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

METALEPTEA

THE NEWSLETTER OF THE ORTHOPTERISTS' SOCIETY

President's Message

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Dear Fellow Orthopterists!

Warmest heartfelt wishes for the new 2019 year! Evidently, this year is a very particular one for the Society because we will hold our main event - the International Congress of Orthopterology. The 13th Congress is almost here! For the first time in the history of the Society, it will take place on the African continent, in the beautiful Mediterranean setting of Agadir, Morocco. And, as you might know, our next Executive Director, Mohamed Abdallahi Babah Ebbe, is from Africa too. I sincerely hope that these two facts will contribute to promoting the Orthopterists' Society in Africa and increasing its African membership and participation, especially among the young researchers.

Time flies, and this message is my last one. During my 2.5 year-long President's tenure, I always felt a very strong and constructive support from all members of the Board and I am very grateful to them. I am confident that the next Governing Officers of the Society will find it in great financial shape. I am happy with the progress of our main outlet, the *Journal of Orthoptera Research*, since it became a part of the Pensoft group. As you all probably noticed, the Society's website now has a new and very attractive look. We continue to actively support

young scientists through Ted Cohn's Research Fund and travel grants to the OS Congresses. The Society's Orthoptera Species File project is quite vigorous: seven grants were awarded for 2019 and the geography of the grantees is amazingly diverse: Austria, Brazil, Germany, Singapore, Spain, Tunisia, U.S.A…

I would like to conclude by welcoming my two long-time colleagues and friends, David Hunter and Mohamed Abdallahi Babah Ebbe, who, respectively, officially become President and Executive Director of the Orthopterists' Society in Agadir.

Looking forward to see a wonderful gang of fellow Orthopterists in Agadir in March!

TABLE OF CONTENTS

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

Our next ICO conference in Agadir – Some news

By L. MINA IDRISSI HASSANI
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Dear Orthopterists,

On behalf of the organizing committee, I wish everyone a very good and wonderful year 2019 and a remarkable conference.

Already we can say that we are very optimistic about the progress of this prestigious event. The preparations for the congress are going well. The provisional program is available on the website **www.ico2019morocco.com.** The final program is under development and will be communicated to you as soon as possible. The book of abstracts will be the subject of a special issue of the next *Metaleptea*. We have about 210 participants from more than 20 different nationalities from 5 continents and a rate of 17% doctoral students; the participants (first author) in 11 symposia are 96. Among the participants, we have many consultants and people who are not presenting, but who are interested in the importance of the event.

There will be 3 workshops of interest to Orthopterists:

1. The **Global Locust Initiative** which is a research and action program of Arizona State University (Tempe, Arizona, U.S.A.), designed as a unit to help researchers, international agencies, government organizations, agribusiness and farming communities to mitigate the effects of invasions and locust epidemics.
2. The **Orthoptera Species File** (OSF, **http://orthoptera.speciesfile.org/**) is the most up-to-date and complete taxonomic database of the world's Orthoptera, both living and fossil. The workshop about OSF, supported by Taxon Works, will be to think about how we can still improve the present version of OSF.
3. The **CLCPRO Regional Research Plan**: the Commission for Controlling the Desert Locust in the Western Region (CLCPRO), within the framework of the EMPRES program of the Food and Agriculture Organization of the United Nations (FAO), developed in 2009 a first regional research plan (2010-2013), based on a screening of research studies carried out in the western region (West and North-West Africa) during the last 50 years. A second regional research plan was established in 2015. This workshop will first present the details of the regional research plan, the actions supported by the CLCPRO since 2016, and the expected actions in the near future.

During the congress, for interested attendees, many activities are proposed, such as a visit of the city of Agadir, and to the seaside or the souk (marketplace, bazaar). After the congress, we propose a tour of the National Center for Locust Control to observe the locust rearing laboratory, visit the facilities, and learn more about the national and regional role of this important institution. The post-Congress tour will be an opportunity to visit the region of southern Morocco with many sites within the Atlas Mountains up to the Sahara border, and, of course, the city of Marrakech.

I thank you all for your trust and look forward to welcoming you to the 13th International Congress of Orthopterology in Agadir.

Grants supporting the Orthoptera Species File

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The **Orthoptera Species File (OSF)** grants committee received and evaluated eighteen applications from thirteen countries (Algeria, Argentina, Australia, Austria, Brazil, Colombia, Germany, India, Pakistan, Singapore, Spain, Tunisia, U.S.A.) from which the following proposals listed below will be funded. The proposals were selected based on the amount of data (images, specimen records, etc.) expected to be added to the Orthoptera Species File. The candidates' expertise was also considered and if the proposal was somehow related to a taxonomic research project of the candidate.

OSF grants funded for 2019:

1. **Collins, Nancy** (Wisconsin, USA)
   Title: Oecanthines of high interest in the United States
2. **Hernández Teixidor D., López Hernández, H. & Oromí, P.** (Department of Animal Biology, University of La Laguna, Spain)
   Title: Adding new data on Orthoptera from the Canary Islands to complete the existing data on Species File
3. **Husemann, M. & Dey, Lara-Sophie** (Centrum für Naturkunde, University of Hamburg, Hamburg, Germany)
   Title: Digitization and imaging of types of Oedipodinae described by Henri de Saussure (Collections in Vienna and Geneva)
4. **Moussi, Abdelhamid & Tlili, Haithem** (University of Biskra, Algeria; University of Cartage, Tunisia)
   Title: Photographic database of North African Acridomorpha (Orthoptera, Caelifera) type specimens deposited at NHM London
5. **Slobodan, Ivković & Horvat, Laslo** (Department of Biogeography, Trier University, Germany; Austria)
   Title: From lowland sands and steppes to alpine grasslands – Taxonomy, bioacoustics and distribution of Orthoptera in Serbia and Montenegro
6. **Souza-Diaz, Pedro Guilherme** (Museu Nacional – Universidade Federal do Rio de Janeiro, Brazil)
   Title: The Orthoptera Collection at the Museu Nacional, Rio de Janeiro (MNRJ). Reconstruction – stage 1: the Orthoptera from the city of Rio de Janeiro and the lost types from MNRJ
7. **Tan, Ming Kai** (Department of Biological Sciences, National University of Singapore, Singapore)
   Title: Contribution to the species diversity and acoustic data on Orthoptera from Sandakan (Borneo, East Malaysia, Sabah)

The New Orthopterists' Society Website is Now Live

By DEREK A. WOLLER
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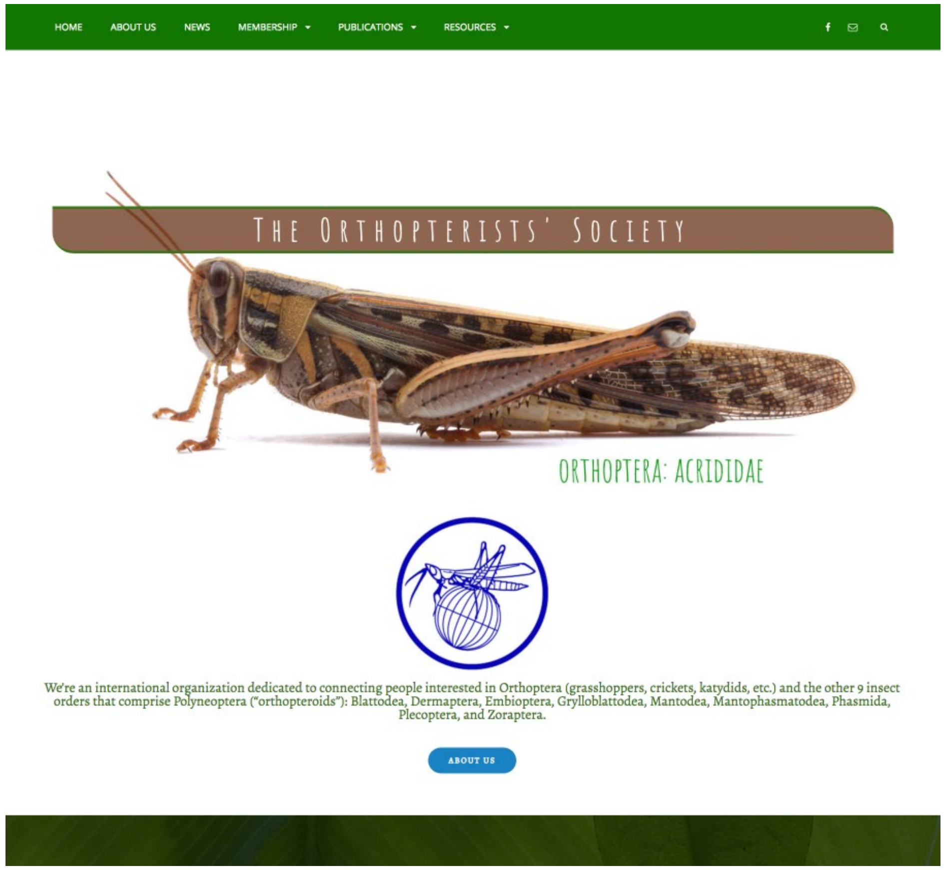
Fellow members, if you have not already visited our Society's new website, then I encourage you to do so. The address is the same as before (**orthsoc.org**), but we are now using Wordpress for its infrastructure. As your new Webmaster, I have tried hard to preserve the overall feel of the previous site that was created and run by Piotr Naskrecki, while also adding a new look that gives it a distinct appearance among other insect society sites. Like all new things, there are still some issues to sort out, such as bringing back our searchable member database and the ability to become a member, solutions for which are in progress. Two other issues that are being worked on are stabilizing the site's address, so it properly reflects the main address on every page, and finding a way to provide access to all back issues of the *Journal of Orthoptera Research* (JOR).

If you have ideas for new additions to the site, wish to submit constructive feedback, or have news you want posted to the News section/home page, please do not hesitate to contact me because this site belongs to all members. I also encourage everyone to post general announcements (e.g., jobs and funding opportunities) on the "**Bulletin Board**" (within the Resources section) as well as new publications in "**Just Published**" (also within the Resources section). I'm also looking for new polyneopteran images to use when needed, such as in **News** announcements because everyone likes to see amazing pictures – please send these to me directly as JPEGS. Additionally, if you know of more books that should be added to the "**Books (& More)**" list (within the "Publications" section), then tell me which one(s) and provide a good image of the cover (via link or image file - JPEG). You are also welcome to ask for a link to be added to the "**Links**" page (within the Resources section). If you think it might be useful to others, then let's add it!

Furthermore, if you're an orthopterist with an interest in the history of our field's contributors, then please take some time to look through the "Photo Gallery" Exhibit called "**Orthopterists And Their Allies**" (within the Resources section) and help place names on people labeled with a "?" in the captions. Photo contributors have done a very good job over the years of keeping track of people in the photos, but we still need a few people identified. And do you have more photos? Send them my way! They can be added to an existing Exhibit or a new one can be created to curate them.

Finally, the Society is interested in locating an **Associate Webmaster** who can occasionally assist me with Webmaster duties, such as posting news and adding files, particularly when I'm unavailable. If you're interested, please contact me directly.



Update on Rebuilding Brazil's National Museum's Orthoptera Collection

By **PEDRO G.B. SOUZA DIAS**
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Progress to rebuild Brazil's National Museum (Museu Nacional) is still in the very early stages and the Palace section, where the Orthoptera collection resided, is being treated as an archaeological site. Practically all museum staff are working steadily on recovering the few items that survived the fire and removing the large amounts of debris. This task will take several months to complete. Simultaneously, plans are already underway to replace Orthoptera specimens via new expeditions. In short, there is a lot to do, but we are optimistic!

If you would like to contribute to our efforts you can do so through a financial donation. To do this, one must access the site of Museu Nacional **http://www.museunacional.ufrj.br** and click on Donations, where it is possible to donate through Paypal. Please note that the currency is Brazilian real (BRL) and the exchange rate is around 3.7 to approximately $1 USD (e.g., R$75 = $20 USD). After you complete the process, please send an email to **sosmuseunacional@samn.org.br** and copy me (**pedrogdias@gmail.com**) with the receipt of the donation, value, and intended destination of the resources (Laboratório de Orthoptera, Departamento de Entomologia), so I can track the transaction.

We are also interested in acquiring donations of specimens for the new collection. Any and all orthopteran taxa are important for us. People can contact me directly to discuss donations of specimens, joint projects, partnerships, etc.

Thank you very much for your support!

Regional Reports - What's happening around the world?

East Europe, North and Central Asia

By MICHAEL G. SERGEEV
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The summer season of 2018 was very complicated and impressive. There were some serious problems with three species of locusts, namely *Locusta migratoria migratoria*, *Calliptamus italicus*, and *Dociostaurus maroccanus*, in almost countries of Central Asia, in the Caucasus, and in the southern part of European Russia. Local governments and applied acridologists tried to manage the local locust populations. However, international activity and cooperation under an umbrella of the Regional Program for better locust management in Caucasus and Central Asia (FAO) was also very important (**http://www.fao.org/ag/locusts-CCA/en**). The special Workshop on Locusts was organized in November, in Bishkek, Kyrgyzstan to discuss some actual problems of applied acridology in the region.

Several field studies of ecology, distribution, and diversity of the orthopteroid insects were organized. The Russian Foundation for Basic Research supported the project to investigate these insects in Tuva, the beautiful and interesting territory in South Siberia. The expedition crossed the southern slope of Academician Obruchev Range and studied the small Turan Intermountain Basin for the first time. Some dense populations of the rare apterous grasshopper *Zubovskya mongolica* were found in the upper altitudinal belts of Academician Obruchev Range (Figs. 1, 2). In the lower (steppe) belts, the abundance of Orthoptera was very high. This resulted in the very high level of their air-dry biomass, more than 15 kg per ha. Some studies of orthopteran distribution were continued in the northern and central part of the Kulunda steppe in South Siberia, near the boundary with Kazakhstan. The first attempt to use a UAV (Unmanned Aerial Vehicle) for evaluation of some peculiarities of the Italian locust distribution was also undertaken. Distribution of stoneflies was also studied in the mountains of South Siberia, mainly in some streams of Kuznetsky Alatau. The special field trip was organized to Kunashir Island to collect some new data about diversity and relations of local forms from the genus *Podisma*. Besides that, research on diversity, distribution, and ecology of grasshoppers and katydids were also continued in other territories of North and Central Asia, for instance, in the North Caucasus, in the steppes of Orenburg Region, in Tajikistan and Uzbekistan.

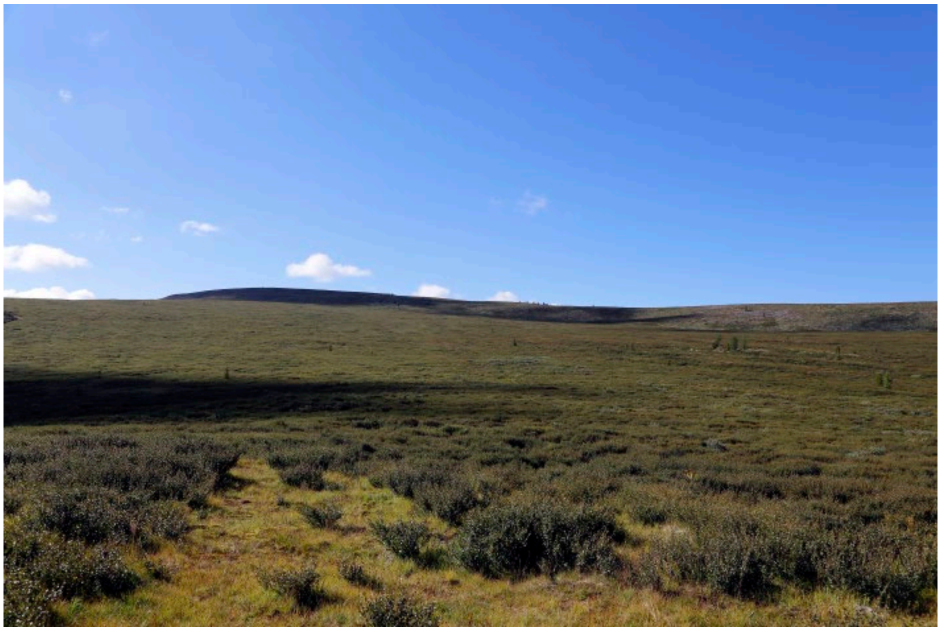

Figure 1. The mountain tundra on Academician Obruchev Range with some unusual assemblage of species: *Zubovskya mongolica* Storozhenko, *Podismopsis poppiusi* (Miram), *Stenobothrus lineatus* (Panzer) and *Stauroderus scalaris* (Fischer de Waldheim).

