banat area.

In June, we visited Deliblato Sands, which represents the largest sand area in Europe. Here we were lucky to find large populations of *Euchorthippus pulivnatus* (Fischer von Waldheim, 1846), *Montana montana* (Kollar, 1833), and *Calliptamus barbarus* (Costa, 1836). After Deliblato Sands, we visited Zagajička Brda (Zagajica Hills) (Fig. 1), where we observed *Arcyptera microptera* (Fischer von Waldheim, 1833) and *Paracaloptenus caloptenoides* (Brunner von Wattenwyl, 1861) (already reported by Nagy, 2005), plus two *Saga pedo* (Pallas, 1771) females. After that, we spent two days on Ram Sands and continued our trip along the Danube where our last stop was Kladovo surrounding. This area is specifically interesting and, as in previous years, we succeeded in finding very rare Orthoptera species (e.g. *Montana medvedevi* (Miram, 1927)). This trip, we also found an interesting find from Vajuga surrounding (Fig. 2): *Onconotus servillei* Fischer von Waldheim, 1846 (Fig. 3), a species which was last reported in Serbia in 1938 by Us. Besides this species, we also observed a large population of *Conocephalus hastatus* (Charpentier,

Figure 1. Zagajička Brda (Zagajica Hills)

Figure 2. Vajuga surrounding

Figure 3. *Onconotus servillei* Fischer von Waldheim, 1846, species rediscovered after 81 years

1825), a species for which there are not so many reports in Serbia, and one *Locusta migratoria* (Linnaeus, 1758) female, a species which is nowadays very rare in this part of Europe.

After this field trip, several short trips were conducted in southwestern Serbia, together with members of Habiprot (the non-governmental organization). During this field research, a large amount of data about Orthoptera in this part of Serbia was collected, especially on Orthoptera species which are considered as rare for this part of Europe, such as *Modestana ebneri* (Ramme, 1926), *Odontopodisma albanica* Ramme, 1951, and *Psorodonotus macedonicus* Ramme, 1931.

In August, we visited two mountains in Montenegro: Hajla Mt. and Prokletije Mt. (Fig. 4), where we collected data for a future paper, as a continuation of expanding Orthoptera knowledge in Montenegro. In many ocassions we slept in a tent, as it was a much easier way to collect the material, especially (bush-cricket) species, which are active at night. After sampling, specimens were usually placed in a net cage in a car for song recording and, after that (usually in the morning), prepared for DNA and chromosome studies.

This season, we didn't visit the coastal part of Montenegro, but we spent several days in Croatia, where we collected comparative material for our future studies of the Montenegro coast. There we have observed several interesting species for which there is not much data from the coastal region of this part of Europe; species such as *Arachnocephalus vestitus* Costa, 1855, *Dolichopoda araneiformis* (Burmeister, 1838), and *Chorthippus*

Table 1. List of photos and songs uploaded on OSF

Species	Male	Female	Song	Country
Acheta domesticus (Linnaeus, 1758)	-	-	+	Serbia
Anterastes serbicus Brunner von Wattenwyl, 1882	+	+	+	Serbia
Arachnocephalus vestitus Costa, 1855	+	+	-	Croatia
Barbitistes serricauda (Fabricius, 1794)	+	-	+	Montenegro
Broughtonia domogledi (Brunner von Wattenwyl, 1882)	+	+	-	Serbia
Chrysochraon dispar dispar (Germar, 1834)	+	+	+	Serbia, Montenegro
Conocephalus hastatus (Charpentier, 1825)	+	+	+	Serbia
Cyrtaspis scutata (Charpentier, 1825)	+	+	+	Croatia
Dolichopoda araneiformis (Burmeister, 1838)	+	-	-	Croatia
Decticus albifrons (Fabricius, 1775)	+	+	+	Croatia
Decticus verrucivorus verrucivorus (Linnaeus, 1758)	+	-	-	Serbia
Eupholidoptera schmidti (Fieber, 1861)	+	-	-	Croatia
Ephippiger ephippiger ephippiger (Fiebig, 1784)	-	-	+	Serbia
Ephippiger ephippiger harzi Adamovic, 1973	-	+	-	Serbia
Gryllomorpha dalmatina (Ocskay, 1832)	+	-	-	Croatia
Isophya clara Ingrisch & Pavifáevifá, 2010	+	-	-	Serbia
Isophya modestior Brunner von Wattenwyl, 1882	+	+	-	Serbia
Isophya modesta modesta (Frivaldszky, 1868)	+	-	+	Hungary
Leptophyes boscii Fieber, 1853	+	+	+	Hungary, Serbia
Meconema thalassinum (De Geer, 1773)	+	-	-	Serbia
Melanogryllus desertus (Pallas, 1771)	+	+	-	Serbia
Metrioptera brachyptera (Linnaeus, 1761)	+	+	+	Serbia
Modestana ebneri (Ramme, 1926)	+	+	-	Serbia
Montana montana (Kollar, 1833)	+	+	+	Serbia
Nemobius sylvestris (Bosc, 1792)	-	-	+	Germany
Onconotus servillei Fischer von Waldheim, 1846	+	-	+	Serbia
Pachytrachis frater (Brunner von Wattenwyl, 1882)	+	+	+	Croatia
Phaneroptera nana Fieber, 1853	+	-	-	Serbia
Pholidoptera fallax (Fischer, 1853)	+	+	-	Serbia
Pholidoptera frivaldszkyi (Herman, 1871)	+	-	-	Serbia
Pholidoptera griseoaptera (De Geer, 1773)	-	+	-	Serbia
Pholidoptera transsylvanica (Fischer, 1853)	-	-	+	Serbia
Platycleis grisea (Fabricius, 1781)	-	-	+	Montenegro
Poecilimon affinis affinis (Frivaldszky, 1868)	+	-	-	Serbia
Poecilimon gracilis (Fieber, 1853)	+	-	+	Montenegro
Poecilimon intermedius (Fieber, 1853)	-	+	-	Hungary
Psorodonotus fieberi (Frivaldszky, 1853)	+	-	+	Serbia
Psorodonotus macedonicus Ramme, 1931	+	-	-	Serbia
Pteronemobius heydenii (Fischer, 1853)	-	-	+	Serbia
Rhacocleis germanica (Herrich-Schv§ffer, 1840)	+	-	+	Croatia
Saga pedo (Pallas, 1771)	-	+	-	Serbia
Sepiana sepium (Yersin, 1854)	+	-	+	Croatia
Troglophilus cavicola (Kollar, 1833)	+	+	-	Serbia
Yersinella raymondii (Yersin, 1860)	+	+	+	Croatia
Arcyptera fusca (Pallas, 1773)	+	+	+	Serbia
Anacridium aegyptium (Linnaeus, 1764)	+	+	-	Croatia
Arcyptera microptera (Fischer von Waldheim, 1833)	+	+	+	Serbia
Chorthippus bornhalmi Harz, 1971	+	+	+	Serbia
Chorthippus mollis lesinensis (Krauss, 1888)	+	+	+	Croatia
Chrysochraon dispar (Germar, 1834)	-	+	+	Serbia
Euchorthippus pulvinatus (Fischer von Waldheim, 1846)	+	+	-	Serbia
Gomphocerippus rufus (Linnaeus, 1758)	+	+	+	Serbia
Locusta migratoria (Linnaeus, 1758)	-	+	-	Serbia
Miramella irena (Fruhstorfer, 1921)	+	+	-	Croatia
Myrmeleotettix maculatus (Thunberg, 1815)	+	-	+	Serbia
Odontopodisma albanica Ramme, 1951	+	+	-	Serbia
Odontopodisma decipiens Ramme, 1951	+	+	-	Serbia
Odontopodisma schmidtii (Fieber, 1853)	+	+	-	Croatia
Oedipoda germanica (Latreille, 1804)	-	+	-	Albania
Omocestus haemorrhoidalis (Charpentier, 1825)	+	+	-	Serbia
Omocestus petraeus (Brisout de Barneville, 1856)	+	+	-	Serbia
Paracaloptenus caloptenoides (Brunner von Wattenwyl, 1861)	-	+	-	Serbia
Podisma pedestris (Linnaeus, 1758)	+	+	-	Montenegro, Serbia
Pseudopodisma fieberi (Scudder, 1897)	+	+	-	Serbia
Stenobothrus crassipes (Charpentier, 1825)	-	+	-	Montenegro
Stenobothrus nigromaculatus (Herrich-Schv§ffer, 1840)	+	+	-	Serbia
Stenobothrus stigmaticus faberi Harz, 1975	-	+	-	Serbia

Figure 4. View from one of the Prokletije Mt. peaks

Figure 5. *Chorthippus mollis lesinensis* (Krauss, 1888)

mollis lesinensis (Krauss, 1888) (Fig. 5). On the return, due to very bad weather conditions, we spent only one day on Tara Mt. where we collected more new data about Orthoptera. Besides data uploaded to OSF, all collected data about Orthoptera in Serbia were uploaded on two online national databases: Alicphron (http://alciphron.habiprot.org.rs/) and Biologer (https://biologer.org/).