Several Orthoptera Species File grants also included inventory and digitization of the three main orthopterological collections of Russia: 1) Zoological Institute in Saint Petersburg, 2) Zoological Museum of Moscow State University, and 3) Siberian Zoological Museum of the Institute of Systematics and Ecology of Animals, Novosibirsk.

Figure 2. Two males of the widely distributed *Zubovskya koeppeni* (Zubovsky) in the mountain tundra of the West Sayan Mts. (M.G. Sergeev)

Theodore J. Cohn Research Grant Reports

Male mate choice in the stick insect *Clitarchus hookeri*: sexual vs. parthenogenetic females

By MARI NAKANO
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Although sexual reproduction is the dominant mode of reproduction (for multicellular organisms), some species exhibit parthenogenetic reproduction, a type of asexual reproduction in which the offspring develops from unfertilized eggs. Within stick insects (Phasmatodea), parthenogenetic reproduction has evolved multiple times (Burke, Crean, & Bonduriansky, 2015; Schwander, Crespi, Gries, & Gries, 2013). The evolution of parthenogenetic lineages is sometimes associated with the decay of sexual traits (e.g., alternation in pheromone or cuticular hydrocarbon (CHC) profiles: Burke et al., 2015; Schwander et al., 2013). This is due to selection against traits that are no longer useful (Schwander et al., 2013). As a consequence, males are likely to discriminate between sexual and parthenogenetic females as observed in the Australian stick insect *Extatosoma tiaratum* where males preferred sexual females over parthenogenetic ones (Burke et al., 2015).

In New Zealand, the stick insect *Clitarchus hookeri* (Fig. 1) has all-female populations (i.e., parthenogenetic) in the southern range of the North Island whereas sexual populations, consisting of males and females in equal numbers, are found in the island's northern range (Morgan-Richards, Trewick, & Stringer, 2010). *Clitarchus hookeri* are nocturnal insects and become active after sunset. Individuals from sexual populations exhibit a scramble competition mating system (Myers, Buckley, & Holwell, 2015) in which males and females have distinctive sex roles: males are searchers and females are signallers (Myers et al., 2015). The phenotypic traits that enhance mobility (e.g., long legs) and mate location (e.g., well-developed antennae), and the traits that facilitate being found by males (e.g., production of pheromones) will be favoured in males and females, respectively. However, this is only the case for sexual populations, as females from parthenogenetic populations are released from the selective pressure of scramble competition. Thus, it is likely that parthenogenetic *C. hookeri* females are investing less in the traits that are related to scramble competition.

Finally, as parthenogenetic females are likely to invest less in the traits to signal, I speculated that males should be able to discriminate between sexual and parthenogenetic females.

The purpose of this study was to elucidate the intriguing reproductive strategies of *C. hookeri*. I hypothesized (1) male and female *C. hookeri* would exhibit the morphological and chemical differences that are advantageous to their sex role in the scramble competition mating system; (2) morphological and chemical differences identified as being associated with sex roles will be reduced or lacking in parthenogenetic females; and (3) males will use morphological and chemical differences identified in (1) and (2) to discriminate between sexual and parthenogenetic females in their pre- and post-copulatory choices.

Figure 1. *Clitarchus hookeri*: male (top) and female (bottom).

Methods

Insects were collected from sexual (Auckland, Whanganui, and Paraparaumu) and parthenogenetic (Palmerston North, Lower Hutt) populations from North Island (N= 15 per sex per population), New Zealand. 16 morphological parameters were measured: total body length (cm), the length and width of body parts (antennae, pro-/meso-/meta-notum, abdomen, poculum (male)/operculum (female), and fore-/mid-/hind-legs) (cm), and body mass (g). These morphological traits were measured in adults using electronic callipers (Q-1382, Dick Smith Electronics, Sydney, Australia) and scales (ED224S, Sartorius, Göttingen, Germany).

Chemical volatiles from males and females from each population were sampled (N= 6 for each sex per population) over ten hours (15-01:00h), at two-hour intervals. Lights were on between 15-21:00h, and off between 21-01:00h (according to the photoperiod during summer in New Zealand). Sampled volatiles were analysed using a Gas Chromatograph-Mass Spectrometer (GCMS-QP2010, Shimadzu Corporation, Kyoto, Japan).

Mate choice experiments (N=49) were conducted in an open arena (H39cm x W38cm x D20cm) by placing one male and two females (i.e., 1 parthenogenetic vs. 1 sexual female). I recorded which female the male made the first physical contact with (*1st*) during 20-00:00. This was considered to be a pre-copulatory

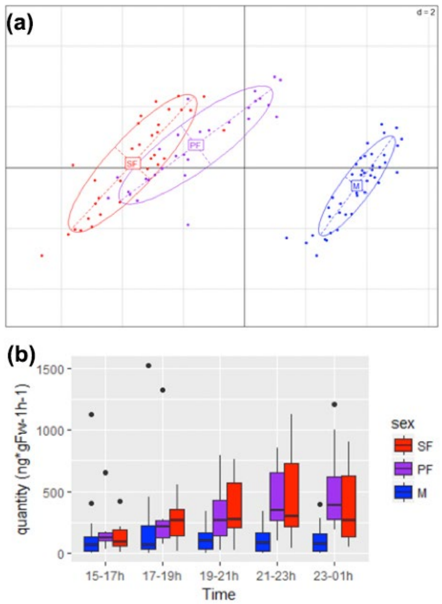

Figure 2. (a) Morphological groupings of males (M, blue), sexual females (SF, red), and parthenogenetic females (PF, purple). Variation of principal components: PC1=75% (x-axis), PC2=12.6%. (b) Increase in the quantity ($ng*gFw^{-1}h^{-1}$) of volatile emission overtime in (15-01:00h) in females but not in males.

male choice. Then, they were left in the tank until 09:00h next morning when I recorded whether the male had stayed with the same female (overnight mate-guarding: *OMG*). This was considered a post-copulatory choice. Females were scored 1 point for each of the behavioural assays (i.e., *1st* and *OMG*) and the frequency of males exhibiting each of the behavioural assays was calculated.

Results and Discussion

Clear differences between males and females were resolved by the morphological analyses (Fig. 2a). The morphological traits that accounted for the segregation between sexes include the length of legs and antennae that were disproportionately longer in males compared to that of females. These results fit my prediction that male *C. hookeri* will exhibit traits that enhance mobility and mate location, which will be advantageous as a searcher. In contrast, female *C. hookeri* were larger (body length, body mass, and abdomen width). As female body size is often positively correlated with fecundity (Bondurianksy, 2001; Edward & Chapman, 2011) and sexual females mate multiple times with males (i.e. promiscuity) (Myers et al., 2015), it is likely that larger body size in females is related to fecundity advantage. My chemical analyses showed *C. hookeri* release compounds that are derived from what they eat, and none of the compounds were specific to females. Thus, it is unlikely that *C. hookeri* females produce specific sex pheromones to attract males. However, females significantly increased the amount of volatiles emitted ($ng*gFw^{-1}h^{-1}$) (p-value < 0.05, Friedman test) at night (Fig. 2b), when the species is sexually active. At night, their host plants cannot synthesize these compounds due to the need of light for their synthesis. As the significant increase volatile emission was not seen in males (Fig. 2b; p-value > 0.05, Friedman test), this change in volatile emission in *C. hookeri* females is likely to be related to their role in scramble competition, i.e. signallers.

Although the traits that are related to the female's role in scramble competition was assumed to be decayed in parthenogenetic females, my results showed an overlap between sexual and parthenogenetic females in terms of their phenotypic traits. These include body length, body mass in relation to body length, and increase in volatile emission at night. These results suggest that parthenogenetic females are maintaining sexual traits. Furthermore, male choice experiments showed that male *C. hookeri* did not discriminate between sexual and parthenogenetic females both in pre- (Fig. 3a) and post-copulatory (Fig. 3b) choices (p-value > 0.05, Binomial test). This is consistent with previous results and supports the possibility of parthenogenetic females maintaining sexual traits. Instead, males chose lighter females significantly more than heavier females in their pre-copulatory choice (Fig. 3c; p-value < 0.05, Binomial test).

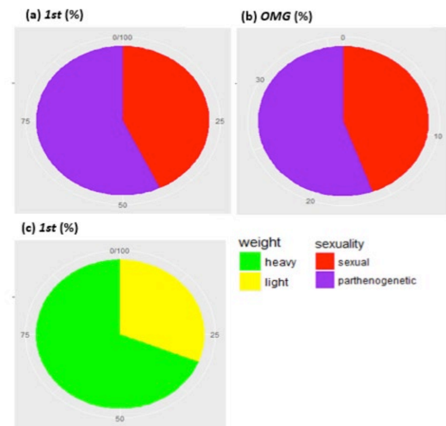

Figure 3. Frequencies of male *Clitarchus hookeri* exhibiting mate choice (*1st* and *OMG*) between sexual and parthenogenetic (a) & (b) and between heavy and light (c) females.

The body mass in female *C. hookeri* increases during their adulthood, and newly moulted adult females are lighter than older ones. Thus, male preference for lighter females is likely to be associated with a male preference towards younger females that are more likely to be virgins.

More research is required to elucidate whether parthenogenetic females are still capable of sexual reproduction, and to establish the advantages of maintaining sexual traits in parthenogenetic populations, which can be associated to the possibility of increasing genetic variability under strong selective pressures or reducing the impact of deleterious mutations (Agrawal, 2001).

Acknowledgments

I would like to thank the Orthopterist's Society for their financial support. To be granted as a recipient has motivated me to do more in-depth analyses and pushed me towards the goal. I am also grateful to my supervisors, Prof. Mary Morgan-Richards and Dr. Andrea Clavijo-McCormick, for giving me guidance, supports, and constructive criticism. Lastly, thank you to my family, friends, and fellow colleagues, who were really supportive in both field and laboratory works.

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Temporal and spatial evolution of the *Poecilimon jonicus*-group in southern Greece

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The Mediterranean region is characterized by complex land-sea configuration and active tectonics as a result of the post-Oligocene collision of the African and Arabian plates with Eurasia (Mantovani et al. 2006). These, together with dynamic climatic processes during glacial-interglacial cycles, result in high levels of endemism and biodiversity of terrestrial animals in the region. The genus *Poecilimon* Fischer, 1853 is among the most evolutionary successful genera of bush-crickets and is the largest tettigoniid genus in the Palearctic. Microptery, which is characteristic for all species in the genus, limits dispersal ability and increases isolation, thus speeding up evolutionary processes (Vogler & Timmermans 2012).

Closely related species of the genus *Poecilimon* are traditionally assigned into species groups with common characteristics (Heller et al, 2006, Chobanov & Heller, 2010). The studied species group, *Poecilimon jonicus,* consists of four species (Cigliano et al. 2019) (Fig. 1). One of them, *P. jonicus* (Fieber, 1853), is divided into four subspecies and has the widest range, covering Albania, Macedonia, western Greece with some Ionian islands, and reaching the Peloponnese peninsula. One of its subspecies, *P. jonicus superbus* (Fischer, 1853), is isolated in Italy and is probably a distinct species. In the Peloponnese peninsula *P. jonicus tessellatus* (Fischer, 1853) occurs sympatrically with other species from the group: *P. laevissi-*

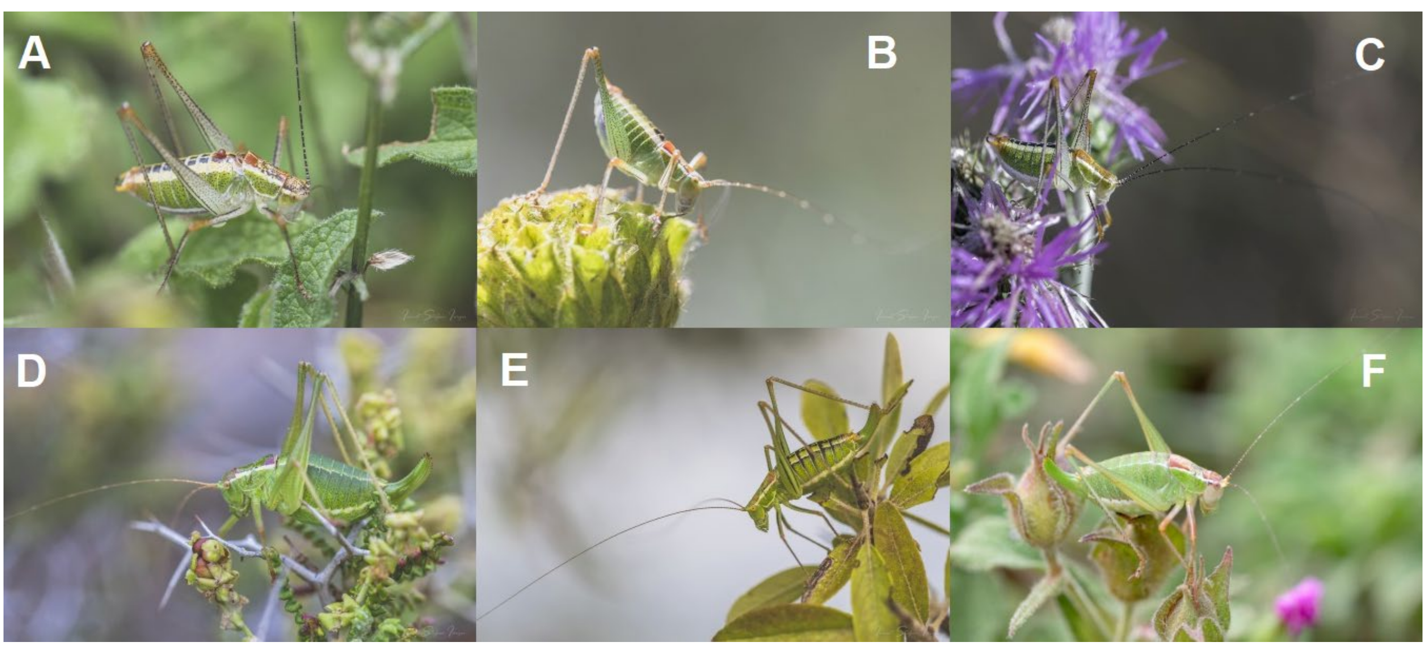

Figure 1. Photos of the study species. A - *Poecilimon erimanthos*; B - *Poecilimon laevissimus*; C - *Poecilimon jonicus lobulatus*; D - *Poecilimon jonicus tessellatus*; E - *Poecilimon werneri*; F - *Poecilimon cretensis*.

mus (Fischer, 1853) and *P. erimanthos* Willemse & Heller, 1992, the latter being endemic to Mount Erymanthos. *Poecilimon werneri* Ramme, 1933 is found along the seashore on the mainland and on Peloponnese. There is only one *Poecilimon* species occurring on the island of Crete. *Poecilimon cretensis* Werner, 1903 is widespread on the island and was recently arranged into the *P. inflatus* group (Kaya et al 2018) which is distributed in south Anatolia.

Our study aimed to collect more data and clarify some taxonomic problems in the studied group and to infer phylogenetic relations. In addition, we applied different methods to compare ecological requirements of closely related species in the studied group. Material was collected during two field trips. In May, 2017 we collected samples of all the species of the *P. jonicus* group in northwestern Greece and Peloponnese. Poecilimon jonicus superbus from Italy was not considered in the current study. Despite intense research we found only two females of *P. werneri* in one single locality on the Ionian seashore near Paliovarka vill. In May, 2018 we visited the island of Crete and collected *P. cretensis* from different localities and habitats for comparison (Fig. 2). Additional material, including *P. jonicus jonicus* from Macedonia and Albania, as well as outgroups for the analyses, was provided by Dragan Chobanov.

For the genetic analysis we amplified mitochondrially encoded NADH dehydrogenase 2 (ND2) which shows high phylogenetic performance for insects (Cheng 2018). For the PCR reactions, primers TM-J210 and TW-N1284 (Simon et al. 1994) were used. We compiled a matrix of 40 DNA sequences, 970 bp each. In order to obtain the phylogeny we applied Bayesian inference analysis using MrBayes (Huelsenbeck and Ronquist, 2001). According to this analysis, the best supported tree placed all species in the *P. jonicus* group on a separate branch, but surprisingly close to the Anatolian *P. inflatus sensu sticto*. (Fig. 3). The phylogeny of *P. cretensis* remains unclear as it probably diverged early and shows significant genetic differences to both analyzed groups. It may represent a remnant of an ancestral lineage for the group originated at the southern border of the Aegeid plate and sister to some taxa occurring in SW Anatolia (*P. antaliaensis, P. isopterus*). The genetic analysis also shows that *P. jonicus tessellatus* is significantly different from the other subspecies and is probably a distinct species closer to *P. laevissimus*. All Greek representatives form the top of the tree and thus their origin seems to be later.

For ecological niche modelling we applied MaxEnt (Phillips et al. 2017) using bioclimatic variables available at wordclim.org (Hijmans et al. 2008) as a background and 120 localities (literature and new data). Maps of estimated bioclimatic suitability are shown in Figure 4. Niche overlaps based on D (Schoener 1968) and I (Warren et al. 2008) parameters were measured using ENMTools (Warren et al. 2010). Identity tests (Warren et al. 2008) performed with 100 pseudoreplicates for *P. jonicus jonicus* and *P. jonicus tessellatus* based on their climatic niche models support significant differences between the climatic requirements of these subspecies (Fig. 5).

Preliminary results of the study support a common origin of fauna in the Aegean region along its southern arc. These results will be used for further analyses on the lineage divergence times and estimations on their origin and dispersal within the Aegeid land, and after its fragmentation due to land submergence and formation of the Aegean Sea.

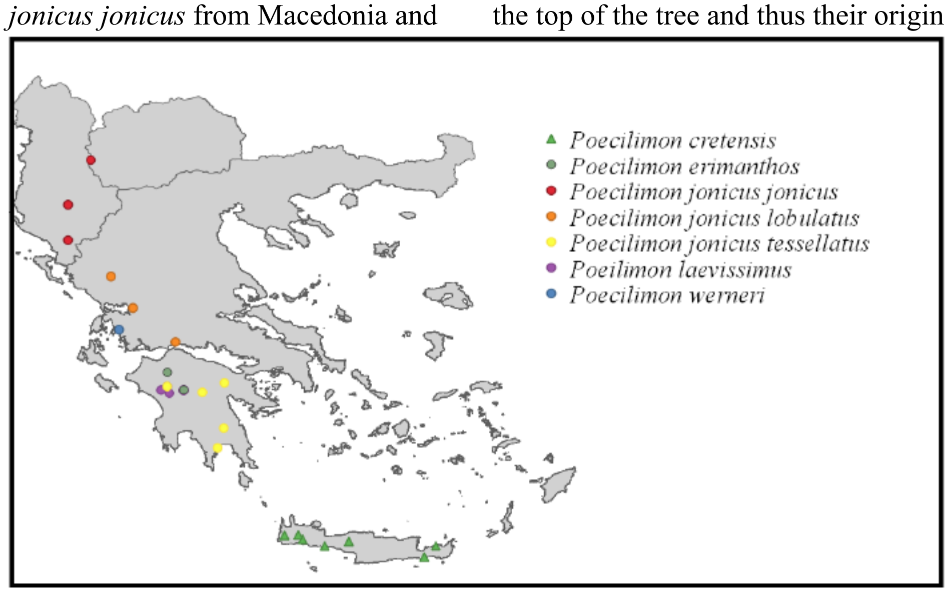

Figure 2. Map showing records from this study for *Poecilimon jonicus* group

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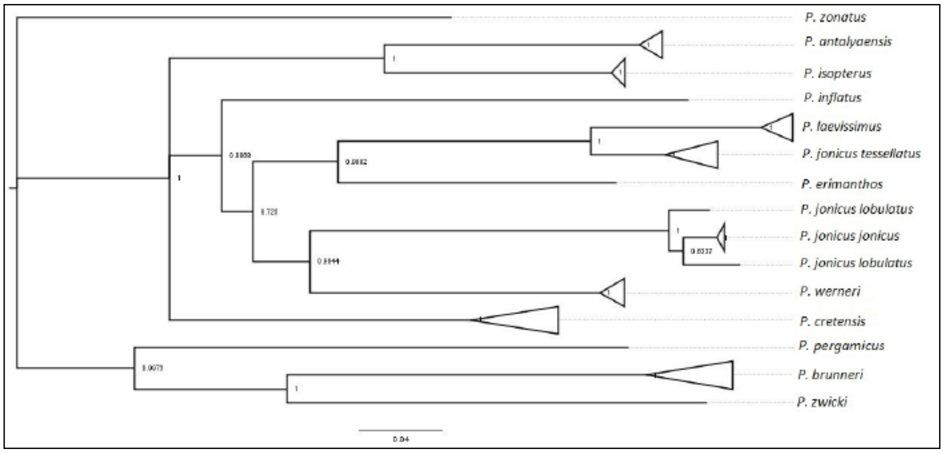

Figure 3. Phylogeny of the *Poecilimon jonicus* group and related species based on Bayesian Inference from 940 bp of the ND2 gene.

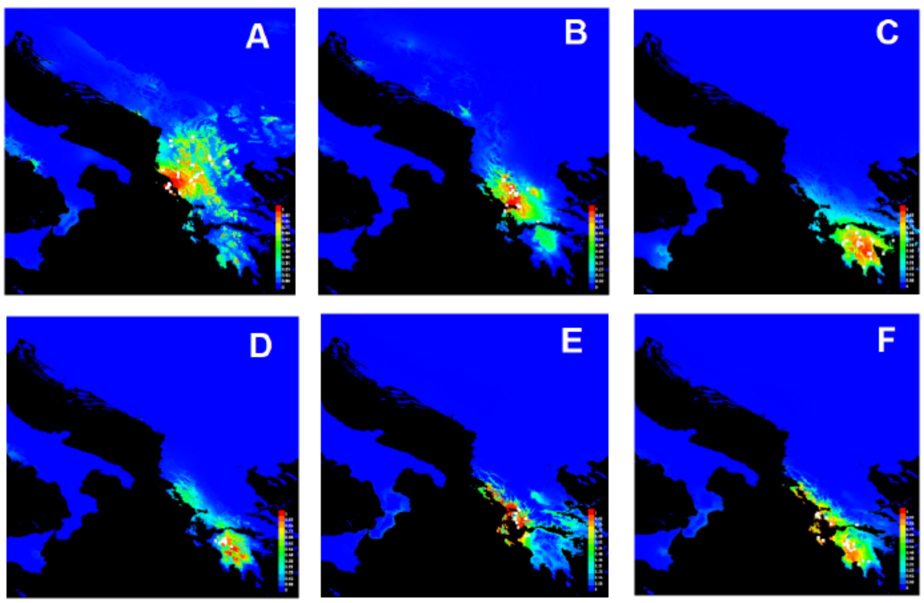

Figure 4. Ecological niche models with MaxEnt. A - *Poecilimon jonicus jonicus*; B - *Poecilimon jonicus lobulatus*; C - *Poecilimon jonicus tessellatus*; D - *Poecilimon erimanthos*; E - *Poecilimon werneri*; F - *Poecilimon laevissimus*

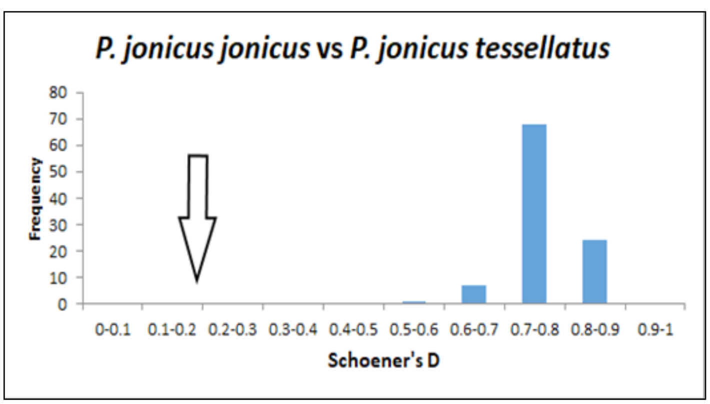

Figure 5. Identity tests based on the same data used for the maximum entropy models (Warren et al. 2008). Number of pseudoreplicates is 100. Arrow shows the Schoener's D values for the model with real data.

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Investigating a photoactivated metabolite in the nocturnal grasshopper *Schistocerca ceratiola*

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The rosemary grasshopper, *Schistocerca ceratiola* Hubbell and Walker (Figure 1 a, b), is endemic to central Florida and has a unique relationship with its endemic host plant, Florida rosemary, *Ceratiola ericoides* (Figure 1 c). The rosemary grasshopper is peculiar in that it exhibits strict monophagy on Florida rosemary, an exceptionally rare trait among grasshoppers. In fact, it is one of only two known strictly monophagous grasshopper species in North America, the other being *Bootettix argentatus* Bruner associated with creosote bush, *Larrea tridentata* (Otte and Joern 1976). Additionally, the rosemary grasshopper is nocturnal, easily encountered at the tips of branches feeding on fresh leaves throughout the early night hours but seldom spotted during the day, another uncommon trait among grasshoppers (Hubbell and Walker 1928).

In permitting conditions, hundreds of individual *Ceratiola* bushes will conspicuously dominate an area, usually near one of Florida's numerous ponds and lakes (Hubbell and Walker 1928). The striking feature of these areas is the lack of competitive growth from neighboring vegetation, which is due to allelopathic chemicals in the soil that are leached from the leaves of *C. ericoides* by rainwater (Fischer et al. 1994). The allelopathic activity of *C. ericoides* is unique in the way the primary metabolite, ceratiolin, is photoactivated (Fischer et al. 1994). I was awarded the Theodore J. Cohn Research Grant to travel to central Florida and investigate a possible connection between the photoactivated secondary metabolites of *C. ericoides* and the nocturnal behavior of *S. ceratiola*.

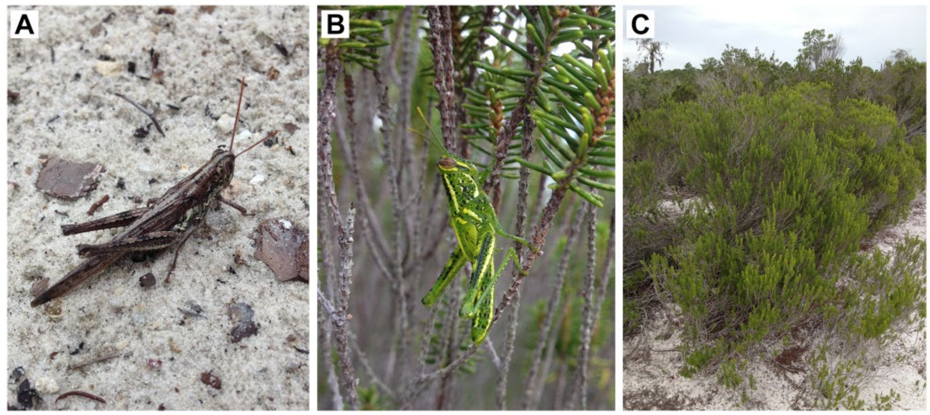

Figure 1. (a) *Schistocerca ceratiola* adult showing its brown cryptic coloration. (b) *S. ceratiola* nymphs showing its green cryptic coloration. (c) A typical Florida rosemary bald

I tested the hypothesis that ceratiolin, the photoactivated plant metabolite, might not be restricted to the gut of the grasshopper and therefore might be present in the hemocoel of the grasshopper. Not all the breakdown products of ceratiolin have been identified and are potentially noxious compounds. I hypothesize that the breakdown of ceratiolin in the hemocoel of the grasshopper may produce a selection pressure for the insects to avoid feeding during the day. I collected regurgitant, hemolymph, and frass from adult grasshoppers and performed qualitative analysis by liquid chromatography- mass spectrometry (LC-MS/MS). Additionally, I tested samples for the presence of a breakdown product, hydrocinnamic acid (HCA), to determine if ceratiolin degrades once inside the grasshopper.

Materials and Methods

I collected 10 adult grasshoppers on the night of August 20, 2017 in a rosemary bald located in Altoona, FL (29°07'33.2"N 81°34'37.2"W). I kept specimens in a cage with a 10-hour light/14-hour dark cycle at a constant 25°C with fresh rosemary branches. I collected frass, regurgitant, and hemolymph in that order from these 10 individuals on three consecutive days. I collected frass by placing individuals in clean 50 mL Eppendorf tubes for 8 hours of daytime. I collected regurgitant by grasping insects between the thumb and index finger, with the forelegs held dorsally to prevent interference, and pipetted directly from the mouth. I collected 5 µL of regurgitant from each grasshopper. I collected 5 µL of hemolymph from each insect by direct pipetting through a small incision proximal to the coxa of a hind leg on the insect being sampled. Hemolymph was collected on the final day of sampling because the hemolymph sampling process is the most damaging to the insects, compared to the frass and regurgitant sampling methods. Ceratiolin was isolated from the plant source for use as a standard and HCA was purchased from Sigma-Aldrich.

Metabolites were qualified by LC-MS/MS. 5 µl of extractions were injected into an Ascentis Express C-18 Column (3 cm × 2.1 mm, 2.7 µm) connected to a Sciex API3200 LC-MS/MS in (-) ESI mode. To determine if the biological samples

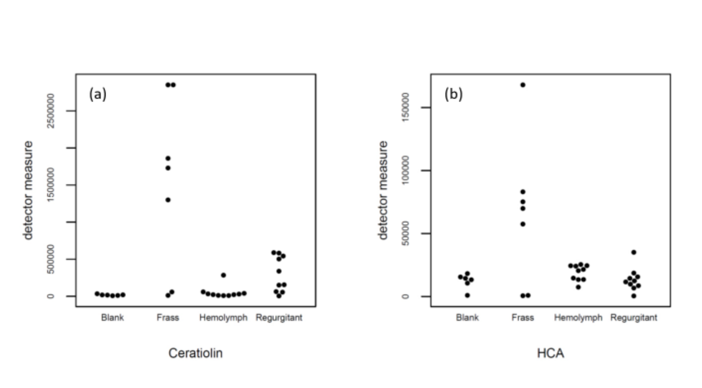

Figure 2. Integrated peak areas (in counts per second) from liquid chromatography-tandem mass spectrometry of blanks, frass, hemolymph, and regurgitant samples. (a) detection of ceratiolin (b) detection of hydrocinnamic acid (HCA).

contained ceratiolin or HCA, I used a non-parametric approach to compare the mean detector response for the frass (n=7), regurgitant (n=10), and hemolymph (n=10) samples to the mean detector response for blanks (n=6). I used the integrated area under the extracted ion transition curve from each sample as the data points for our tests. I used a Kruskal-Wallis test followed by Dunn's post-hoc using Holms' correction for multiple comparisons. All statistical analyses were completed in R.

Results and Discussion

This study investigated a possible connection between ceratiolin, a photoactivated plant compound, and the nocturnal behavior of the monophagous grasshopper that consumes ceratiolin with every meal. I detected ceratiolin in the frass (P = 0.007) and regurgitant (P = 0.038), but not in the hemolymph (Figure 2 a). I did not get a significant result for the presence of HCA in the frass, regurgitant, or hemolymph. Multiple frass samples produced relatively strong signals of HCA presence (Figure 2 b). I can infer from the abundance of ceratiolin in the frass samples that HCA should be present, because ceratiolin is known to readily decompose, so perhaps with further replication the presence of HCA in the frass could be confirmed. My results do not support the hypothesis that the grasshopper may experience potentially noxious effects of ceratiolin breakdown in the hemocoel, but I continue to be intrigued by the coincidence of photoactivated ceratiolin and nocturnal specialized herbivores. This research has been recently published and the full manuscript can be found in the Annals of the Entomological Society of America, 112(1), 2019, pp. 50-55 (https://doi.org/10.1093/aesa/say048).