Finally, we can say that our 2019 field trips were much more successful than those in 2018. This year, our research resulted in two submited papers and two more upcoming.

A list of all uploaded photos and male song recordings are presented in Table 1. Besides data from Serbia and Montenegro, which were the topic of this project, several photos and song recordings from Hungary, Croatia, and Germany were also uploaded to OSF. Several of those represent poorly known species with no image or song recordings on OSF, so we hope that some of the uploaded data will be useful for other people interested in Orthoptera.

References

Nagy, Barnabás (2009): Ritka domb- és hegyvidéki fajok Deliblát Orthoptera-faunájában. Állattani Közlemények 94(2): 147-157.

Us, P. (1938). Doprinos poznavanju ortopterske faune u Jugoslaviji. Razprave - SAZU, Ljubljana, 3 (9): 239–252.

Illustrating Neotropical Acridoidea species with emphasis on Romaleinae in OSF

By MARTINA E. POCCO
CEPAVE, CONICET - UNLP
División Entomología, Museo de La Plata, UNLP
La Plata, ARGENTINA
martinapocco@fcnym.unlp.edu.ar

The main objective of this proposal was to add data for the South American Acridoidea in the Orthoptera Species File, with emphasis on the subfamily Romaleinae, providing high-quality photographs of the type specimens deposited at MNHN ("Muséum National d'Histoire Naturelle," Paris) collection, as well as images of additional specimens of Romaleinae species that exhibit intraspecific body color variation. In the MNHN, the Acridoidea collection contains type specimens of 404 species described from South America. Photographs of the types of a great number of species were available in OSF (images taken mostly by Prof. Carbonell during his visits to this collection, mostly black and white photographs or drawings, or images available through hyperlinks to the website of MNHN -digital collection). However, images of type specimens of about 100 species of South American Acridoidea were still lacking in OSF.

During my visit to the MNHN collection (April, 2019), I catalogued and took photographs of type specimens and additional specimens of the general collection of 85 species of South American Acridoidea, of which 33 belong to the family Romaleidae. In total, I photographed 62 type specimens (primary types and paratypes available in the collection for each species) of South American Acridoidea and 35 additional specimens of Romaleidae species. For each specimen, three final images were obtained (lateral and dorsal views of the habitus and labels, Figs. 1-4.). In addition, images of diagnostic characters were taken for species of Romaleinae (Fig. 5). For each final image of the habitus and characters, a series of 15-35 photographs were captured using the photographic equipment of the MNHN, with the photos combined using the software Helicon Focus. All images were then further processed with the program Adobe Photoshop CS6. Im-

Figure 1. *Oyampiacris nemorensis* Descamps, 1977 (male, HT). MNHN. Habitus (lateral and dorsal views) and labels.

Figure 2. *Eurybiacris luteoguttata* Descamps, 1979 (male, HT). MNHN. Habitus (lateral and dorsal views) and labels.

Figure 3. *Tropidacris descampsi* Carbonell, 1986 (male, HT). MNHN. Habitus (lateral and dorsal views) and labels.

Figure 4. *Titanacris picticrus picticrus* (Descamps, 1978) (male). MNHN. Habitus (lateral and dorsal views) and labels.

Figure 5. *Titanacris picticrus picticrus* (Descamps, 1978) (male). MNHN. Diagnostic characters. Pronotum (lateral and dorsal views), male abdominal terminalia (lateral view) and hind femur.

ages of type specimens are available at MNHN website-digital collection, and the corresponding hyperlinks were uploaded to OSF. Images of additional specimens of Romaleidae deposited in the general collection of the MNHN along with specimen records were uploaded to the corresponding taxa to OSF.

During my visit to MNHN, I also had the opportunity to examine and determine specimens of Acridomorpha from French Guiana (material collected during an expedition to the Mitaraka Mountain Range, program "Our Planet Reviewed," MNHN - NGO, 2015). The locality data of the 114 specimens belonging to 25 species of Acridomorpha registered from this material (specimen records) will be uploaded to the OSF. The resulting paper has been recently published (Pocco & Cigliano, 2020).

I also borrowed non-type material from MNHN (which was very useful and essential for my studies on Neotropical Romaleinae). In MLP (Museum of La Plata, Argentina) I took photographs of the habitus (lateral and dorsal views) and diagnostic characters from external morphology

and internal male genitalia from the borrowed material. All these images will be uploaded to the OSF soon.

Acknowledgements
I would like to thank to the Orthopterists' Society for funding this project, and to the OS Treasurer, Pamm Mihm, for all her help. Special thanks to Laure Desutter and Simon Poulain for their generous support and kindly help during my stay in the MNHN.

Orthoptera Conservation in the Middle East: Is *Psorodonotus eberni* priceless or worthless?

By BATTAL ÇIPLAK, ÖZGÜL YAHYAOĞLU, & ONUR ULUAR
Department of Biology, Faculty of Science, Akdeniz University
Antalya, TURKEY
ciplakbattal@gmail.com

Anatolia is a glacial refugium of the Middle East, a part of the West Palearctic and is considered a biodiversity hotspot because of a high number of endemic species, mainly restricted to the high mountain chains. The rate/number of endemic species shows a gradual tendency, the highest existing at southern or Mediterranean Taurus. However, such species/populations, the glacial relicts, occurring along Mediterranean Taurus, are very vulnerable to current global warming because of their changing habitats and low adaptive potential of small populations. The present study aimed to conduct a case study on the conservation of glacial relicts of Mediterranean relicts. To achieve this aim we chose the iconic bushcricket species *Psorodonotus ebneri*, which was considered as one of 100 amazing species by IUCN in the book entitled *Priceless or Worthless: 100 Amazing Species.* The Beydağları bush cricket *P. ebneri* is a species restricted to a very narrow area in the Beydağları Mts, Antalya, Turkey. This species has been recorded from two neighbouring localities on this mountain range, one from 1500 m (Tahtalıdağ) and the second from 1800 m (Calbalıdağ, Imecik Yayla). The low altitude population on Tahtalıdağ has already gone extinct and the species remains only at the high altitude in Imecik Yayla's wetland meadows. The main objectives of the project are: (i) determining the range extent and population size, (ii) studying the characteristics of habitat, (iii) estimating the species' adaptive potential, (iv) estimating effective measures for conservation, and (v) disseminating the outcomes via meetings and booklets. This project is supported by "The Mohamed bin Zayed Species Conservation Fund" (https://www.speciesconservation.org/)

Figure 1. Photos from field studies. A. Male *Psorodonotus ebneri*; B. Range area of the species (*P. ebneri* does not occur in the area in front site of the photo); C. The members of the research team are in an exact occurrence patch of the species (left to right: Ozgul Yahyaoğlu, Onur Uluar, and Battal Çıplak) D- Local briefings to people living in Imecik Yayla.

Studies conducted during the first period

During the first period of the study, the study area has been visited 6 times (Fig. 1). During these visits, we determined that first hatching observed around the first week of May, and first adults around the first week of June until their disappearance at around the end of June. In the possible occurrence area, the bush crickets were observed at five different patches, both by observing direct specimens or hearing the male calling song. The total occurrence area constitutes approximately 2.5 km^2 (see Fig. 1). Although the habitats surrounding these patches seemed promising for the species, we were unsuccessful in locating any in these areas. In a coming year these areas will be especially studied to confirm the exact occurrence area.

To determine population size we also applied a standard sampling method (collecting or recording the observance) at three different sites in an area of 200 m x 200 m during the period that adults were observed. We observed 6 males and 1 female in the first site, 15 males and 10 females in the second, and none in the third. By generalizing the sample numbers to

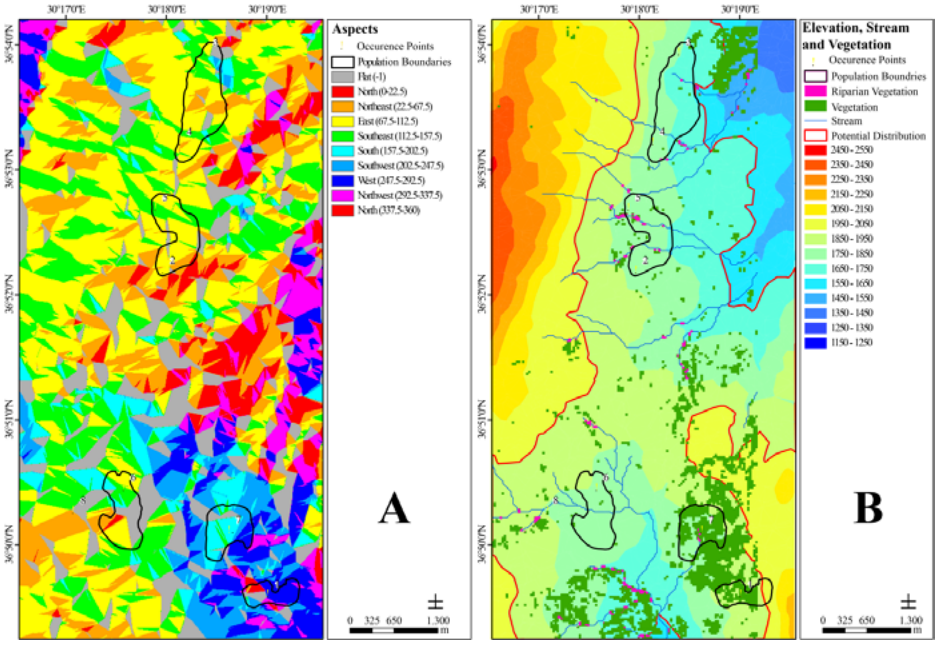


Figure 2. Map showing the characteristics (indicated on the maps) of the range area of *P. ebneri*