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Advanced maternal age leads to greater offspring immune function and fitness

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There are two main schools of thought about how maternal age can affect offspring. The first is aging theory, which predicts that mothers of an advanced age produce offspring that are less fit than offspring produced by young mothers (McCay et al. 1935; Harman 1956; Buzzi et al. 2003). These studies have focused on humans, where we see children with a higher risk of disease and mortality when born from old mothers, but similar trends are also found in many other organisms including flies, mice, guinea pigs, beetles, and birds (Yip et al. 2006; Durkin et al. 2008; Johnson et al. 2009; Parsons 1962; Qazi 2017; Fox et al. 1993; Kern et al. 2001; Hercus and Hoffmann 2000; Yanagi & Miyatake 2002; Heidinger et al. 2016). The opposing school of thought is a component of life history theory, which predicts an increase in reproductive investment by old females in an attempt to increase their own fitness before they die (Trivers 1974; Partridge & Harvey 1988; Stearns 1989). This hypothesis suggests that the offspring of old mothers should be at least equally as fit as the offspring from young mothers, if not more so. Previous work in fish, mammals, and invertebrates have found support for this theory, including our own preliminary data which suggested a similar pattern (Descamps et al. 2008; Hansen et al. 2014; Clark et al. 2017; Tinghitella unpublished).

Upon comparing these two theories and the approaches taken by aging


Figure 1. Hatchlings of *Teleogryllus oceanicus*.


Figure 2. Adult female *Teleogryllus oceanicus*.


Figure 3. Adult *Teleogryllus oceanicus* with hemolymph for immune testing.

researchers, we found that there was a discrepancy between the fitness measures that researchers were recording. Some researchers focused on the general quantity of offspring whereas others focused on offspring quality. Furthermore, an aspect of offspring quality that has been frequently overlooked is offspring immune response. Finally, we also found that insects were vastly underrepresented in transgenerational immunosenescence research. We therefore designed an experiment that would allow us to compare the offspring from old and young mothers, using the Pacific field cricket, *Teleogryllus oceanicus*, as a model insect system. This project allowed us to develop a more complete understanding of parental age effects on offspring fitness and immune function.

Methods

To test the effects of maternal age on offspring fitness and immune function, we established 10 maternal lines of the Pacific field cricket, *T. oceanicus*. We mated them and reared their offspring as the F1 generation. We categorized the F1 females into three groups: a subset to be mated at a young age, a subset to be mated at an old age, and a subset to undergo immune testing (described in detail below). All the male offspring underwent immune testing. For the females that were mated, we collected traditional fitness measures (number of eggs laid, egg mass, hatching success, development time of their offspring, the number of offspring that survived to adulthood, and the sex ratio of the adult offspring). We then performed the same immune testing on the adult offspring produced by the mated F1 generation females as we did on the non-mating females and males of the F1 generation.

We performed two immunocompetency tests: hemocyte abundance and encapsulation response. Hemocytes are the insect equivalent of white blood cells, specialized in aiding in coating foreign objects (e.g., parasitoid eggs/larvae) that have entered the body of an insect in an attempt to asphyxiate the intruder (Smilanich 2009; Beckage 2008). Therefore, the more hemocytes in the hemolymph, the stronger the immune response (Graham 2011). During this process of encapsulating the foreign body with hemocytes, those cells will die and become dark in color (referred to as melanization; Zuk & Stoehr 2002; Strand 2002; Smilanich 2009). We can quantify the amount of melanization as a proxy for how strong an immune response the insect launches. Our two tests measure the strength of the individual's immunological response by counting the number of hemocytes in a sample of hemolymph and the extent of melanization to a synthetic parasitoid attack.

Results and Discussion

Our preliminary results support both aging theory and life history theory. So far, old moms laid smaller eggs and fewer of them hatched, as predicted by aging theory, but in accordance with life history theory the number of offspring that survived to eclosion did not differ between offspring of old and young mothers. We are still analyzing the immune response data from the F2 generation, but we predict that those results may tip the balance in support of one of the two underlying theories, allowing us to make broader conclusions about the effects of advanced maternal on offspring. These are exciting results for the insect aging field. Our results highlight the need for researchers to collect data using measures of both quantity and quality of offspring, including immunocompetency. We humbly thank the Orthopterists' Society for the funding provided by the Theodore J. Cohn Research Fund that allowed us to carry out this experiment and report these unexpected and exciting results.

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Orthoptera Species File Grant Reports

A step towards advancing biodiversity informatics of Orthoptera from the Philippines

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The biodiversity of Southeast Asia is among the highest around the world, and this is also true for Orthoptera (Myers et al., 2000). Although an estimate of more than 4,000 described species can be found in Southeast Asia (Tan et al., 2017; Cigliano et al., 2018), we still have knowledge gaps on the diversity of many groups of orthopterans and unexplored places in Southeast Asia. Taxonomy of many groups still require revisions and given that new species discovery is still soaring over the past decade (Tan et al., 2017), many species are still awaiting discovery. In addition to the research on taxonomy and species discovery exercises, there is a need to make biodiversity information available to a wider audience. This biodiversity information can be crucial for facilitating scientific research, science-driven decision-makings, education, and raising public awareness. For orthopterans, the Orthoptera Species File (OSF) (Cigliano et al., 2018) functions as a global database to store biodiversity information. While the OSF is currently the most comprehensive database for orthopteran bioinformatics, there are still many species that are lacking in data (e.g., images, particularly of live specimens). These include species from the lesser-known parts of the Philippines.

Described as the "Galapagos islands times ten," the Philippines is home to numerous endemic plants and animals (Heaney & Regalado, 1998). Despite its rich biodiversity, there is still a dearth of biodiversity information from the country. As an attempt to advance the biodiversity informatics of orthopterans from the Philippines, we conducted fieldwork in 2018 at two sites in the Philippines, specifically at Siargao Island (Surigao del Norte) and Mount Makiling (Luzon). We also examined the orthopteran collection at the University of the Philippines Los Baños Museum of Natural History (UPLBMNH). The objectives of this project are to: (1) discover and describe Philippine species new to science, (2) contribute new material for taxonomic revisions, and (3) deposit images of both live specimens from the field and old specimens in the natural history museums to the OSF online version to make biodiversity informatics available freely to the public domain.

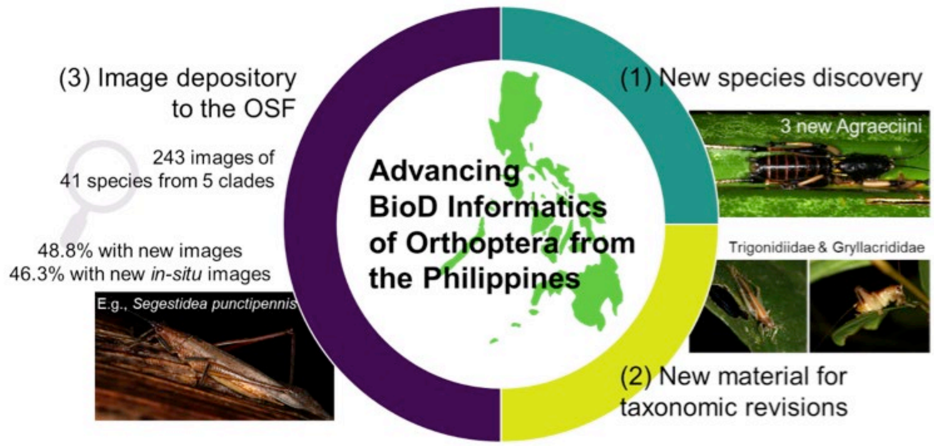

Figure 1. Summary of the objectives and results/findings of the project as of October 31, 2018.

Methods

Survey and collection were conducted at two sites, from April 7-9, 2018, in the over-limestone forest and coastal areas (including the mangrove forests) of Siargao Island; from April 9 to 12, 2018, in the lowland secondary forest of Mount Makiling. The entomological collection at the UPLBMNH was also visited during the latter date. To improve knowledge and raise awareness on orthopterans, MKT presented in the UPLB Biodiversity Seminar on "Improving Bioinformatics on Biodiversity in Southeast Asia" (YouTube video). From the UPLB collection and the literature, the orthopteran diversity on Siargao Island is relatively unknown compared to Mount Makiling. As such, we intensified our surveys at Siargao Island from October 14 to 18, 2018. Surveys and collection were conducted mostly at night, but also in the morning. Male genitalia were dissected from softened specimens,

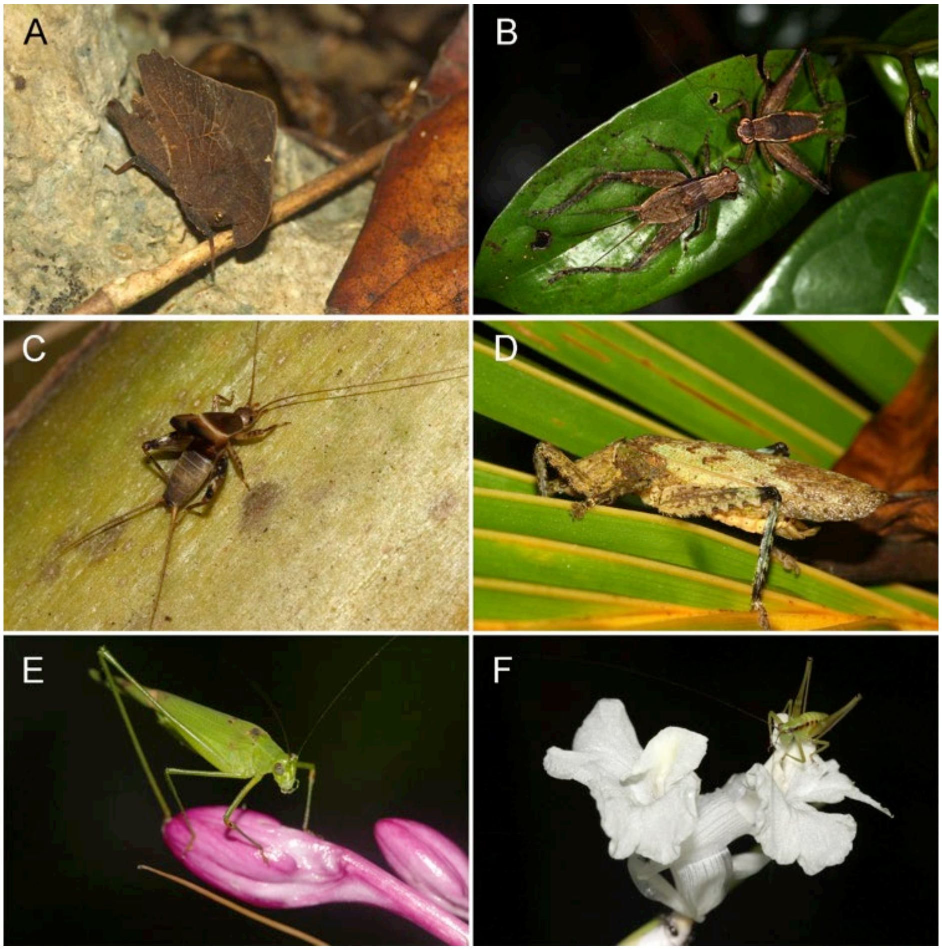

Figure 2. Some noteworthy orthopterans and their natural history: (A) One of the first in-situ images of *Hymenotes triangularis* Westwood, 1837; (B) a male and female *Lebinthus* in communication; (C) a potentially new species of *Orenbius* calling on the trunk of a banana plant; (D) a male *Sathrophyllia* which is typically hard to encounter for many species of Cymatomerini; (E) a male *Phaneroptera (Phaneroptera) neglecta* (Karny, 1926) endemic to Siargao Island feeding on a flower; (F) one of the many Phaneropterinae nymphs (often unidentifiable) visiting and feeding on flowers.

and then cleaned using aqueous KOH and subsequently preserved in glycerine. The specimens were preserved in absolute analytical-grade ethanol and later pinned and dry-preserved. A single hind leg from each specimen was also preserved in absolute analytic-grade ethanol for future molecular work. We took images in the field and in the museum collections. Habitus images were done with a Canon EOS 500D digital SLR camera with a compact-macro lens EF 100mm 1:2.8 USM. Close-up images of morphological features (including male genitalia) were done using a macro photo lens MP-E 65mm 1:2.8 USM (1–5×). Canon Macro Ring Lite MR-14EX was used for lighting and flash. Images (provided with scale bars) was edited using Adobe Photoshop CC 2014. The new material from the surveys were deposited in the UPLBMNH, the Zoological Reference Collection, Lee Kong Chian Natural History Museum (Singapore), and Muséum national d'Histoire naturelle (Paris, France).

Results and Discussion

From the April trip, we collected 78 specimens from Siargao Island (39 specimens) and Mount Makiling (39 specimens) and examined (including identifying) 60 specimens from the orthopteran collection in the UPLB MHN. From the October trip, we collected 45 specimens from Siargao Island. In total (as of October 31, 2018), we have added 243 images of 41 identified species to the OSF online version (5.0/5.0), which represent five clades from the orthopteran phylogeny (sensu Song et al., 2015). Specifically, orthopterans from Acridoidea, Grylloidea, Stenopelmatoidea, Tetrigoidea, and Tettigonioidea were represented. We added 114 images of 16 species (39.0% of all species deposited) which do not have any image prior to our submission. We also added 45 in-situ images of 20 species (48.8% of all species deposited), of which 19 species (46.3% of all species deposited) did not have any in-situ images prior to our submission (Fig. 1). These in-situ images of live specimens supplement the images of museum specimens already in OSF, in which the latter might have been discolored during the preservation process.

The figures above are likely to be non-exhaustive. There are also a few potential new species from our collection. We will upload the images of these undescribed species once the names have been published. We can also expect images of more species to be added when we have more materials from the Philippines and neighboring region to better identify our current materials.

Based on the material collected and examined, three new species of Agraeciini from the Philippines were already described and published (see Tan et al., 2018). We named one species of *Anthracites* Redtenbacher, 1891 after the fictional superhero character Batman in the Dark Knight Trilogy directed by Christopher Nolan: *Anthracites furvuseques* Tan, Baroga-Barbecho & Yap, 2018 (in Latin; dark = furvus, knight = eques) (Fig. 1) from the Siargao Island. Some noteworthy findings are also highlighted in Fig. 2 and these include discovering the first female for *Eumecopoda reducta* Hebard, 1922 and new locality records for Siargao Island for *Lamellitettigodes contractus* (Bolívar, 1887). There were also interesting natural history observations, including numerous encounters of orthopterans visiting flowers in

Siargao Island and Mount Makiling (Fig. 2). These noteworthy finds will be elaborated in upcoming publications.

The project was not without challenges. Both the new material and old museum collection contain species which are currently extremely difficult to identify confidently without a more comprehensive taxonomic revision. Species include many Gryllacrididae and Trigonidiidae crickets (Fig. 1). Nonetheless, the material will come in useful for future collaborative work with the help of the experts from around the world. We also planned to examine the collection at the Philippine National Museum of Natural History (PNMNH). However, owing to the construction of a new building and the movement of the collection from the old building at the time of our visit in April, we were not able to examine the specimens there and this had to be rescheduled.

Therefore, the project is still very much work in progress. Our collaborators are working with us on at least three other manuscripts on the taxonomy/ new species discovery and the first checklist on the diversity of orthopterans from Siargao Island. Beyond the timeframe of the OSF grant, we also aim to extend our fieldwork to areas beyond Mount Makiling and Siargao Island. The collection at NMP will also be examined. These aim to improve our understanding of the orthopterans from Philippines and making more bioinformatic data available in OSF public domain. Lastly, to also address the lack of acoustic data (especially for ultrasonic calls) for many species, we hope to focus more on recording their calling songs in the future surveys.

Acknowledgements
We thank the Orthopterists' Society for funding this project. We are thankful to Huiqing Yeo for field assistance and for the help in the sorting and examination of specimens. We thank Tony Robillard, Andrej Gorochov, Sigfrid Ingrisch, Oscar Javier Cadena-Castañeda, Josef Tumbrinck, and Josip Skejo for help in species identification and providing resources for identification. We are also grateful to the UPLBMNH for allowing us access their orthopteroid collections, especially for the assistance of Orlando L. Eusebio and Cristian C. Lucañas; as well as Normandy M. Barbecho (PNMNH) for accommodating our request to examine the orthopteroid specimens from their collections in the near future. The authors would also like to thank Siargao Islands Wildlife Conservation Foundation, Inc., Mr. Jose Macavinta, Ms. Deny Comon, MODECERA project, Mayor Alfredo Coro, Jr., and the municipality of Del Carmen for the accommodation and allowing us to conduct research on their area.

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Orthoptera, Mantodea and Phasmida of the Serbia and Montenegro

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With the help of an Orthoptera Species File (OSF) grant, we have collected new data on the Orthoptera of Serbia and Montenegro. In two years we have gathered a large amount of data for both countries, such as new species for Montenegrin fauna, like *Oecanthus dulcisonans* Gorochov, 1993 (Fig. 1) and many others for which there are only a small number of reports. All data collected during these field trips in Montenegro will be published in a paper that is in preparation. For Serbia we have several new distributional records, which will be presented in an upcoming short article, but we can still expect that future research will provide more interesting results. Besides Serbia and Montenegro, photos and sounds of several species from FYR Macedonia were uploaded. List of all uploaded photos and sounds are presented in Table 1.

Besides Orthoptera in 2017, as part of the project "Distribution, faunistics and stridulation of Orthoptera, Mantodea and Phasmida of the Serbia and Montenegro", we succeeded in finding several specimens of Mantodea and Phasmatodea. The aim of the

Species	M	F	S
Phaneroptera falcata (Poda, 1761)	+		
Tylopsis lilifolia (Fabricius, 1793)	+		
Acrometopa macropoda (Burmeister, 1838)	+	+	
Isophya costata Brunner von Wattenwyl, 1878	+	+	+
Barbitistes yersini Brunner von Wattenwyl, 1878	+		
Barbitistes ocskayi Charpentier, 1850	+	+	
Andreiniimon nuptialis (Karny, 1918)	+	+	+
Leptophyes discoidalis (Frivaldsky, 1867)	+	+	
Leptophyes laticauda (Frivaldszky, 1868)	+	+	+
Poecilimon ornatus (Schmidt, 1850)	+	+	+
Poecilimon affinis komareki Cejchan, 1957	+	+	+
Poecilimon jonicus (Fieber, 1853)	+	+	+
Poecilimon brunneri (Frivaldszky, 1868)	+	+	+
Poecilimon macedonicus Ramme, 1926	+	+	+
Meconema meridionale Costa, 1860		+	
Conocephalus conocephalus (Linnaeus, 1767)		+	
Conocephalus fuscus (Fabricius, 1793)	+	+	+
Conocephalus ebneri Harz, 1966	+	+	+
Ruspolia nitidula (Scopoli, 1786)	+	+	
Tettigonia cantans (Fuessly, 1775)	+		
Tettigonia balcanica Chobanov & Lemonnier-Darcemont, 2014	+	+	+
Decticus albifrons (Fabricius, 1775)	+		
Platycleis grisea (Fabricius, 1781)	+	+	
Montana montana (Kollar, 1833)		+	
Montana stricta (Zeller, 1849)	+	+	+
Modestana modesta (Fieber, 1853)	+	+	+
Tessellana veyseli (Koçak, 1984)	+	+	+
Tessellana orina (Burr, 1899)	+		
Tessellana carinata (Berland & Chopard, 1922)	+		
Bucephaloptera bucephala (Brunner von Wattenwyl, 1882)		+	
Pholidoptera macedonica Ramme, 1928	+	+	
Pholidoptera dalmatica maritima Zeuner, 1931	+	+	
Pholidoptera femorata (Fieber, 1853)	+	+	
Psorodonotus fieberi (Frivaldszky, 1853)	+	+	
Yersinella raymondii (Yersin, 1860)		+	
Pachytrachis gracilis (Brunner von Wattenwyl, 1861)	+		
Pachytrachis striolatus (Fieber, 1853)	+	+	
Rhacocleis germanica (Herrich-Schäffer, 1840)	+	+	+
Gampsocleis glabra (Herbst, 1786)		+	
Saga natoliae Serville, 1838	+	+	
Saga campbelli Uvarov, 1921	+	+	+
Saga rammei Kaltenbach, 1965	+	+	
Ephippiger discoidalis Fieber, 1853	+	+	+
Ephippiger ephippiger (Fiebig, 1784)	+	+	+
Troglophilus cavicola (Kollar, 1833)	+	+	
Gryllus campestris Linnaeus, 1758	+	+	
Acheta domesticus (Linnaeus, 1758)			+
Modicogryllus (*Modicogryllus*) *truncatus* (Tarbinsky, 1940)	+	+	+
Modicogryllus (*Modicogryllus*) *frontalis* (Fieber, 1844)	+	+	+
Gryllomorpha dalmatina (Ocskay, 1832)	+	+	
Ovaliptila willemsei (Karaman, 1975)		+	
Pteronemobius heydenii (Fischer, 1853)	+	+	
Oecanthus dulcisonans Gorochov, 1993	+		+
Tetrix depressa Brisout de Barneville, 1848	+	+	
Melanoplus frigidus (Boheman, 1846)	+	+	
Galvagniella albanica (Mistshenko, 1952)		+	
Odontopodisma albanica Ramme, 1951	+	+	
Calliptamus barbarus (Costa, 1836)	+	+	
Paracaloptenus caloptenoides (Brunner von Wattenwyl, 1861)	+	+	
Tropidopola graeca Uvarov, 1926	+	+	
Acrida ungarica (Herbst, 1786)	+	+	
Locusta migratoria (Linnaeus, 1758)	+		
Oedipoda germanica (Latreille, 1804)	+	+	
Oedipoda miniata (Pallas, 1771)	+	+	
Acrotylus patruelis (Herrich-Schäffer, 1838)	+	+	
Aiolopus thalassinus (Fabricius, 1781)		+	
Mecostethus parapleurus (Hagenbach, 1822)	+		
Stethophyma grossum (Linnaeus, 1758)	+	+	
Chrysochraon dispar (Germar, 1834)	+	+	
Sphingonotus caerulans (Linnaeus, 1767)	+		
Ramburiella turcomana (Fischer von Waldheim, 1833)	+		
Dociostaurus maroccanus (Thunberg, 1815)	+	+	
Dociostaurus genei (Ocskay, 1832)	+	+	
Gomphocerus sibiricus (Linnaeus, 1767)	+		
Gomphocerippus rufus (Linnaeus, 1758)	+		
Myrmeleotettix antennatus (Fieber, 1853)	+		
Chorthippus apricarius (Linnaeus, 1758)	+	+	
Chorthippus dichrous (Eversmann, 1859)	+	+	+

Table 1. List of photos and songs uploaded on OSF. M – male; F – female; S – song.

project and this short article is to provide data which could be used for future studies in distribution and taxonomy of the members of those two orders. Knowledge about both orders in Montenegro is poor, with only some literature data. Concerning Mantodea fauna in Montenegro, Us, 1967 and Adamović, 1968 listed 3 genera and 3 species - *Mantis religiosa* (Linnaeus, 1758), *Empusa fasciata* Brulle, 1832 and *Ameles decolor* (Charpentier, 1825), while Agabiti et al. 2010 has reported *A. heldreichi* Brunner, 1882 from Bioče (coll. F. Willemse). Our investigations were focused on finding two later species because *M. religiosa* is considered to be a widespread species in this part of Europe. *E. fasciata* (Fig. 2a, 2b) was found in several localities around Ulcinj on different habitats – in Ulcinj and Ulcinj Salt Pond it was found in tall dry grass, while in Gornji Štoj we found it in a marsh with high vegetation. A female of *A. cf. decolor* was found in Gornji Štoj in the same habitat as *E. fasciata*. As our finding is based only on field observation of eye shape, whether or not this female specimen is actually *A. decolor* cannot be confirmed until we collect a larger number of specimens for comparison.

In Serbia, knowledge about the distribution of mantids is a little better, but still a lot of data is incomplete and old, while recent reports are rare. First

Figure 1. *Oecanthus dulcisonans* Gorochov, 1993, new species for the fauna of Montenegro. Photo by L. Horvat.

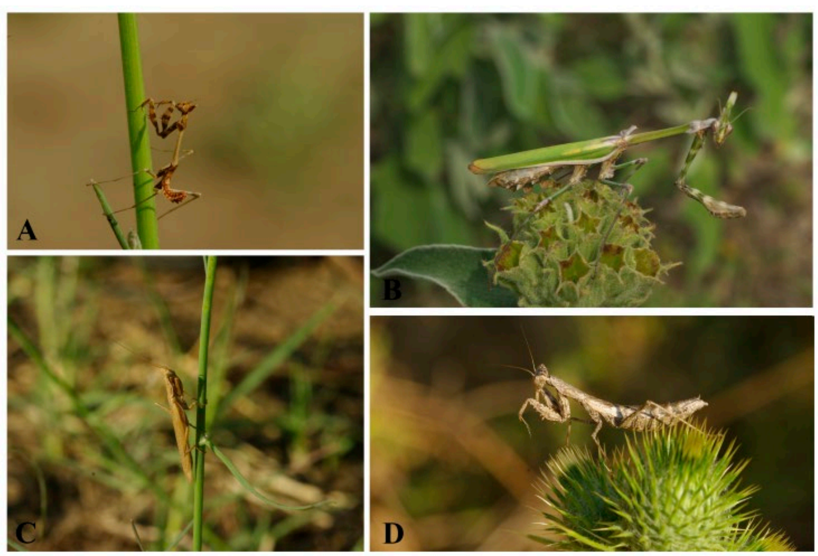

Figure 2. Some of the representatives of the Mantodea in Serbia and Montenegro. A - *Empusa fasciata* Brulle, 1832, nymph; B - *Empusa fasciata* Brulle, 1832, adult female; C - *Ameles heldreichi* Brunner, 1882, adult male; D - *Ameles heldreichi* Brunner, 1882, adult female. (A, C, D – photo by L. Horvat; A – photo by Slobodan Ivković.

records of mantid species for Serbia were given by Graber, 1870 where he listed the species *M. religiosa*. Later, Pančić, 1883 listed two species *M. religiosa* and *E. fasciata* to be present in Serbia. After this, only a few articles, mainly from Adamović, were published. The last contribution to Serbian mantis fauna was published by Pavićević et al. 2014, where a new species for fauna was reported: *A. heldreicihi* (Fig. 2c, 2d). In Table 2 we present the localities of *Empusa* and *Ameles* species in Serbia and Montenegro; we excluded data for *M. religiosa.*

The order Phasmatodea in Montenegro is present with only one species/subspecies – *Baccilus rossius redtenbacheri* Padewieth, 1899 (Fig. 3). It was first reported by Us, 1967 without an exact locality, but one year lately, Adamović found the species in surrounding Ulcinj. During our field trips we have managed to find *B. rossius redtenbacheri* in several localities (Table 3). Although it is not rare, a male specimen was observed for the first time (Fig. 4) in Montenegro. The male was found in Ulcinj on *Spartium junceum* bushes feeding on flowers of the same plant. Females were found on *Rubus* sp. bushes.

As our field trips in Montenegro were more focused on the southeastern part of the country, we are providing data only for this part, but it is expected that *B. rossius redtenbacheri* is widespread in the coastal part of Montenegro. Also, the presence of several mantis species – *A. spallanzania* (Rossi, 1792), *Iris oratoria* (Linnaeus, 1758) and a phasmid - *Bacillus atticus atticus* Brunner von Wattenwyl, 1882 is expected in Montenegro, as the published data indicates a wide distribution in coastal part of Adriatic Sea, but gaps in distributional data are present due to lack of studies for both insect group.

Table 2. List of Mantodea species recorded in Serbia and Montenegro with literature and new data. *S – Serbia; M - Montenegro

Species	Locality	Data source
Empusa fasciata Brulle, 1832	**S**, Rujevica near Aleksinac	Pančić, 1883
	S, Vinik near Niš	Pančić, 1883
	S, Hum near Niš	Pančić, 1883
	S, Prokuplje surrounding	Us, 1938
	S, Bela Palanka	Adamović, 1975
	S, Niš, Jelašnica gorge	Pavićević et al., 2014
	S, Miratovac, Suva Reka	Pavićević et al. 2014
	S, Kalafat Mt., Miljkovac village, Prinolac, Goli Vrh	Pavićević et al. 2014
	S, Temska N 43.261982°, E 22.549005°	Unpublished data – female collected by J. Husarik and D. Trnovac, 15 VII 2011
	M, Montenegro	Us,1967
	M, Ulcinj	Adamović, 1968
	Gornji Štoj N 41.872432°, E 19.332203°	Unpublished data, 12 VI 2017
	Ulcinj N 41.916814°, E 19.246656°	Unpublished data, 12 VI 2017
	Ulcinj Salt Pond N 41.919895°, E 19.255755°	Unpublished data, 12 VI 2017
Ameles heldreichi Brunner, 1882	**S**, Miratovac, Suva Reka	Pavićević et al., 2014
	M, Bioče	Agabiti et al., 2010
Ameles decolor (Charpentier, 1825)	**M**, Montenegro	Us, 1967
	M, Ulcinj	Adamović, 1968
	Gornji Štoj N 41.872432°, E 19.332203°	Unpublished data, 12 VI 2017

Table 3. List of localities in Montenegro where *Baccilus rossius redtenbacheri* Padewieth, 1899 was recorded.

Species	Locality	Data source
Baccilus rossius redtenbacheri Padewieth, 1899	**Montenegro**	Us, 1967
	Ulcinj, Štojska Peskovita Greda N 41.891827°, E 19.299031°	Adamović, 1968
	Gornji Štoj N 41.870268°, E 19.333996°	Unpublished data, 12 VI 2017
	Gornji Štoj N 41.871197°, E 19.339998°	Unpublished data, 12 VI 2017
	Ulcinj N 41.908276°, E 19.233855°	Unpublished data, 12 VI 2017
	Utjeha N 42.013026°, E 19.153405°	Unpublished data, 13 VI 2017
	Skadar Lake, Godinje N 42.225015°, 19.123438°	Unpublished data, 15 VI 2017

Acknowledgements

We are grateful to the Orthopterists´ Society for funding our research. Thanks also to Luc Willemse for providing us an exact locality for *Ameles heldreichi* in Montenegro and to Paul Brock for helpful information and papers about *Bacillus rossius redtenbacheri*.

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Figure 3. *Baccilus rossius redtenbacheri* Padewieth, 1899, female. Photo by Slobodan Ivković.

Figure 4. *Baccilus rossius redtenbacheri* Padewieth, 1899, male. Photo by Slobodan Ivković.

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Improving the digital content of the genus *Sphenarium* Charpentier, 1842 (Orthoptera; Pyrgomorphidae) in the Orthoptera Species File

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The genus *Sphenarium* comprises a group of colorful, medium sized, and fusiform grasshopper species, which are found across the Mexican Neotropics and northwestern Guatemala. These grasshoppers are fascinating in many ways. For instance, with its seventeen extant species, this genus is the most diverse among the American Pyrgomorphidae genera and recent studies have found that most of its species originated relatively recently, over the last 2.5 million years BP in Mexico (Sanabria-Urbán et al. 2017). More-

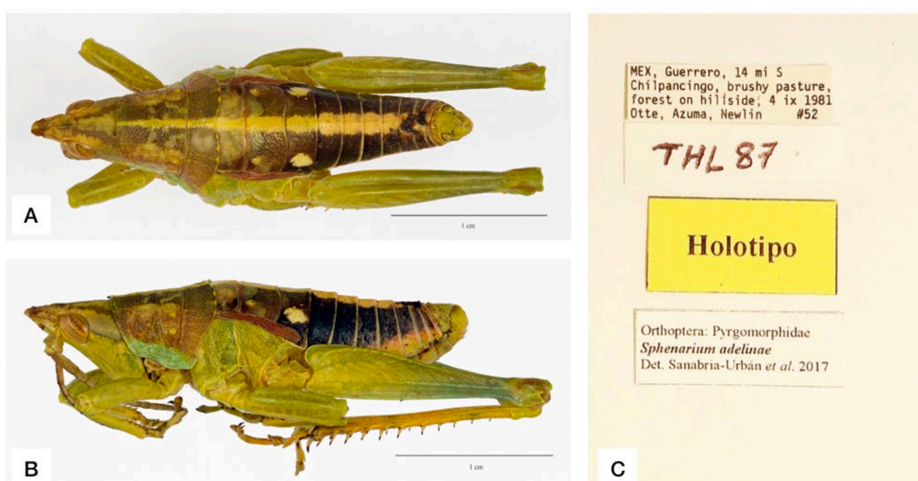

Figure 1. Example of images of type material of *S. adelinae* uploaded to OSF: a) holotype lateral view, b) holotype dorsal view, and c) holotype labels.