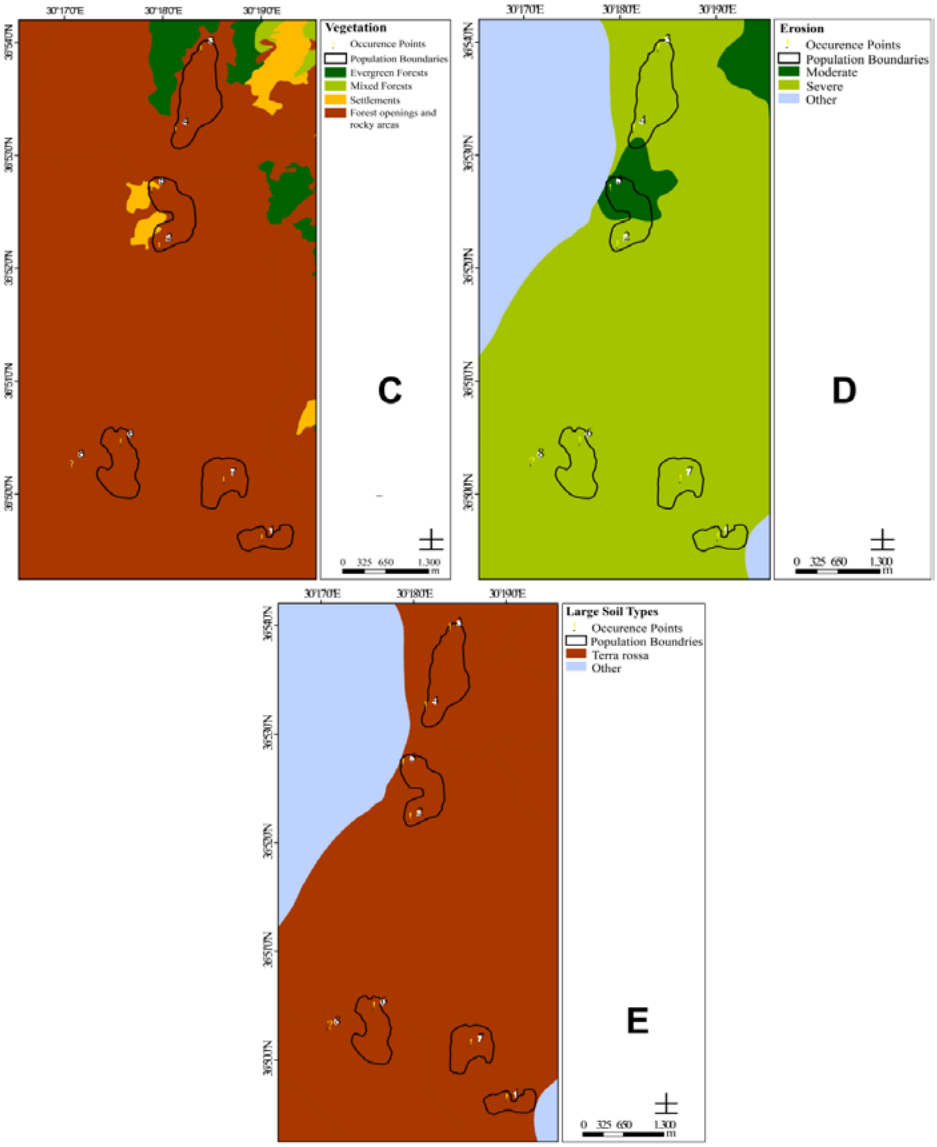


Figure 3. Map showing the characteristics (indicated on the maps) of the range area of *P. ebneri*

total occurrence area the population was estimated to be 960 individuals. However, adult *P.ebneri* hide well in the vegetation and may be difficult to observe, thus, these numbers should only be considered a rough estimation of the population size.

To estimate the ecological parameters determining the species' distribution and to determine the possible limits of occurrence area the recorded localities were mapped according to soil structure, degree of erosion, elevation, slope aspects/direction, vegetation, and the water sources in the area (Figs. 2 and 3). Of these six parameters, only altitude partly explains the occurrence of the species while others do not. The species occur between an elevation of 1650-1850 m. We estimated the population size regarding the areas with similar altitude as 24.3 km^2. According to this estimation of maximum range area the population size is expected to be around 9,720 individuals. However, this is certainly not possible as it does not continuously exist in the area since we only observed it in some patches. Thus, when we evaluated the conservation status of the species based on these early data it is classified as "critically endangered."

Social and administrative activities

To increase public awareness a social media account (Instagram) has been established. In this application, we posted several informative photos (the species' features, occupancy area, potential risks, and information about the Mohammed Bin Zayed conservation fund), and conducted surveys and polls to interact with the local people, university's academic stuff and other conservation project members. We believe that these efforts are helping to increase the awareness of climate, extinctions, and the importance of habitat conservation.

Another activity related to raising public awareness was establishing public relations with the people living in the district. The species distribution area "Imecik Yayla" is an area used for grassing the herds of goats, sheep and cows during summer. Our observations indicate that the herds constitute the main threat to *P. ebneri*.

Figure 4. Photos from "Imecik Yayla Şenliği" festival.

During the last 15-20 years, herds have been released to the area during the end of the May or beginning of June. As the people observed that the vegetation getting poorer year-by-year they decided to stop releasing the herds into the area. The decision was made according to the blooming and seed maturation time, and the herds were released after a festival called "Yayla Şenliği" (Fig. 4). All herd owners are obeying the rule by Mukhtar. In 2019, the ceremony was held on June 23th, 2019. This is sagacity by the local people which provide great support for the conservation of the Beydagları bushcricket. These animals hatch in the second week of May and disappear by end of the June after laying their eggs in the ground. Thus, the non-egg life period is about 40 days and ends around the time of the "Imecik Yayla Şenliği" period. In total, the maturation period, mating, and egg laying period, seem to finish within the approximate 40 days. This activity allows the bushcrickets to bypass the threat by herd grazing, which we consider to be the main threat. Regarding all these, we think climate change remains the main threat to this species. But, in any case, there is no more suitable measure to conserve species.

We will continue monitoring the species in 2020 to further determine the exact occurrence range and better-estimate the population size. The greatest conservation is provided by the local people by delaying the herds of the cows, sheep and goats. Although people are doing all these things to enrich the vegetation for their animals, such an application provides conservation for total habitat and all organisms living there. This sagacity should be advertised to the whole world.

How do locusts and grasshoppers control hatching time?

By SEIJI TANAKA
National Institute of Agro-biological Sciences at Ohwashi
JAPAN
stanaka117@yahoo.co.jp

Locusts and grasshoppers deposit eggs as egg pods (Fig. 1) and they often hatch simultaneously from an egg pod (Fig. 2). Many studies have been performed to determine the factors that influence the seasonal life cycles in those insects. In general, hatching time of insects is influenced by various factors, such as geographic localities, voltinism, moisture, light, and temperature cycles (Tauber et al. 1986; Danks, 1987; Saunders, 2002). I became interested in the mechanisms that control hatching time in locusts several years ago. I was looking at body-color polyphenism in the desert locust (*Schistocerca gregaria*) and wanted many solitarious hatchlings within a short period for my experiments. One morning I obtained a dozen egg pods near hatching from one of my postdocs. We usually incubate eggs for hatching at 30°C, but on that day I transferred the egg pods from 30 to 35°C, hoping that they would hatch rapidly. However, only a few nymphs hatched by the evening and I then stored the unhatched eggs at 20°C before I went home. Next morning, I found that most eggs had already hatched. After a few times of similar experiences, I realized that hatching of desert locust eggs was inhibited by a high temperature and favored by a low temperature and started analyzing this phenomenon with my postdocs.