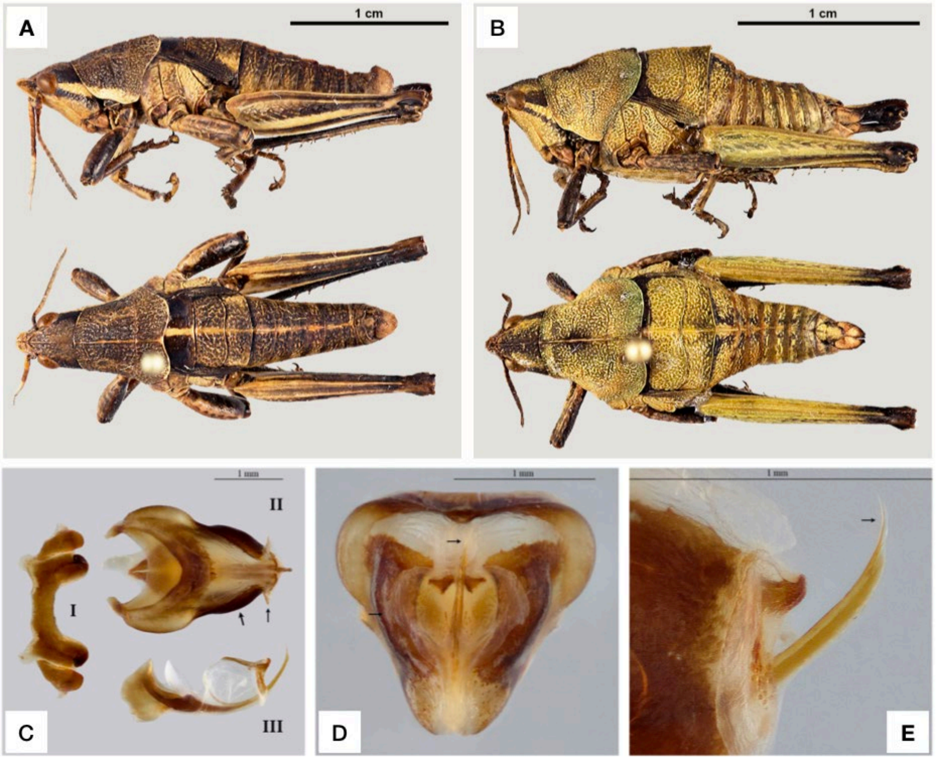

Figure 2. Example of images of pristine non-type specimens and diagnostic characters of *S. purpurascens* morphotype 1 uploaded to OSF: a) male external morphology, b) female external morphology, and c-e) male genitalia complex.

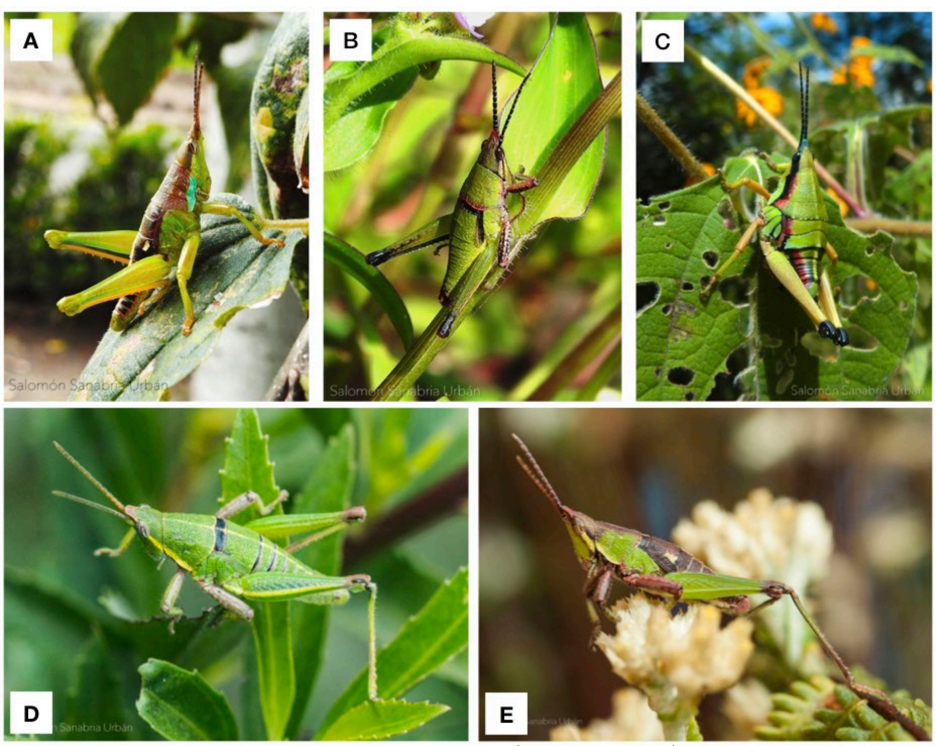

Figure 3. Photos of live specimens of a) *S. adelinae* (♂), b) *S. borrei* (♂), c) *S. histrio* (♀), d) *S. planum* (♂), and e) *S. tarascum* (♂).

over, these grasshoppers show a remarkable variation in color patterns, body size, and sexual traits across their distribution, both within and among species, making them a very interesting system for ecological and evolutionary studies (Sanabria-Urbán et al. 2015). Another important aspect of *Sphenarium* grasshoppers is that they are the only American Pyrgomorphidae known to outbreak. In fact, some species in the genus are regarded as serious crop pest across their distribution, but at the same time they are part of the traditional diet for Mexican people (Kevan 1977). This "hate and love" relationship between *Sphenarium* grasshoppers and Mexicans has a long history that dates back to pre-Hispanic times (Ramos-Elorduy & Moreno, 198).

Despite the biological, economic, and cultural importance of *Sphenarium* species only recently have we gotten a better understating about their diversity, systematics, and evolutionary history. These aspects have been part of my research interests and contributions over the last few years. However, the new findings on this genus were scarcely represented on the Orthoptera Species File (OSF) previous to this project. Therefore, I aimed to improve the digital content of *Sphenarium* on this database, which has become a primary international reference for orthoptera information. Specifically, my objective was to provide data that facilitates the identification of *Sphenarium* species on the OSF according with the last taxonomic revision in the group. This data included images of type specimens (Fig. 1), diagnostic characters (Fig. 2), and live specimens (Figs. 3-6), as well as georeferenced localities for each species in the genus.

Thanks to the funding provided by the OSF, I was able to obtain photos of live specimens of all *Sphenarium* species and different populations of each taxa by conducting expeditions to central and southern Mexico in the fall of 2017 (Fig. 7). Contrary to my original expectations the field work was not that easy. That year the climate was somewhat atypical as suggested by the local people and reflected in the population densities of some *Sphenarium* species in the visited regions. For instance, in western Mexico the rainy season was

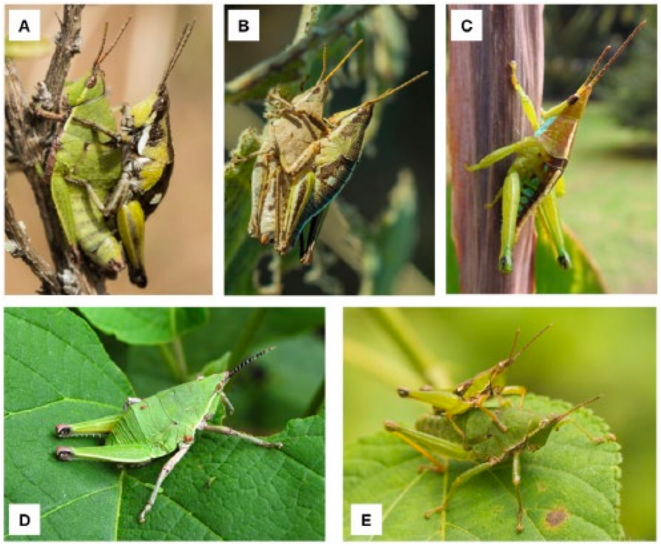

Figure 4. Photos of live specimens of a) *S. variabile* (♂,♀), b) *S. purpurascens* (♂,♀), c) *S. miztecum* (♂), d) *S. crypticum* (♀), and e) *S. zapotecum* (♂,♀).

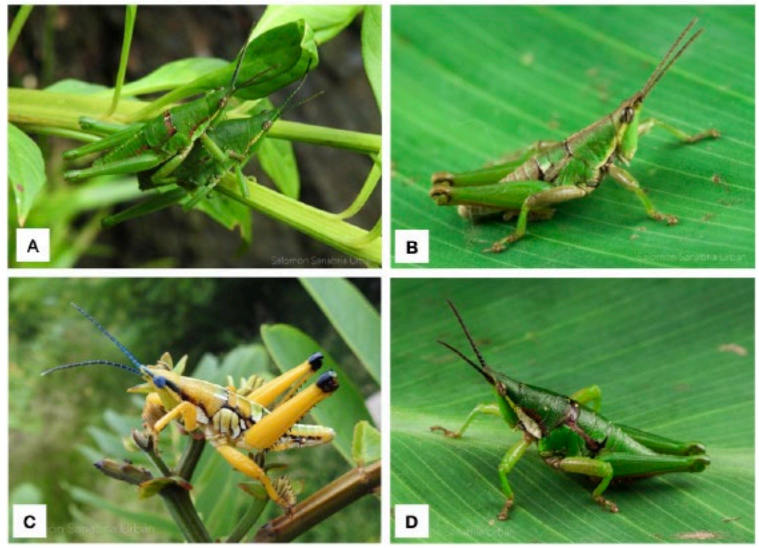

Figure 5. Photos of live specimens of a) *S. mexicanum* (♂,♀), b) *S. minimum* (♂), c) *S. occidentalis* (♂), and d) *S. totonacum* (♂).

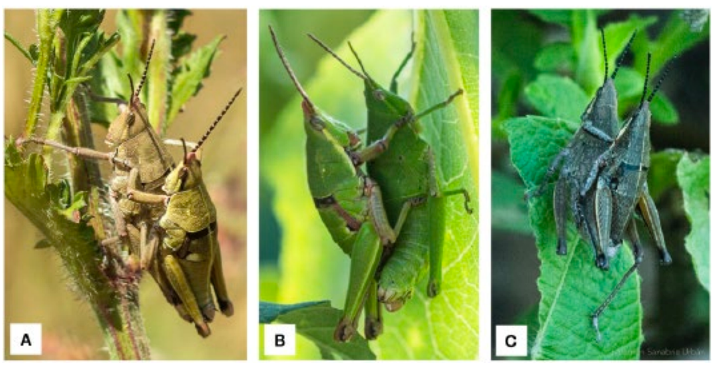

Figure 6. Photos of live specimens of a) *S. infernalis* (♂,♀), b) *S. rugosum* (♂,♀), and c) *S. macrophallicum* (♂,♀).

Figure 7. a) Field work in Oaxaca and b) expedition team.

shorter than in previous years and some species that were highly abundant when I first found them, such as *S. infernalis*, *S. macrophallicum*, and *S. occidentalis*, were very hard to find that year. In southern Mexico the rainy season was longer than in previous years and, although the *Sphenarium* species there showed their common high abundances, several landslides were found along the way, altering the field-work itineraries. Nevertheless, my colleagues and I were able to accomplish the goals of the expeditions. Moreover, we were able to visit some poorly explored areas in the Mexican states of Guerrero and Oaxaca, where we discovered new isolated populations of some *Sphenarium* species that are now under analysis. Similarly, during the expeditions we were able to obtain new and interesting records of other species of Mexican orthoptera.

Most of the obtained material as part of this project is now available on the OSF. Moreover, an illustrated and interactive key for *Sphenarium* species is under construction on this database. Finally, I would like to thank the Orthopterist's Society for funding this project, and the Society's Treasurer, Pamm Mihm, for all her help in the administrative matters. I thank also Víctor Ramírez Delgado, Miriam Illescas Aparicio, Ricardo Mariño Pérez, Martina Pocco, and Bert Foquet for their help during the expedition.

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Caelifera Type Collection at the California Academy of Sciences, San Francisco, USA

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The California Academy of Sciences (CAS) was established in San Francisco in 1862 and by 1900 it had approximately 50,000 specimens. After the earthquake of 1906, a fire destroyed almost all of it. Today, with 14 million specimens, it is the fourth largest collection in North America. Regarding Orthoptera, there is type material of 184 valid species, thanks to the efforts of Ernest R. Tinkham (1905-1987), D. Keith McE. Kevan (1920-1991), Marius Descamps (1924-1996), Kurt K. Günther (1930-1998), David Rentz, and David Weissman, among others.

Concerning Caelifera, there is type material of 89 valid species, which is mostly from North America (51) and South America (14), followed by Africa (12), and the rest from Temperate and Tropical Asia (12). There are types of two species of Tetrigidae, six species of Tridactylidae, six species of Ripipterygidae, six species of Eumastacoidea, and 59 species of Acrididae (Fig. 1). The 12 Melanoplinae and 13 Oedipodinae described by Rentz and Weissman from North America are remarkable.

Also important to mention is the type material of the 10 species of Pyrgomorphidae (Fig. 2). Kevan described all of them between 1962 and 1990. One species from each of these six countries: Madagascar, Republic of the Congo, Democratic Republic of the Congo, Zimbabwe, Thailand, Indonesia, and four species in the genus Ichthiacris from Mexico. This genus is found in Baja California Peninsula and for geographic reasons a lot of material from this peninsula is deposited at CAS. The last three species of Pyrgomorphidae that Kevan described in his prolific life are here and were, precisely, three species of *Ichthiacris* in 1990.

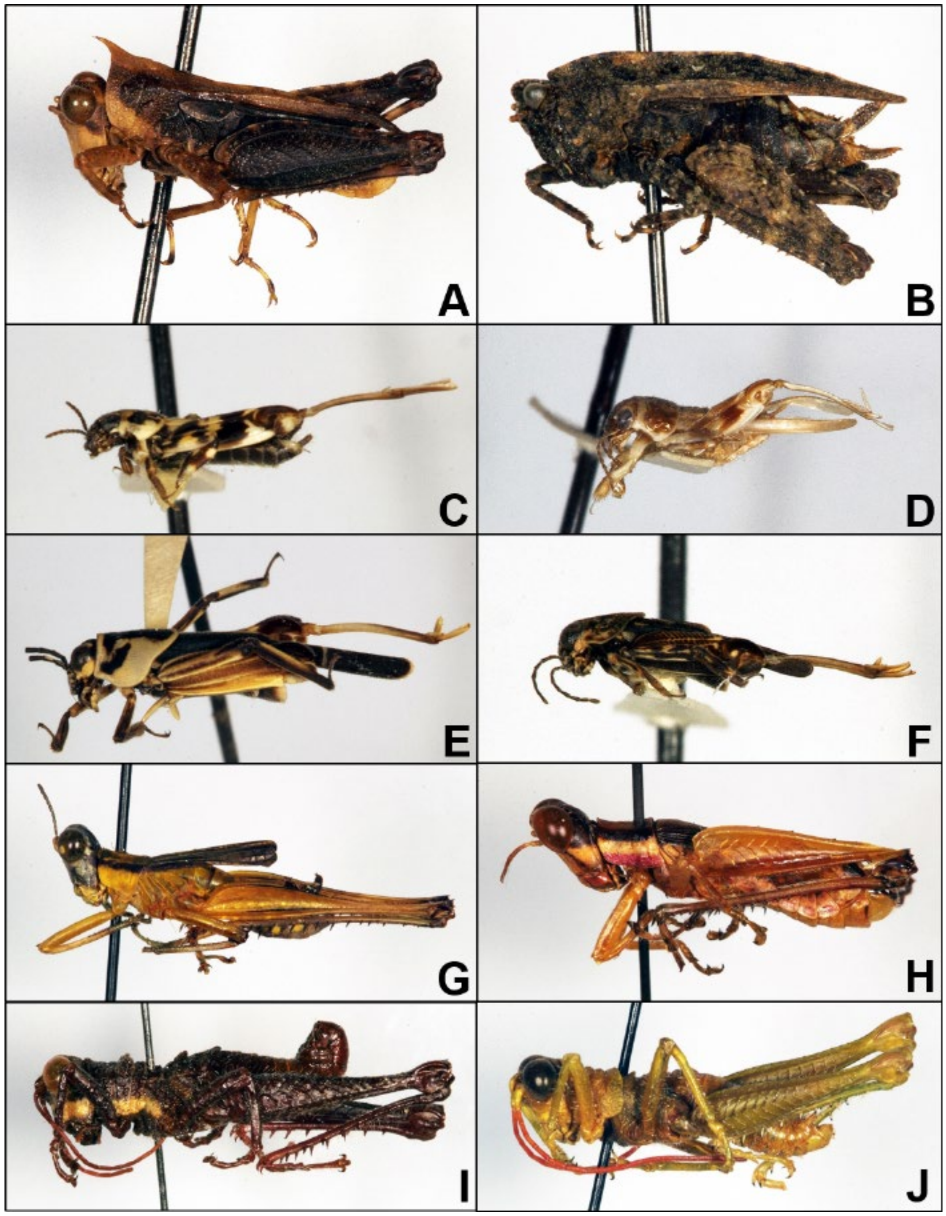

Figure 1. Caelifera types from CAS. **A.** *Rehnidium mendosum* Grant, 1956 (♂, HT) Peru (Tetrigidae). **B.** *Tetrix ornata insolens* Rehn & Grant, 1956 (♀, HT) USA (Tetrigidae). **C.** *Ellipes californicus* Günther, 1985 (♂, HT) Mexico (Tridactylidae). **D.** *Neotridactylus spinosus* Günther, 1974 (♂, HT) Brazil (Tridactylidae). **E.** *Ripipteryx trimaculata* Günther, 1969 (♀, HT) Ecuador (Ripipterygidae). **F.** *Mirhipipteryx lilo lilo* Günther, 1969 (♂, HT) Peru (Ripipterygidae). **G.** *Eumastax andeana* Descamps, 1979 (♂, HT) Colombia (Eumastacidae). **H.** *Euschmidtia nyassae* Descamps, 1964 (♂, HT) Malawi (Euschmidtiidae). **I.** *Kyphiacris andeana* Carbonell & Descamps, 1978 (♂, HT) Ecuador (Acrididae: Ommatolampidinae). **J.** *Paropaon pilosus tingomariae* Amédégnato & Descamps, 1978 (♂, HT) Peru (Acrididae: Rhytidochrotinae).