Hatching under thermocycles

We first tested the above hypothesis by exposing desert locust eggs to 12-h cycles of various low and high temperatures under continuous illumination during the last 5 days of the egg stage. For comparison, we also incubated eggs of the migratory locust (*Locusta migratoria*) under the same temperature conditions. We observed that almost all desert locust eggs exposed to cycles of 25°C and 35°C hatched at 25°C, whereas most migratory locust eggs hatched at 35°C (Nishide et al. 2015a). Interestingly, desert locusts hatched consistently during the low temperature period in all combinations of temperatures ranging from 35°C to 20°C, and the

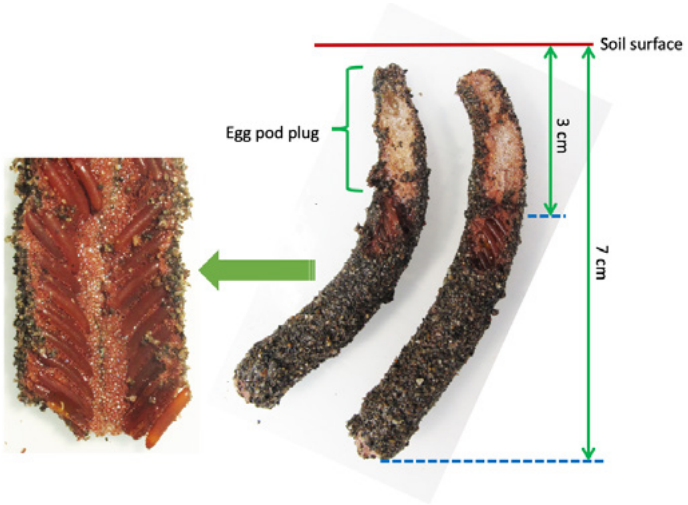


Figure 1. Egg pods (right) of the migratory locust, *Locusta migratoria*. Part of an egg pod cut open (left).

opposite was true for migratory locust eggs. Therefore, 25°C favors hatching of desert locusts when it alternates with 35°C, but this temperature strongly inhibits hatching when it alternates with 20°C. Their temperature-monitoring ability was quite amazing, because both locusts can detect as small as a 1°C-difference of temperature and hatch at their "appropriate period" of daily cycles.

Hatching under photocycles

After we started our research on hatching, we learned that Padgham (1981) had reported hatching of desert locust eggs during the scotophase at LD 12:12 h. We confirmed his observation with desert locusts and found that migratory locusts also responded to photocycles by hatching, but during the photophase (Nishide et al. 2015b). In these observations, all eggs were removed from egg pods and held on sand. Hatching also occurred at the species-specific time of the day at LD 12:12 h when the eggs were covered with glass beads that allowed light to reach the eggs. In contrast, if they were covered with sand, hatching occurred both during the light and dark periods, indicating they failed to respond to photocycles. The presence of the light sensitivity and the light-driven mechanism that controls hatching time appears quite puzzling, because locust eggs are normally laid in sand or soil where light is unlikely to reach them. Our measurements suggested that light intensity at 1 cm deep in sand was undetectable with our apparatus (Ondotri, T and D Co.). These results pose an intriguing question regarding the presence of photo-sensitivity displayed by the locust eggs. Although it may be highly speculative, we have proposed a possibility that molecules that are responsible for the perception of thermoperiod also perceive light, so that a photoperiod acts like a thermoperiod (Nishide et al. 2015b). A candidate for such molecules might be rhodopsin that is involved in circadian rhythms in insects and other animals. In the fruit fly *Drosophila melanogaster*, a rhodopsin is known to function as a thermoreceptor as well as a light receptor (Shen et al. 2011). I hope that this possibility will be explored in the future.

Hatching time in the field

The habitat of the desert locust is the Old World deserts, where temperatures often rise to over 50°C and humidity is low during the day (Ellis and Ashall 1957). In the field, the hatching period of desert locust eggs is relatively short, ranging from shortly before dawn to the first 4 h after sunrise (Ellis and Ashall 1957), though oviposition occurs regardless of the time of day or night (Popov 1958; Stower et al. 1958). Early morning hatching may be an adaptation to the desert because the hatchlings can move and lie on a rock or grass before sunrise and prior to extremely high temperatures at ground level. We tested two patterns of thermocycles consisting of a 12-h thermoperiod (35 or 30°C) and 12-h cryoperiod (low temperature period; 30 or 25°C), and two patterns of field temperatures observed in a natural habitat, Mauritania, in May and September (Nishide et al. 2017a). The majority of eggs hatched during low temperature periods in all patterns tested, leading us to conclude that the hatching time of egg pods observed in the laboratory was consistent with the observations by Ellis and Ashall (1957). We also observed that eggs removed from egg pods and kept individually under the same experimental regimen tended to show a wider range of hatching period, indicating that egg condition is important in hatching synchrony (Nishide and Tanaka 2016; Nishide et al. 2017a).

In the migratory locust Chen (1999) reported that eggs hatch between 11:00 and 13:00h in China. However, the relevant data and methods of observations are not available. Therefore, we observed hatching behavior of the migratory locust by depositing eggs in soil outdoors a few days before hatching from May to September in 2013 in central Japan and by counting hatchlings every hour (Nishide et al. 2017b). They hatched between 09:00 and 16:00h. We found no large differences in hatching time from May to September. The absence of clear seasonal differences in hatching time might be related to the fact that their hatching time was highly correlated with an increase in temperature during early morning. Egg pods usually complete hatching within a day, but some take 2 or 3 days, and egg hatching is interrupted by rain. Laboratory experiments in which the eggs are exposed to temperatures simulating outdoor conditions show that soil temperature is the main factor responsible for hatching activity (Nishide et al. 2017b).

Mechanisms controlling hatching synchrony

As mentioned above, migratory locust eggs hatch during daytime but the eggs of each pod hatch within a few hours (2.5 ± 1.2 h; n = 36) under outdoor conditions (Nishide et al. 2017b). This finding was confirmed in laboratory experiments in which 22 egg pods laid into sand bottles were incubated at 30°C under continuous illumination and photographs were taken every 30 min to count hatchlings from each egg pod (Tanaka 2017). The eggs hatched simultaneously from the egg pods with a mean hatching period of 2.4 h, the value being similar to that

Figure 2. Hatching of the migratory locust *Locusta migratoria* in the field.

observed outdoors (Nishide et al. 2017b). However, if eggs are removed from the egg pod and incubated individually, they hatch later and more sporadically over an extended period than those kept in a mass (Nishide and Tanaka 2016; Tanaka 2017), which suggests the presence of a mechanism that controls hatching synchrony in this locust. It was observed that even a pair of eggs hatch together if kept in contact with one another.

When is hatching timing determined?

This question was answered by separating or clumping pairs of migratory locust eggs at different times before hatching (Tanaka 2017). I used a paintbrush to separate or clump eggs and observed their hatching patterns by photographing every 30 min. The results indicated that hatching synchrony is lost or restored if eggs are separated or clumped during the last day before hatching. Based on this and other lines of evidence, we assume that hatching time is decided shortly before hatching.

Hatching synchrony of eggs from different egg pods

I obtained two egg pods produced one day apart and observed whether two eggs from different pods could hatch together compared with those singly kept as controls at 30°C under continuous illumination. Two eggs obtained from different pods and kept singly hatched one day apart as expected, whereas those kept in contact with one another hatched simultaneously at an intermediate time between the two controls. I performed similar tests using 38 pairs of egg pods and found that migratory locust eggs modified their hatching time for synchronous hatching if they were laid less than 40 h apart. This observation suggests that locust embryos may use some age-specific signals to control hatching time during the last 40 h before hatching. In this locust, embryos monitor neighboring embryos and hatch synchronously by delaying or advancing hatching time (Tanaka 2017).

Eggs hatch rapidly when a Mozart's music is played

During studies we observed that migratory locust eggs hatched rapidly when they were vibrationally stimulated with a Mozart's music (Turkish march) during the last 2 days before hatching. The music was played repeatedly until all eggs hatched. We also played various other music including Beethoven's Für Elise, Chopin's Nocturne, and pop music ("Hey, Mr. DJ" sung by the Backstreet Boys) and obtained similar results (Tanaka et al. 2018). This observation led us to carry out another experiment to confirm the importance of vibrational stimuli in hatching synchrony. We kept two eggs separated by several millimeters and confirmed that they hatched sporadically compared with those kept in contact with one another. However, eggs similarly separated hatched as synchronously as those kept in contact with one another when they were connected by a piece of steel wire (Fig. 3; Tanaka et al. 2018). This result has suggested that hatching synchrony is controlled by some vibrational stimulus that is produced by the embryos and can be transmitted via the wire.

A two-step mechanism

We encountered a problem: i.e., separated eggs vibrationally stimulated by a music during the last 2 days of the egg stage hatched earlier than those kept without music, but they did not hatch synchronously (Tanaka et al. 2018). In another experiment, we started playing the music at different times before hatching and found that hatching synchrony was achieved when the music started shortly before hatching. In other words, embryos had to attain a certain stage before they became ready to respond to the music by hatching, which we called the standby stage. Similar results were also obtained when a hatchling was introduced to single eggs placed on sand at different times before hatching and kept together until the egg hatched, indicating that the hatching-inducing stimulus may not be so specific. Based on this and other results, we proposed a two-step hypothesis that (1) embryos control the time to enter the standby stage in response to a vibrational stimulus emitted by neighboring embryos and (2) those at the standby stage hatch promptly when another stimulus inducing hatching is received. Embryos before the standby stage cannot respond to the second stimulus by hatching but would hatch later spontaneously (Tanaka et al. 2018). In the first step, embryos separated by >40-h-old can modify the time to enter the standby stage for synchronous hatching using a vibrational signal emitted by neighboring eggs. In the second step, embryos at the standby stage are ready to respond to a hatching-inducing signal emitted by a neighboring embryo or a first hatchling in the egg pod.

Identification of hatching-inducing vibrations

Using a needle and a stethoscope connected to a microphone and amplifier, we detected vibrations emitted by migratory locust eggs (Sakamoto et al. 2019). The total number and amplitude of vibrations in single eggs increased as the time to hatch decreased. To examine the roles of these vibrations in controlling hatching time, we played back some of the recordings of these vibrations to

stimulate separated eggs placed on a sand mount and compared their hatching times with those of unstimulated separated eggs (control). The vibrations recorded 8-10 h before hatching caused test eggs to delay hatching when continuously played back for 2 days until hatching compared with the control eggs, whereas those recorded during the last 2.5h before hatching advanced hatching of test eggs. From these observations, we concluded that the vibration emitted by embryos plays an important role in controlling hatching timing in the locust. By analyzing movies of embryos emitting vibration, we found that the abdominal movement of embryos was perfectly synchronized with the vibration (Supplementary Figure 4 in Sakamoto et al. 2019).

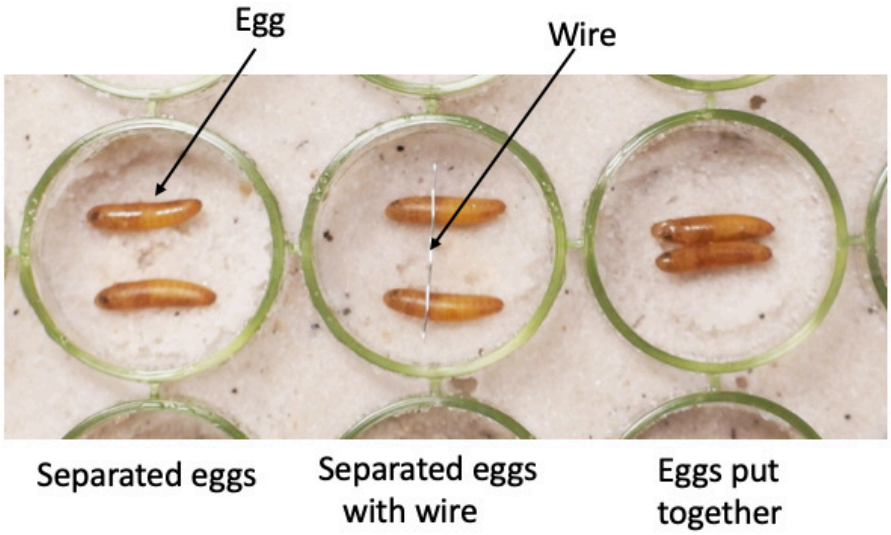


Figure 3. A setup for testing the importance of vibration in synchronous hatching.

Future problems

Hatching is a start of life for most insects and its timing is under natural selection judging from the fact that it is under fine physiological control and often limited to a short period of the day or season. In locusts and grasshoppers, synchronous hatching may be important in reducing predation at hatching and forming aggregations. Although relevant data are mostly missing, we suspect that synchronous hatching from an egg mass may occur in other acridid species. My unpublished observations not only support this inference but also indicate that vibrational signals may serve as a pivotal cue inducing synchronous hatching in at least 9 species, including *L. migratoria, S. gregaria, Patanga succincta, Acrida cinerea, Gastrimargus marmoratus, Oedaleus infernalis, Gonista bicolor, Atractomorpha lata,* and *Oxya yezoensis*. Relevant data will be published elsewhere. As mentioned, eggs of *L. migratoria* produced by <40 h apart modify hatching time when put together: hatching time is delayed or advanced depending on whether the egg is paired with a younger or older egg (Tanaka 2017). The first vibration was recorded 25 h before hatching by our recording device. A more sophisticated device may be required to detect the vibrations emitted by the embryo >25h before hatching.

References

Chen Y. (1999) The Locust and Grasshopper Pests of China. China Forestry Publishing House, China.

Danks HV (1987) Insect dormancy: an ecological perspective. Biological Survey of Canada (Terrestrial Arthropods), Ottawa.

Ellis PE, Ashall C (1957) Field studies on diurnal behaviour, movement and aggregation in the desert locust (*Schistocerca gregaria* Forskål). Anti-Locust Bulletin 25:1–94

Nishide Y, Tanaka S (2016) Desert locust, *Schistocerca gregaria*, eggs hatch in synchrony in a mass but not when separated. Behavioral Ecology and Sociobiology 70: 1507–1515.

Nishide Y, Tanaka S, Saeki S (2015a) Adaptive difference in daily timing of hatch in two locust species, *Schistocerca gregaria* and *Locusta migratoria*: the effects of thermocycles and phase polyphenism. Journal of Insect Physiology 72: 79–87.

Nishide Y, Tanaka S, Saeki S (2015b) Egg hatching of two locusts, *Schistocerca gregaria* and *Locusta migratoria*, in response to light and temperature cycles. Journal of Insect Physiology 76: 24–29.

Nishide Y, Suzuki T, Tanaka S (2017a) Synchrony in the hatching of eggs in the desert locust *Schistocerca gregaria* (Orthoptera: Acrididae): egg condition influences hatching time in the laboratory and under simulated field temperatures. Applied Entomology and Zoology 52: 599–604.

Nishide Y, Tanaka S, Suzuki T (2017b) The hatching time of *Locusta migratoria* under outdoor conditions: role of temperature and adaptive significance. Physiological Entomology 42: 146–155.

Padgham DE (1981) Hatching rhythms in the desert locust, *Schistocerca gregaria*. Physiological Entomology 6: 191–198.

Popov GB (1958) Ecological studies on oviposition by swarms of the desert locust (*Schistocerca gregaria* Forskål) in Eastern Africa. Anti-Locust Bulletin 31:1–70

Sakamoto H, Tanaka S, Hata T (2019) Identification of vibrational signals emitted by embryos of the migratory locust *Locusta migratoria* (Orthoptera: Acrididae) that induce synchronous hatching. European Journal of Entomology 116: 258–268.

Saunders DS (2002) Insect clocks. Third ed. Elsevier, Amsterdam.

Shen WL, Kwon Y, Adegbola AA, Luo J, Chess A, Montell C (2011) Function of rhodopsin in temperature discrimination in Drosophila. Science 311: 1333–1336.

Stower WJ, Popov GB, Greathead DJ (1958) Oviposition behaviour and egg mortality of the desert locust (*Schistocerca gregaria* Forskål) on the coast of Eritrea. Anti-Locust Bulletin 30:1–3.

Tanaka S (2017) *Locusta migratoria* (Orthoptera: Acrididae) embryos monitor neighboring eggs for hatching synchrony. Journal of Orthoptera Research 26: 103–115.

Tanaka S, Sakamoto H, Hata T, Sugahara R (2018) Hatching synchrony is controlled by a two-step mechanism in the migratory locust *Locusta migratoria* (Acrididae: Orthoptera): roles of vibrational stimuli. Journal of Insect Physiology 107: 125–135.

Tauber MJ, Tauber CA, Masaki S (1986) Seasonal adaptation of insects. Oxford University Press, UK.

Some considerations on the current Desert Locust situation in East Africa

By MICHEL LECOQ
Montpellier, FRANCE
mlecoq34@gmail.com

Large swarms of desert locusts (*Schistocerca gregaria*) are again threatening Africa and huge areas up to India and Pakistan. The Food and Agriculture Organization of the United Nations (FAO) is calling the situation the most serious for decades. These swarms have yet to be contained. They recently reached Kenya, which had not faced a threat of this magnitude for 70 years. West and North Africa are not yet concerned but people are legitimately worried because such an arrival of swarms from the East happened during the last great invasion of the years 1949 to 1962. While we have seen classic images of these devastating swarms before, their impressive impact never seems to diminish: trees writhing with locust bodies and branches breaking under their weight; farmers desperate because of the loss of their crops; and technicians equipped with hand sprayers, often poorly protected from pesticides, and attempting to control these insects where only aerial means would be effective against these highly migratory insects.