An important task of these museum visits is to double-check if the information in the Orthoptera Species File (OSF) regarding type deposition matches the reality. Frequently, there

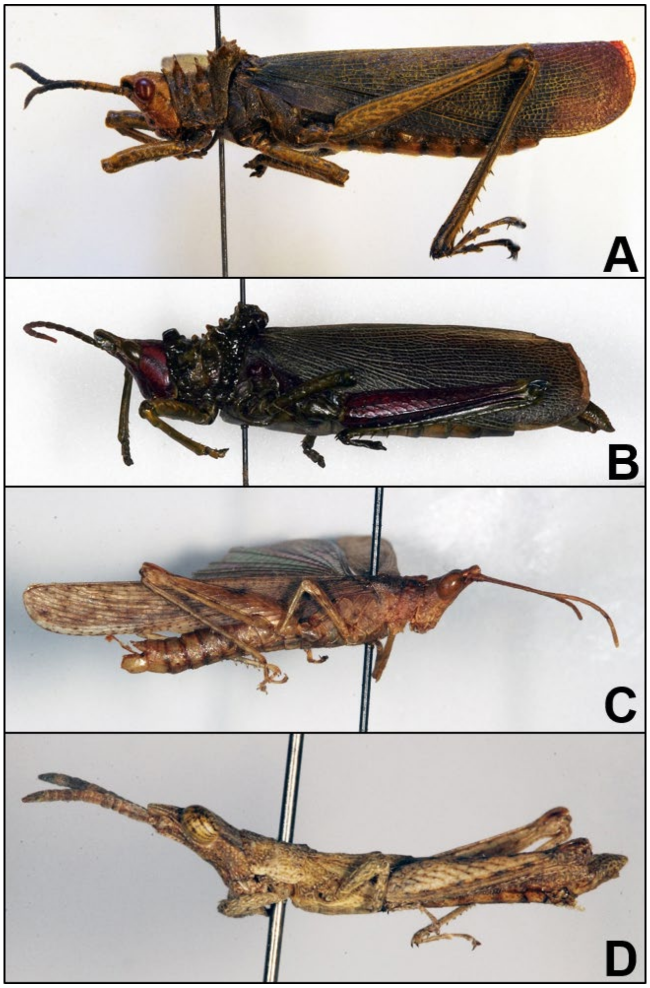

Figure 2. Pyrgomorphidae types from CAS. A. *Rutidoderes concolor* Kevan, 1962 (♂, HT) Congo. **B.** *Taphronota verrucosa* Kevan, 1975 (♀, HT) Democratic Republic of the Congo. **C.** *Desmopterella willemsei* Kevan, 1970 (♂, HT) Indonesia. **D.** *Ichthiacris parva* Kevan, 1990 (♂, HT) Mexico.

are discrepancies and numbers usually do not match. CAS was not the exception and of the 106 valid species recorded to have types housed here, type material for 26 species was missing. The majority (24) of them were described by Descamps (for example, 7 Ommatolampidinae from South America, 8 Thericleidae from Africa, and 4 Eumastacidae from the New World). The next step is to review the original descriptions looking for hints of their whereabouts and to ask curators of collections, such as the Muséum National d'Histoire Naturelle (MNHN) in Paris where Descamps worked. Additionally, type material of 9 species reported to be in other museums was found here. In this case, the action is to contact the museums where the material is supposed to be housed in order to let them know and to update the depository information in OSF. This is not the first time that I have encountered this situation and, in general, when discussing the issue with curators, they are fine to know that missing type material is located in other museums. As long as the types are well curated, they agree to leave it at the current museum. In the end, 105 type specimens of 89 species were photographed from dorsal and lateral view plus labels. All the images are in process to be uploaded to Orthoptera Species File.

I would like to thank the Orthoptera Species File Grant for funding this project, and the Collection Manager of CAS, Christopher C. Grinter, for all his help during my stay in the collection.

II. European Congress on Orthoptera Conservation (Smolenice, Slovakia | September 19-21, 2018)

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After the first Congress at Trier University (Germany, March 2016), a second European Congress on Orthoptera Conservation was organized for September 19-21, 2018 in the Congress Centre of Slovak Academy of Sciences in Smolenice, SW Slovakia. The castle hosted 48 orthopterists from 20 countries and they held altogether 40 presentations. The book of abstracts can be found at **http://orthoptera.sk/2ndECOC/book-of-abstracts/abstracts.pdf**. This meeting was co-organized by the IUCN SSC Grasshopper Specialist Group and the host institution, the Institute of Forest Ecology of the Slovak Academy of Sciences. On the first evening, the congress was opened with words from the organizers: Dr Anton Krištín and Professor Axel Hochkirch. Then, Dr P. Puchala, director of the Little Carpathians Landscape Protected Area, held an introductory lecture on the nature and conservation priorities of the area.

The first plenary lecture by Axel Hochkirch was named "From Red List assessment to conservation action," and analysed the available knowledge on the conservation status

Figure 1. Participants of the 2nd European Congress on Orthoptera Conservation.

Figure 2. Åsa Berggren during her plenary lecture.

Figure 3. Coffee break

of all 1,082 European Orthoptera species as well as their distribution and ecology. This study was the result of the cooperation of 59 European orthopterists. This was a fascinating talk with a nice summary about the two-year long assessment process, which involved numerous experts from all over Europe. We know now that, altogether, 25.7% of the European Orthoptera species are threatened by extinction, which illustrates the strong need for conservation action on the ground.

The following programme was divided into four sections: 1) Species diversity and conservation status, 2) Endangered species, 3) Distribution and ecological miscellanea, and 4) Evolutionary ecology and bioacoustics. In the first section, the speakers gave a superb overview of diversity, threats and protection of the Orthopteran insects in Slovakia, Austria, the Czech Republic and Poland. For instance, we learned from Armin Landmann that during the past two decades the data basis for assessing the threat status of Austrian Orthoptera has exceedingly improved, due to joint effort of Austrian orthopterists. The afternoon programme was devoted to the ecology of several endangered species in Europe, when many new ideas and strategies for conservation were given. To each section, there were also an inspirational series of poster sessions, which generated much discussion and gave the opportunity for comparison of findings and latest trend of research.

The second plenary lecture of Prof. Å. Berggren (Sweden) started the next morning on the long-term research on *Roeseliana roeselii* in Sweden and other northern European countries. She delved into broad discussion on different methods of data sampling and analyses in different corners of the world. Climate change and orthopterans in the Alps were another hot topic. The conservation project for the *Prionotropis rhodanica* introduced a fascinating method of using detection dogs to improve the detection of this cryptic species. Range expansions of some species in Austria were also presented. In other lectures, the biogeography of Carpathian Orthoptera and negative effects of urbanization on diversity and traits of dry grassland Orthoptera in Berlin were discussed. We learned a lot of news about the Balkan and Cretan populations of the *Poecilimon jonicus* group and about the allotopic distribution in two close-

Figure 4. During poster discussions

ly related *Pholidoptera* bush-crickets and about the phylogenetic relationships within the subfamily Phaneropterinae. The evening programme comprised a fascinating visual journey around the world of orthopterans, e.g., from Eastern Carpathians and the Black Sea coast (I. Iorgu, Romania), Dinarian carst and Adria Sea coast (G. Puskás and G. Szövényi, Hungary). A. Krištín (Slovakia) has shown more than 100 Orthoptera species in endangered habitats of Madagascar.

Additionally, some new monographs were introduced at the congress, e.g., The Grasshoppers of Greece (Willemse, Kleukers & Odé 2018) and The Grasshoppers of Austria (Zuna-Kratky et al. 2017). In the Castle hall there was a collection of the Orthoptera endemics of Madagascar, and in insectariums characteristic grasshopper species of sandy habitats in Central Europe were presented. Finally, during the post-congress excursion in the limestone area of the Little Carpathians Mountains we documented 20 Orthoptera species, including the rare bush-cricket *Saga pedo*.

Figure 5. *Saga pedo*, one of the 20 orthopteran species found during the post-congress tour in the Malé Karpaty Mountains

[Photos in this article provided by: Ladislav Naďo, Ľudmila Černecká, Peter Kaňuch, Anton Krištín]

A new locality for *Aztecacris gloriosus* (Hebard, 1935) (Orthoptera: Acrididae) in Sonora, Mexico

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The Atascosa gem grasshopper (*Aztecacris gloriosus* (Hebard, 1935)) is a brightly-colored, spur-throated grasshopper (Acrididae: Melanoplinae) endemic to a small area in southern Arizona and adjacent Sonora, Mexico. Hebard (1935) described it originally as *Perixerus gloriosus* from 1920s specimens taken from the Atascosa Mountains, Santa Cruz County, Arizona. Roberts (1947) erected the genus *Aztecacris for gloriosus* and two Mexican species. *Aztecacris gloriosus* was not seen again for ca. 70 years, until it was rediscovered in 2011 in its historic range (Behrstock and Sullivan 2012).

In 2009, the Madrean Archipelago Biodiversity Assessment (MABA) of Sky Island Alliance in Tucson, Arizona was created to inventory all species of animals and plants in the Madrean Archipelago in Sonora. Since 2015, the Madrean Discovery Expeditions (MDE) program of GreaterGood.org in Tucson has con-

Figure 1. Mating *Aztecacris gloriosus* on Rancho Las Avispas in September, 2013. Photograph by Charles Hedgcock.

Figure 2. Picacho de Bacoachi, Rancho Las Playitas. Photo by Guillermo Molina-P.

tinued biotic inventories in the Sky Island mountain ranges in Sonora. All observations and images from these activities, literature, field notes, etc. are publicly available in the MDE data base (madreandiscovery.org).

Aztecacris gloriosus was found in Mexico for the first time on a 2013 MABA excursion to the Sierra Las Avispas, 15 km (by air) west-southwest of Nogales, Sonora (Fig. 1) (Behrstock and Van Devender 2015). The Rancho Las Avispas population is ca. 27 km south of the closest U.S. records in Santa Cruz County Arizona.

Here we report a second record for Sonora and Mexico. We were studying mammals using wildlife cameras on Rancho Las Playitas in the Municipality of Bacoachi. The scenic Picacho de Bacoachi is on the ranch (Fig. 2). One of us (JAS-M) found *A. gloriosus* at 1347 m elevation in desert grassland 13.8 km (by air) west-southwest of Bacoachi (30.596°N 110.105°W) on December 5, 2018. The locality is 81 km south of the Arizona border (south of Hereford, Cochise County) and 118 km southeast of the Rancho las Avispas population.

Due to the small known world distribution of *A. gloriosus*, we suggest that the species is worthy of protection in the United States and Mexico, and that regulatory agencies monitor its numbers and distribution.

Figure 3. *Aztecacris gloriosus* (female) on Rancho Las Playitas in December 2018. Photo by José Abel Salazar-M.

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The Case of the Missing *Hesperotettix*: how tracking down an unreturned loan led to the rescue of an important Orthoptera collection

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I have been a member of the Orthopterists' Society off and on since 1999, and this is my first *Metaleptea* submission. I have served as curator of Orthoptera at the Mississippi Entomological Museum (MEM) since 2002, and since 2012 have also been curating the United States National Museum's (USNM) North American Melanoplinae collection, which is on long-term loan to the MEM. Having this collection on-hand started me down the path of an orthopterological journey that involved lost specimens, a little known orthopterist, and salvaging a soon-to-be-abandoned collection. I'd like to share the tale of that journey with you now.

Several years ago, when I started gathering specimens to begin a revision of the genus *Hesperotettix*, I was briefly diverted after opening the cabinets in the USNM collection, finding a tag on the front of the *Hesperotettix* drawer that said "Material on Loan to Wallace." Who was Wallace? At

Figure 1. Images from the relocation of the missing USNM *Hesperotettix* and acquisition of the ULM collection. **A.** USNM drawer label stating that the *Hesperotettix* were on loan to Wallace, **B.** Some of the *Hesperotettix* specimens in Wallace's collection, **C.** JoVonn Hill with the 19 Schmitt boxes of *Hesperotettix*, **D-E.** Some of grasshoppers acquired from ULM that will soon be incorporated into the MEM collection.

that point in my career, I had worked on North American grasshoppers for 17 years and knew the names of all the major orthopterists, but had never come across anyone named Wallace.

After inspecting the few specimens that remained in the collection, I walked over to my computer and pulled up the Orthoptera Species File and searched for Wallace, which returned a single result: "Wallace H.S. Revision of the genus *Aeoloplides* (Orthoptera: Acrididae)." At the time, most of my experience was with the grasshopper fauna of eastern North America and as *Aeoloplides* is a small western genus it had escaped my attention. I then went to the museum library and found the issue of the journal with Wallace's article, which was published in 1955, and quickly read through it. It turns out that *Aeoloplides* and *Hesperotettix* are closely related, so it seems logical that Wallace would have started revising it after finishing with *Aeoloplides*. I then checked entries for *Hesperotettix* and there was no mention of Wallace. Next, I contacted David Nickle, former curator of Orthoptera at the USNM, and he told me that when he first came to work at the USNM, Ashley Gurney, his predecessor, was coming in to visit to make sense of many loose ends he had left behind when he retired, including loans. One of the ones that concerned Nickle was a big loan of most of the Hesperotettix collection to Wallace.

I turned my attention to finding out more about Wallace. Who was he? Where was he? Why didn't he finish his *Hesperotettix* study? After some extensive Google searches, I found an obituary dated 1984 for Herbert S. Wallace who worked at the University of Louisiana at Monroe (ULM). Another quick search revealed the University had a natural history collection, so I emailed the zoology curator to see if he had any knowledge of Wallace and if his specimens were still there. It turned out they did still have Wallace's specimens and the curator invited me down to look at them and try to find the USNM specimens so that they could be returned. He also sent me a copy of an article Wallace wrote for the Franklin University Alma Mater newsletter, entitled, "Grasshoppers are Fun." In this article Wallace discusses his field studies of *Aeoloplides* and the pleasure he got from building a grasshopper collection.

A few months later, I traveled the five hours southwest to Monroe where staff members had 19 Schmitt boxes of specimens out and waiting for me. I did a quick scan and saw that most of the specimens were still in good shape, and though all of the paperwork was gone and the specimens were no longer sorted by collection, I was able to readily pick out some of the names of collectors associated with the USNM on the specimen labels. There was not an entomologist at the university, so the zoology curator was happy to let me borrow all the specimens, so that I could separate the USNM specimens from Wallace's. After loading up the boxes, the staff gave me a tour of their collection, which was housed in the locker room of an old track stadium. The conditions were pretty dire, with leaks in the ceiling and poorly sealed specimen drawers resulting in scattered dermestid beetle damage. Because of my experience working in an entomological museum, I spoke at length with the staff about good curatorial practices for insect collections and what issues should be prioritized first.