We know that to multiply, the desert locust requires a combination of weather, soil, and vegetation conditions that favour the reproduction and aggregation of otherwise solitary individuals. Rain is a key factor: if sufficient, persisting for a fairly long period, and spread over a wider area than usual, the numbers of locusts can increase significantly. Gregarization then starts, the first hopper bands form, followed by primitive swarms. This is the beginning of an outbreak that can turn into an upsurge, and into an invasion if favorable conditions persist. The current situation is the result of favorable conditions that occurred several months ago, in 2018, when unusually strong tropical cyclones formed in the southern Arabian Sea. They caused heavy rains in Yemen, Oman, Djibouti, in N Somalia, E Ethiopia, and in S Saudi Arabia. The favorable conditions for Desert Locust breeding were maintained for at least nine consecutive months… but locusts remained undetected and, therefore, uncontrolled.

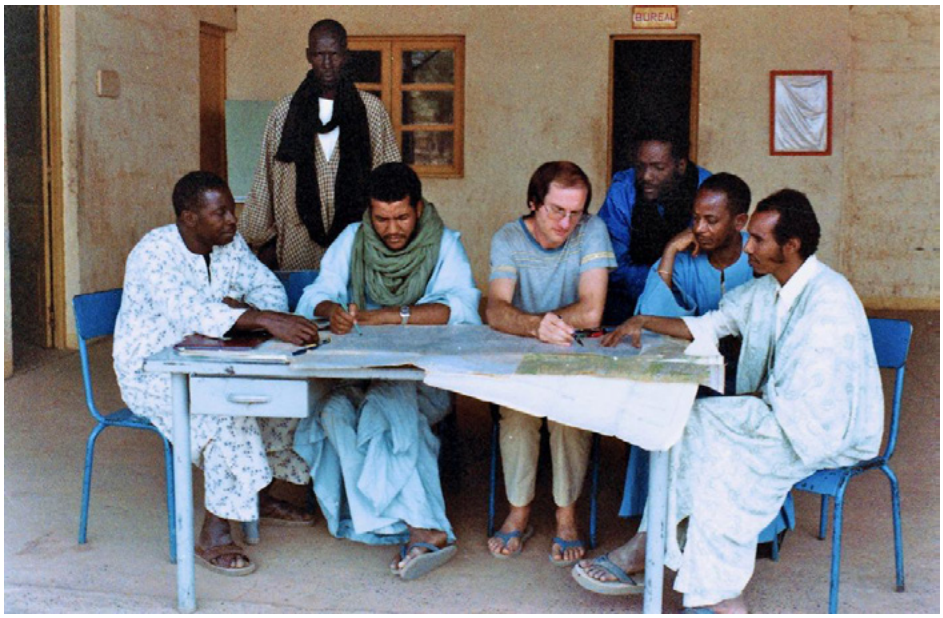
Such invasions have occurred regularly in the past following exceptionally abundant rains in outbreak and key breeding areas. If climate change leads to increased precipitation in these outbreak areas, this would undoubtedly increase the probability of future invasions… but desert locust dynamics are complex and it's too early to say that the current invasion is the result of climate change. Actually, even when the desert locust finds suitable conditions, invasions nowadays can only develop following various failures in the international management system.

A preventative control strategy has been applied for several decades to control this plague. Recommended by the FAO, it involves early warning and rapid response capacities in countries with outbreak areas, which require monitoring of environmental conditions, locust population levels, and the implementation of preventative treatments against the first gregarious populations. Such capacities have been gradually developed and are currently implemented in most countries with outbreak areas. At the international level, the FAO Desert Locust Information Service (DLIS) in Rome produces monthly maps of the locust situation and forecasts for the next three months. But speed is a key element at all stages for a successful strategy. This includes the localization of risk situations, the transmission, sharing, and analysis of information, and, ultimately, the decision to intervene. This early intervention policy has resulted (in addition to new control methods) in less frequent invasions, reduced magnitude, and, if they are not stopped at an early stage, shorter and better managed invasions.

But it is a great feat to successfully monitor (in real time) the population level of a highly migratory insect and the evolution of ecological conditions over vast and often remote areas. One of the critical points is that people must be able to go into the field. No satellite will ever replace the regular work of scouts crisscrossing desert locust habitats. The present situation shows the vulnerability of the preventative system to the numerous insecure zones (terrorism, war...) prevailing in the locust's habitats, making, in some cases, surveys and initial control measures ineffective or even impossible. The inability to detect and control the current invasion from its start is, without a doubt, the result of insecurity in the initial outbreak areas, particularly in Yemen.

Furthermore, the long-term sustainability of the entire preventive control system remains problematic. An important constraint is the reduc-

North Niger, 1989, in the desertic Tamesna area, looking for Desert locust during a recession period.



1983, in Gao, North Mali, working on Desert Locust with people from OCLALAV, at that time an international organization for Desert locust control South of the Sahara.

tion of resources (and, therefore, of survey and early control capacities) during recession periods. Funding is most often abundant during, or shortly after, an invasion (allowing the development of research and strengthening of survey and control systems). But, if prevention is effective and locusts are scarce, there is often a transfer of resources to other more immediate problems. The memory of crises is gradually lost. By the time the next critical situation arises, local expertise and control capacities may have become insufficient to prevent the development of an upsurge. The result is a vicious cycle observed many times, both for the desert locust and other locust species. The answers are not only scientific and technical, but above all, financial, institutional, and ultimately political.

Loss of the memory of past experiences, financial and political impediments, recurrent insecurity in many regions known to be favorable in the event of rain, the problems to be solved are numerous. Whatever the research results, if these various points, which depend on man and not on nature and climate change, are not effectively addressed, invasions will continue to follow one another in the future. For the time being, the current COVID-19 pandemic crisis will not facilitate the control of the current plague.

Leaky lockdown and fieldwork in Uruguay

By KLAUS RIEDE
URUGUAY
k.riede.zfmk@uni-bonn.de

As to be expected, SARS-Cov-2 arrived even in remote Uruguay! Fortunately, the country was well prepared: scientists from the national Instituto Pasteur (http://pasteur.uy/en/home/) were already developing their own PCR-test, to be independent from imports. Since 13th of March, 18,000 tests were made, revealing 625 cases and 15 deaths (as of 29th April - for actual numbers see https://www.gub.uy/sistema-nacional-emergencias/pagina-embebida/visualizador-casos-coronavirus-covid-19-uruguay). Meanwhile, monitoring is a routine, and sequences from Uruguay are available on nextstrain.org, showing their origin from Europe and the U.S. The national health system is very good, and medical personnel was already preparing before the arrival of Patient 0, practicing safety protocols and preparing protective gear. After detection in March, contact persons of Patient 0 were isolated, first patients had to be hospitalized, including a popular politician (recovered since).

Kindergarten, schools, and universities were closed, passenger air traffic was stopped, as was the ferry to Argentina, except for repatriation of tourists visiting the La-Plata countries, or incoming flights repatriating a considerable number of Uruguay citizens, vacationing or working all over the world. Uruguay´s well-funded health system definitely profited from analysing anti-corona measures in other countries, favouring South Korean intelligent monitoring and distancing methods as a model. Citizens were urged - but not forced - to stay at home, particularly elderly persons. Face masks are obligatory in most public venues and public transport. Response and cooperation of people was excellent, and national habits, such as greeting with hugs and kisses, or sipping maté together, were cancelled outside families. The mighty neighbouring giants, Argentina and Brazil, pursued distinct and opposed strategies, with a complete lockdown in Argentina, but a patchy variety of measures reaching from lock-down to laissez-faire in distinct Brazilian provinces (Souza et al. 2020). Consequently, the large green border with Brazil was “closed” and monitored by an impressive military contingent.

In summary, these measures were adequate and balanced, and fortunately compatible with my program for the last weeks of the 2019/20 austral

Figure 1. Halophytic vegetation and sedge meadows near Rio Solis chico. Crabs and grasshoppers can be found together. A map of this and all other sites can be found on my iNaturalist profile https://www.inaturalist.org/observations/klaus16

Figure 2. Dune vegetation near the coast

Figure 3. Complex grassland - Eucalyptus ecotone with interspersed micro-wetlands. Foreground: *Eryngium* sp.

summer field season. The season was unusually dry, with strong populations of grasshoppers at my favourite field sites, representing 3 habitats:

- Halophytic vegetation and sedge meadows near Rio Solis chico (Fig. 1)
- Dune vegetation (Fig. 2) at the coast, and a
- Complex grassland- Eucalyptus ecotone with interspersed micro-wetlands (Fig. 3).

This season´s target were:
- acoustic monitoring of grasshoppers with compact, programmable audiomoth recorders.
- recording acridine species of the tribe Hyalopterigini and their crepitation (a series of short sound pulses generated during flight)

Audiomoth recorders (Fig. 4) are small and can be left in the field for days, while expensive DAT recorders require presence of the recordist. DAT recorders are more sensitive and better for recordings of faint acridid stridulation, but audiomoths reach far into the Ultrasound (up to 192 kHz). This is more than sufficient to cover not only high-frequency components of acridid songs (going up to 50 kHz), but also reveal a fascinating soundscape generated by katydids, which, in most habitats, dominated the frequency range above 20 kHz. The final aim of these investigations is the development of a non-invasive acoustic monitoring method for rapid assessment of grasshoppers.

While gomphocerine grasshoppers generate sounds with their well-known femuro-tegminal stridulation, an additional sound-producing mechanism employing hindwings is observed in Acridinae. In Uruguay we can observe several species of the New World acridine tribe Hyalopterygini, characterised by fenestration and modified wing venation of male hindwings (Fig. 5). They are used to generate "crepitation" sounds during flight (Riede 1987, Lorier et al. 2002).

Crepitation was only heard in the field, which means that the relation between crepitating individual and recording is unreliable. Fortunately, populations within a certain microhabitat were homogeneous. The sound pulses are click-like and probably among the shortest observed in the animal kingdom. They are well audible to humans, but a high sampling rate is necessary for a good recording of these supershort clicks.

Field sites were all within a 20 km distance from my home lab near Montevideo. They were not remote, but solitary, hence no problem to keep up social distancing. Fortunately, I had no issue finishing fieldwork. Probably the worst disturbance were some complications in logistics and many hours lost watching viruses evolve on nextstrain, or reading about virology in general, and coronavirus gain-of-function experiments in particular (Menachery et al. 2015) - not recom-

Figure 4. Small audiomoth recorders were left in the field for 48 hours, using a 1-minute sequence recording period every 5 minutes. Here, the audiomoth was hidden in a log. Because of their small size there was no danger of robbery, in fact the problem was to find them again. The Sony recorder can be seen in the distant middle background of the first photo.

mended!

As we all know, the situation is much more complicated in most parts of South America and the world, with severe interruptions of on-going fieldwork or lab experiments. Best wishes to all colleagues, stay healthy!

References

Lorier, E., García, M., Clemente, M., & Presa, J. (2002). Acoustic behavior of *Metaleptea adspersa* (Orthoptera: Acrididae). The Canadian Entomologist 134, 113-123.

Menachery, V., Yount, B., Debbink, K. et al. (2015). A SARS-like cluster of circulating bat coronaviruses shows potential for human emergence. Nat Med 21, 1508–1513 .

Riede, K. (1987). A Comparative Study of Mating Behaviour in Some Neotropical Grasshoppers (Acridoidea). Ethology 76, 265-296.

Souza, WM et al. (2020). Epidemiological and clinical characteristics of the early phase of the COVID-19 epidemic in Brazil. medRxiv 2020.04.25.20077396.

Figure 5. *Eutryxalis filata* male, with characteristic fenestration and venation of hindwing.

My short-lived sabbatical in Australia

By HOJUN SONG

Department of Entomology, Texas A&M University
College Station, TX, USA
hsong@tamu.edu

This is a story about my short-lived sabbatical in Australia, which had to prematurely end due to COVID-19. This global pandemic has claimed countless lives and caused emotional and financial sufferings to nearly everyone on this planet. So, in the grand scheme of things, the story that I am about to tell might not even qualify as an example of hardship. It's simply a personal story of disappointment and missed opportunities.

In the U.S. (and probably other countries as well), university professors are allowed to take a sabbatical leave every 5-7 years. Usually, a sabbatical is used as an opportunity to rest, recharge, or work on new ideas without any of the responsibilities of being in academia. I started my faculty career in 2010, but I had never taken a sabbatical until now for various reasons. I had been pushing myself hard for many years, and I had been feeling a bit burned out. So, when an opportunity came up for me to take 6 months off from my school and move to Australia to refresh myself as well as to give my family an experience of a lifetime, I became very excited and wanted to seize that opportunity.

Why Australia, one might ask? Well, in 2009, I visited Australia for the first time to collect some rare and endemic katydids found in Western Australia as part of my NSF project at that time. During that trip, I had an opportunity to visit the Australian National Insect Collection (ANIC) in Canberra to borrow specimens for my research. There, I found hundreds of undescribed grasshopper species belonging to Catantopinae (Acrididae) that were nicely curated and organized by the late Dr. Ken Key (1911-2002), who devoted his life to studying Australian grasshopper diversity and collected throughout the vast landscape of Australia. Throughout his career, Key discovered numerous grasshoppers new to science (his early focus was on the Australian endemic family, Morabidae), but, unfortunately, Key passed away before describing more new genera and species. It is estimated that there are probably 500 undescribed but "known" species of catantopine grasshoppers housed at the ANIC. However, because there has not been any active grasshopper taxonomist in Australia since Key, the biodiversity of these endemic grasshoppers has remained undocumented for more than two decades. So, ever since my first

Figure 1. At the Fulbright award ceremony in Canberra, Australia (February 2020).

visit to Australia, I had been yearning for an opportunity to go back for an extended period to work on the taxonomy of these grasshoppers.

The dream of visiting Australia for an extended period to work on the taxonomy of Key's amazing grasshoppers became a reality when I was fortunate enough to be awarded the Fulbright Future Scholarship in March 2019 (Fig. 1). This scholarship, administered through the Australian-American Fulbright Commission and funded by the Kinghorn Foundation, would cover my travel, stipends, and health insurance for my visit. My plan was to visit the ANIC from January to July, 2020, and learn the taxonomy of the Australian Catantopinae, image types at various Australian collections, describe a few new genera and species, and collect DNA-grade specimens from different habitats throughout Australia. And, for my family, I had plans to visit many iconic places in Australia, including the Great Barrier Reef, Blue Mountains, and Uluru, as well as large cities like Sydney and Melbourne.

My sabbatical was off to a great start when my family and I took a flight from Houston to Canberra via Sydney (a 23-hour journey) to arrive in Australia on January 17th. At the time, we were hearing news about how bad the air quality was in Canberra due to smoke from the bushfires. We even brought several N95 masks with us just in case (which, as you might imagine, became handy later when the virus hit). But luckily, a couple days before our arrival, it had rained and cleared the air in Canberra. After our arrival, we moved into our new and unfurnished apartment, all very tired from the travel, yet excited about new experiences that awaited us. Anyone who has ever moved to another country would agree that it takes a lot of time and effort to get settled down. For us, settling-down involved many trips to IKEA, Costco, and appliance stores to purchase bare-minimum furniture and appliances to use for 6 months, enrolling my kids in Canberra's public school system, and buying a used car to get around. We also began to explore Canberra and immediately felt in love with the city. Many Australians would tell you that Canberra is a small town built for government offices, but for my family, who just had moved from a small university town in Texas, Canberra was a big city. We quickly discovered many fantastic restaurants and amazing coffee shops in the city, as well as many beautiful parrots and cockatoos, which made the whole process of adjusting to a new life in Australia ever more enjoyable.

About 2 weeks after arriving in Canberra, I began my work at the ANIC. As I looked through the specimens collected and curated by Key, I realized how much I missed working in the collection. After my PhD, my research focus had expanded to molecular phylogenetics, and later to a lot of laboratory experiments using locust colonies. It has been always my intention to work on descriptive and revisionary taxonomy, but because of all the other projects, teaching, student advising, and other service work, I simply do not have much time to do taxonomic work. So, this sabbatical was a perfect opportunity to get back to taxonomy, and spend as much time as possible looking through the microscope and examining specimens.

Because the Australian Catantopinae was a new taxonomic group for me, I first had to figure out how to distinguish different groups and learn taxonomically important characters. One of Key's last publications was his 1993 paper titled, "A higher classification of the Australian Acridoidea (Orthoptera). II. Subfamily Catantopinae." In this paper, Key described many new subtribes and listed morphological characters that he thought were important, and identified what he called the "core genera" that would be representative of the subtribes. So, I decided to study and understand Key's subtribe concepts by first creating a small synoptic

Figure 2. Synoptic collection of Australian catantopines that I prepared for studying.

Figure 3. My family during the short field trip to the NSW outback. This picture was taken from a mallee habitat. My wife and kids were wearing masks, not because of the bushfires or coronavirus, but because they did not like bushflies going into their mouths!

collection consisting of male and female specimens representing 43 core genera that he recognized (Fig. 2). However, I quickly realized that many of these subtribes were quite loosely defined based on characters that were superficial at best, such as lengths and widths of different body parts. Key certainly examined male genitalia of nearly all of the species (both described and undescribed) that he had collected, but did not leave any document discussing specific genitalia features unique to each genus. Therefore, I decided to do my own characterization of the morphological features by examining the specimens under the microscope, making rough illustrations of head, thorax, and male abdomen (cerci, supra-anal plate, subgenital plate) for each genus, and compiling a set of taxonomically useful characters. I also dissected and cleared male and female genitalia, but did not spend too much time studying these characters yet because I planned to image them later.

After about a month of museum work, I was able to go through all 43 core genera, but unfortunately, I could not make much sense of Key's subtribe concepts. While some subtribes were unique and different enough to be recognized, many subtribes seemed a bit arbitrary without any clear diagnostic and group-defining characters. I felt a need to expand and study more different genera to really grasp the true diversity of the Australian Catantopinae. So, I pulled out 80 more described genera, and began characterizing their external morphology and dissecting male and female genitalia. My thought was that it would take another two months to study all these additional genera, which would leave about three months for me to synthesize my findings. I spent about 6 hours each day studying the specimens. This was the first time since my PhD that I was able to devote a large chunk of time each day for taxonomic work, and I truly enjoyed every moment of it.

Because I started my Fulbright visit in the summer season in Australia, I wanted to explore and collect from as many different habitats near Canberra and elsewhere as possible, while the weather was still good for grasshopper collecting. However, because of the bushfires, many areas were either burned down or inaccessible. Luckily, the inlands were less affected by the bushfires, so I decided to take a short collecting trip to the NSW Outback with my family in the last week of February (Fig. 3). It was a 4-day trip visiting Dubbo, Bourke, and Hillston, covering over 2,000 km in distance. It was a fantastic opportunity to show my family some of the unique Australian habitats (although not really touristic at all), hundreds of kangaroos and wallabies, many different reptiles and birds, and all different types of eucalyptus trees. However, the trip was not so great for collecting grasshoppers mainly because of the long drought that struck the inlands that basically wiped out all grasshopper populations. While driving back to Canberra, I told my kids about all the other places that we were going to visit while in Australia and how lucky we were to have this kind of opportunity. Little did I know that this would be the only family trip that we would take in Australia.

Over the years, I have met many wonderful Australian scientists at various meetings or during fieldwork. So, one of the things I wanted to do while in Australia was to visit them in person and deepen our relationships. During my short visit, I was able to meet several orthopterists, including David Hunter (our Society's President), Roger Farrow (locust ecologist), Dave Rentz (katydid taxonomist and a former curator of ANIC), You Ning Su (cricket taxonomist and collection staff at ANIC), and María Marta Cigliano (our Society's past President who visited Canberra for a few days from Argentina – for more about her COVID-19 story, please see the Regional Report from South

Figure 4. Orthopterists in Canberra. Left to right: Dave Rentz, Hojun Song, Haeran Park, María Marta Cigliano, Barbara Rentz, and You Ning Su.

America in this issue) (Fig. 4). I also had several opportunities to get to know more about my colleagues at the ANIC, which I appreciated very much. I also had plans to visit Sydney, Melbourne, Adelaide, Perth, as well as New Zealand to meet my colleagues and friends, but unfortunately, all these plans had to be cancelled as the coronavirus situation was becoming serious in March.

In mid-March, COVID-19 was spreading like a wildfire all around the world. I was closely following the situation in the U.S., especially how the universities had extended their spring breaks and started transitions into online courses. The situation in Canberra was a bit calmer, but there was a talk about school closures and lockdowns. It suddenly became unclear whether I could continue to work at the ANIC or not. How long would this pandemic last? Should I stay or should I leave? On March 19th, I received a letter from the U.S. Department of State saying that all Fulbright participants should return to the U.S. as soon as possible and that the Fulbright program had been suspended. A few days later, I received a call from the Fulbright Commission saying that if I chose to remain in Australia, I would have to stay as a private citizen under a travel visa with no health insurance from the Fulbright. Australia was beginning to close borders, and international flights were being cancelled. So, it became pretty clear that our window of opportunity to safely leave Australia was rapidly shrinking.

On March 22nd, my wife and I made a decision to return to the U.S. We bought one-way tickets back home to depart on March 28th, which costed a fortune for my family of four. Having made this travel plan, we realized that we had to sell everything we purchased (furniture, appliances, and the car) and pack our luggage within a few days. Quite unbelievably, my wife was able to sell everything we bought through the online market place called Gumtree in 3 days. I told my colleagues at the ANIC about the situation and my decision to return to the U.S. I put all the specimens that I had pulled out into three drawers and placed a small note onto each drawer saying, "Catantopinae Synoptic Collection – Song work in progress." "One day, I will return and finish what I have started," I thought.

On the evening of March 26th, I checked for our flight online and found that our flight from Sydney to Los Angeles was cancelled. I called the travel agency to confirm it, and the cancellation was correct. I was told that the only way to fly out of Australia would be to take an earlier flight. All the flights for the following weeks had been cancelled, so I had to purchase another set of one-way tickets. It was about 9 PM on March 26th when I bought the new tickets and our flight would depart on 7 AM on March 27th. That meant that we had only a few hours to finish packing, clean out the apartment, and go to the airport.

Figure 5. In front of the Canberra International Airport on the day of sudden departure. Because of COVID-19, the airport did not open its doors until just one hour before departure. My kids remained pretty positive throughout the whole experience.

Panic ensued as we finished packing and cleaning. Thankfully, a Korean couple whom we met in Canberra offered to give us a ride to the airport at 3 AM in the morning (Fig. 5). When we were allowed to check in, we ran into another problem. We found out that one of our connecting flights in the U.S. suddenly got cancelled, which caused some issues with the system that prevented us from checking in. Another round of panic ensued because the agent told us that we would not be able to board the flight unless the problem was resolved. All the other passengers were able to check in, except our family, and it had already passed our departure time. Luckily, another agent stepped up and was able to short-check us to Sydney, meaning that we would fly to Sydney, claim our luggage, get new tickets to the U.S., and check our luggage again. By the time we arrived in Sydney, the issue with the system was resolved, and we were issued another set of tickets to fly to Los Angeles, then to Atlanta, and finally to Houston. It took more than 34 hours to fly from Canberra to Houston with all the layovers, and during the whole time we had our masks on and were paranoid about infection.

Only when we finally returned to our house, which had been empty for 2 months, were we able to finally breathe a sigh of relief. We went through a two-week self-quarantine and closely monitored for any symptom of the virus. Thankfully, we all felt fine after the two weeks! It has now been almost a month and a half since we returned from Australia. We only have good memories about Canberra, but now the whole experience almost feels like a dream that never happened.

Surely, I am very disappointed that my sabbatical was cut short. I am not sure when I will have another opportunity to go back to Australia and pick up where I left off. I also feel terrible that my family had to go through the ordeal of narrowly escaping the border closure. I would have never thought that my first sabbatical would end up like this, but I cannot dwell on my disappointment any longer. There will be another opportunity in the future, and what's important for now is that we are all safe at home. The Australian grasshoppers can wait and I'll find a way to finish what I started.

Editorial

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

What an unbelievable time has it been since our last issue of *Metaleptea*! The COVID-19 pandemic has completely upended our lives and we now live in a completely different world from just three months ago. Had it not been for this pandemic, I would be writing this editorial from Australia, but as chronicled in my earlier story, I have been back home in Texas since the end of March. Because everybody in the world has been affected by this pandemic, I have solicited articles from our regional representatives about how orthopterists in different parts of the world have been coping with this ever-changing situation. As you can read from these articles, all our research programs have been critically affected, and those of us in academia had to quickly modify our teaching formats to suit online teaching. Nationwide lockdowns have lasted from a few weeks to a few months, depending on the countries, and most of us have been spending much of our time at home, practicing social distancing to prevent the spread of the virus. I sincerely hope that everyone remains safe and maintains a positive attitude in these trying times.

In addition to this global pandemic, we are experiencing one of the worst desert locust outbreaks in decades. As described in the regional report from North, Sahelian, and West Africa by Amina Idrissi and a contributed article by Michel Lecoq, the desert locust upsurge this year has affected food security and livelihoods in East Africa, Arabian Peninsula, and Southwest Asia. Especially, the current situation in Kenya, Ethiopia, and Somalia remains extremely alarming, and there is no end in sight. In the past, monitoring the movements of hopper bands and swarms used to be quite challenging because of the vast areas that these insects can cover. Recently, I learned of an amazing effort by PlantVillage, a project started by David Hughes and Marcel Salathé at Penn State University, which created a smartphone application called elocust3m. This is a data-collecting app that can be easily installed on a mobile phone that can help trace locust movements. PlantVillage has partnered with the Kenyan government to engage young people to report the locusts using this app, which becomes instrumental in coordination of control measures. I am certain that these types of technological advances powered by massive crowdsourcing locust observations will transform how we manage locust outbreaks in the future.

This is another memorable issue of *Metaleptea* featuring how our Society is coping with these difficult times. I am grateful to all of the regional representatives, as well as many contributors and past awardees who have sent their reports. I would also like to thank our Associate Editor, Derek A. Woller, for his continued assistance in the editorial process.

To publish in *Metaleptea*, please send your contribution to hsong@tamu.edu with a subject line starting with [**Metaleptea**]. As for the format, a MS Word document is preferred and images should be in JPEG or TIFF format with a resolution of at least 144 DPI. The next issue of *Metaleptea* will be published in September of 2020, so please send me content promptly. I look forward to hearing from you soon!

Officers of the Orthopterists' Society