Two years later, while at lunch, I saw a Facebook post indicating that ULM was parting with its biological collections due to facilities management and lack of space for the material. I quickly called the ULM staff I had met previously to let them know I was interested in obtaining the collection. Luckily, but only after several months of paperwork, the MEM was able to purchase the ULM collection for a nominal fee. Upon moving the collection to the MEM, we first placed it in our walk-in freezer for a month or so and then began the inventory process. In total, the ULM collection contained a little over 16,000 specimens, among which were over 2,000 acridid specimens mostly collected by Wallace or purchased from colleagues mentioned in his newsletter article. In addition to grasshoppers, the collection also contained many interesting butterflies, including 14 specimens of the extinct Xerces blue butterfly.

After freezing the collection, we began preparation to incorporate it into the MEM collection, which had recently received a "Collections in Support of Biological Research" grant from the National Science Foundation of the U.S. This grant allowed for the installation of a compactor system in the museum and databasing of our Acrididae and Formicidae holdings. Each specimen from ULM is in the process of receiving a label indicating its accession before final incorporation.

I thought the Society's membership would find Wallace's newsletter article interesting and I contacted Franklin College to get permission to reprint his article. It turned out that Wallace did not attend that University, as I had assumed, but taught there for a brief time. Also, the archives, where copies of their newsletters were housed, had burned down and they no longer had a copy of that newsletter issue, which I was happy to supply them with. Like Wallace, I have yet to finish a revision of *Hesperotettix*, partially because the genus has very little variation in genital morphological compared to other Melanopline genera, and because the time constraints of being a new assistant professor has limited my research time, but I have managed to parse out the USNM specimens and return them to their rightful home. I hope to finish my work with *Hesperotettix* in a year (or two), because, after all, grasshoppers are quite a lot of fun.

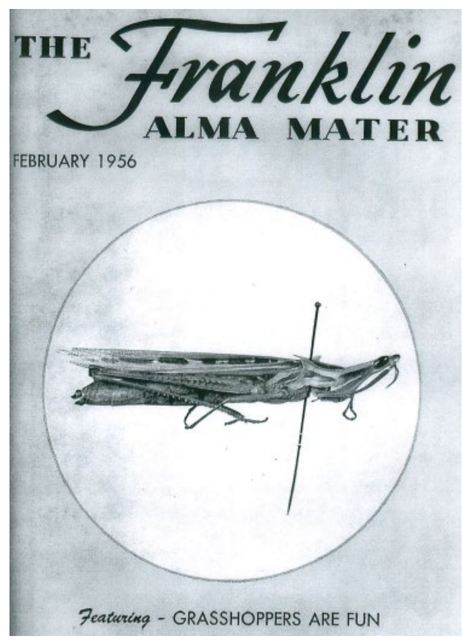
Grasshoppers are Fun

By **HERBERT S. WALLACE**

Any activity that costs money is fun, any activity that makes money is work. On this basis alone, making a scientific collection of grasshoppers is an enormous amount of fun; 25,000 grasshoppers worth for me, in fact. Insect collecting usually starts as a result of the sporting instinct, the pleasures of the search, chase and capture, and grasshoppers give a full measure of satisfaction on this score. This leads to a desire to have a collection as complete as possible in one group of insects. Finally, the collector becomes deeply absorbed in the complex relationships of the species and their incredibly varied and intricate adaptations for different living conditions and habits. Then one day he wakes up to the fact that he has invested a considerable sum of money and many years of his life in something which most people think a bit "queer." In return for the time and money spent, the study has led to many rich and varied experiences and has made fast friends in strange places.

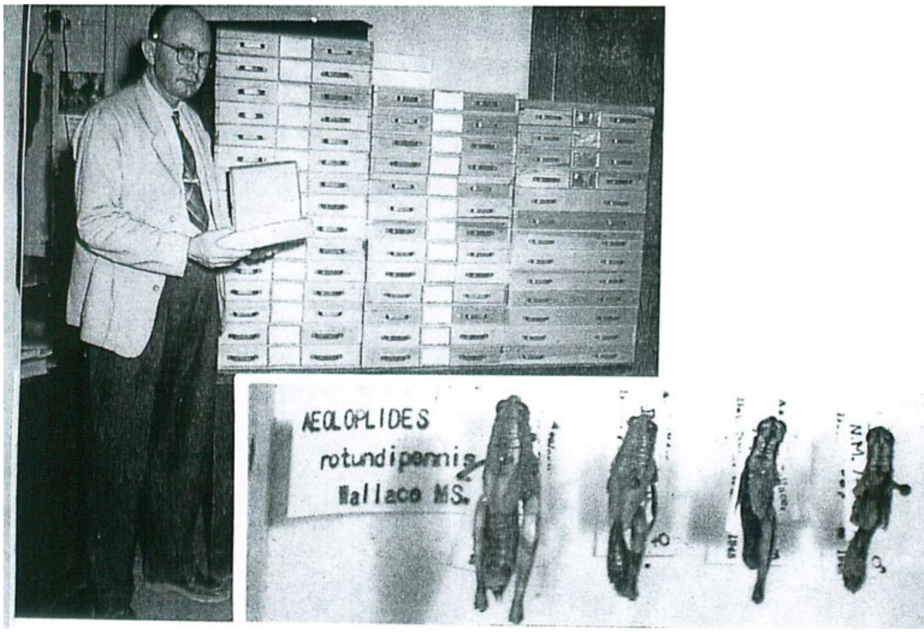
Probably the one question which is asked most frequently of the specialist in insect classification is: "Have you ever found a new species, one entirely new to science, one that no one had ever found before?" To the student of insect classification, finding an entirely new species is unusual but not at all rare. Yes, I found a new species of grasshopper. On a trip for the special purpose of collecting grasshoppers belonging to a certain small group of species, I collected some grasshoppers from a clump of salt-bushes near San Antonio, New Mexico. As soon as I took one of the insects out of the net, I knew that I had something unusual, probably a new species. One doesn't recognize every new species at the time he finds it, but if he is studying that group intensively at the time, it is likely that he will.

I remember the incident more by the dusty, inhospitable desert than by the new species. The temperature was 110º in the shade (but we didn't have



Editor's Note. This article was originally published in the February 1956 issue of *The Franklin Alma Mater*. I am happy to republish this article in *Metaleptea*.

to stay in the shade, there wasn't any). The salt-bush was unpleasant stuff; stiff, thorny, dusty, (and worst of all) fully of yellow pollen. This was July 1, 1947, right at the height of my hay fever season. Between sneezes and



Dr. Wallace is shown in his office with many of the cases that hold his fabulous collection. His collection numbers about 100,000 insects of which 25,000 are in the Museum of Zoology Research Collection at the University of Michigan. Of 1,000 known series of grasshoppers and related insects in North America, Dr. Wallace has 600. All photo on this page are from his collection. The insert shows a close up of *Aeoloplides rotundipennis* found by the author and described in the article.

wiping my eyes I managed to catch about 30 of the new species. Other members of the party caught about 20 more for me after I told them what I had found. Did I publish a description and name for the new species the next week and assure for myself a place in the entomologist's Hall of Fame? No. It isn't done that way nor will it have that result. After two more years of work on this group of grasshoppers (the genus *Aeoloplides*), one year at the University of Kansas in 1947-48 and another at the University of Michigan in 1953-54, I finally worked out satisfactorily the relationships within the group, the distribution of the species and many other things that are necessary for taxonomic study. Then in May of 1954 I sent the paper describing my work on this genus to a technical journal. *The Annals of the Entomological Society of America*, where it was accepted for publication. Was it published the next month so I could have that seat in the Hall of Fame? Oh no! It was printed twenty months later. Technical journals, particularly in biology, are so poorly supported financially that they have many more good papers than they can publish, so they are months and even years behind. This is one of the big bottle-necks in the progress of science. Our scientific journals tell us today of the discoveries made one or two years ago. It is not their fault. They are doing the best they can with the little money they have. So my paper, "Revision of the Genus *Aeoloplides*," came out January 15 of this year. And now about that "Hall of Fame" business. Well, the seats are all full. In the center of the grasshopper section is a throne occupied by J.A.G. Rehn of Philadelphia, who has described more than 100 new species of grasshoppers and related insects. Seated on either side of Mr. Rehn in a semi-circle are about 15 men who have described five or more new species and two or three who have not described any at all. Standing around them is a small crowd of men who have described one or more new species and some more who have never described any. These men hold their places, not by the number of new species they have described but by the amount and excellence of their published work in the variation, adaptation and relationships in grasshoppers. I might find standing room in that august company some day, but not yet.

After collecting specimens locally, one soon becomes curious about the insects of other countries. So when a collector in India (who had found my name and address in the *The Naturalist's Directory*) wrote to me, I was intrigued, to say the least. In a letter dated Sept. 30, 1937, Mr. P. Susai Nathan of Nedungadu, South India, wrote: "We have numerous and interesting species of Orthoptera in South India, and if you do require any, I shall make a species collection for you. I am usually in the habit of letting the purchaser judge for himself the value of individual small consignments and I should like to extend the same terms to you." How could a collector of grasshoppers resist such an offer? I couldn't. It was not long since I had graduated from college and folding money was still a novelty to me but I asked Nathan to send me a small collection which he would value at about $5.00. About four months later I received three small boxes containing 300 grasshoppers, all in excellent condition with all the required information for each specimen. Since then I have received three or four shipments from Nathan every year, except the three years I spent in the Navy collection insects in the Marshall Islands and various interesting places. In addition to the interesting specimens from Nathan and the pleasant friendship which has developed through the years, his shipments are of special interest because he uses his personal correspondence, among other things, for making the paper envelopes in which the grasshoppers are enclosed for shipping. So through the years I have been well posted on Nathan's family life, his son's college work, his church work, etc. Many of the letters were written in the semetic script of Nathan's native language. This was frustrating and probably caused me to miss important chapters.

The trail of the grasshopper hunt has led me into many out-of-the-way places where I met wonderful people and made some life-long friends. Late in the afternoon on one of my early jaunts in my native Colorado Rockies, when I planned on spending the night camping out, I was soaked by a driving rain. Following a foot path for a couple of miles, I came to a little log cabin on a side of a mountain. The elderly couple there insisted that I come in, change into dry clothing, eat supper and stay all night. I was only 19 then and probably looked like a drowned rat. Many times since, when collecting insects in that area, I have stopped at the log cabin of Roe and Mable Baldwin. Every time they treated me to home made bread with gooseberry jam and goat's milk. During the war, years later, they wrote to me and sent me small gifts which made life more pleasant in far-away places.

Yes, grasshoppers are fun, and it does cost a lot to do any serious work with them, but the rewards are great in healthy outdoor living, warm friends, and the personal satisfaction of having done something that no one else has done before by making new discoveries and solving difficult problems. It is not the finding of new species but the search for new truths that is the greatest thrill.

Rocky Mountain Locust opera
An invitation to watch

By **JEFFREY A. LOCKWOOD**
University of Wyoming, USA
Lockwood@uwyo.edu

Locust is a one hour chamber opera intended to bring orthopterology to the general public through the story of the Rocky Mountain locust, *Melanoplus spretus*. The tale unfolds as an environmental murder mystery which is true to the science - as well as resonant with the imagination. This is an epic account of the Rocky Mountain locust, an iconic species that blackened the skies of North America in the 1800s with huge swarms, but suddenly disappeared forever at the turn of the twentieth century. In the operatic formulation, the ghost of the locust haunts a scientist until he can figure out how a creature that once numbered in the trillions survives only in folklore. And the answer to this extinction provides powerful lessons for contemporary conservation.

Composer Anne Guzzo (left) set music to a libretto written by entomologist Jeff Lockwood for the opera about locusts, pushing science communication into new realms. (courtsey of J.A. Lockwood)

A performance of the opera was filmed by Wyoming PBS program and it can be viewed on YouTube at **https://youtu.be/03QofaRPVyc**. The opera will be performed live at the Congress in Agadir as well.

For more information about the opera, please read my article published in **Entomology Today**.

A scene from ***Locust: The Opera*** (Photo credit: J.A. Lockwood)

Treasurer's Report

By PAMELA MIHM
Treasurer
p.mihm@regencyapartments.com

The Statement of Assets as of December 31, 2018 and the 2018 Summary of Cash Receipts and Expenditures are shown below. The Orthoptera Species File continues to be the largest cash activity. This is funded by an allocation of endowment income from the University of Illinois. The second largest use of cash was publishing the *Journal of Orthoptera Research* (JOR). The Society supported the upcoming Congress in Morocco with a grant for the Locust Opera, a grant to the ICO, and travel grants to students and young professionals. There will be additional support for the Congress in 2019. If you have any questions, please contact me at p.mihm@regency-multifamily.com.

Orthopterists' Society
Statement of Cash Receipts and Expenditures
(1/1/18 through 12/31/18)

Cash Receipts	
Dues	$4,100.00
Publications	2,205.00
Community Foundation endowment	11,733.68
Royalty and revenue sharing	4,443.39
Donations	130.00
Transfer cash from Vanguard & Wells Fargo	47,284.00
Proceeds from sale of investments	48,500.00
University of Illinois allocation	129,000.00
Total Cash Receipts	$247,396.07
Cash Expenditures	
Publisher JOR	$4,628.77
Pensoft Publishers	18,861.63
JOR assistance	21,000.00
Research grants (Ted Cohn)	14,784.00
Executive director remuneration	1,500.12
Ed. Metaleptea remuneration	1,500.00
Webmaster remuneration	300.00
JOR editor remuneration	3,000.00
Maintenance of Orthoptera Species File	90,000.00
Grants-Orthoptera Species File	38,279.51
Locust opera grant	10,000.00
Congress Morocco contribution	3,000.00
2019 Congress travel-Board/Plenary Speakers	600.92
2019 Congress travel grants	12,000.00
Professional fees (income tax preparation and audit)	4,490.00
Accounting reimbursement	12,000.00
Other	2,445.65
Total Cash Expenditures	$240,253.60
Cash Receipts over Cash Expenditures	$7,142.47
Beginning Cash Balance	10,231.09
Subtotal	17,373.56
Contribution for OSF 2019	20,000.00
University of Illinois endowment for 2019	153,000.00
Vanguard sales for 2019 expenditures	40,000.00
Ending Cash Balance	**$230,373.56**

Orthopterists' Society
Statement of Assets
(As of December 31, 2018)

Cash		
Paypal cash balance	$812.41	
Midland States Bank	229,561.15	
	$230,373.56	
Investments at market value		
Vanguard:		
Grants (Note 1)		$362,205.19
Operating (Note 2)		672,653.15
		1,034,858.34
Wells Fargo:		
AAAI (Note 3)		12,751.98
Endowment (Note 4)		29,346.42
Operating (Note 2)		224,251.74
Grants (Note 1)		73,158.16
		339,508.30
Total assets		**$1,604,740.20**

Note 1: This fund is restricted and can only be used for research grants.
Note 2: This fund is nonrestricted.
Note 3: This fund can only be used for the Uvarov Award made at each int'l meeting.
Note 4: The income in this account is available for Society expenses; can extract capital but must have a plan for repaying it within 3 years.

Editorial

By HOJUN SONG
Editor, *Metaleptea*
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It is already the end of the first month of 2019! Time flies and so much has happened since the last issue of *Metaleptea*. For our society, we have a newly designed website (**orthsoc.org**) thanks to Derek A. Woller (who now wears two hats, Webmaster and Associate Editor of *Metaleptea*), we are in the process of electing our new President-Elect, and we are gearing up for the 13th International Congress of Orthopterology in Agadir. For me personally, I had a very busy semester, teaching two graduate courses, during which I had to squeeze in two field expeditions and one conference. My most senior student, Ricardo Mariño-Pérez, officially (and finally!) graduated in December 2018, and a new PhD student joined my lab. I don't think that the new year will be any less busy for me than the last year, but I guess I should try to enjoy and make the best of it.

Recently, I was in South Africa and Namibia for about a month to collect Orthoptera. This expedition was part of an NSF-funded project that aims to understand the diversification of the lentulid genus *Eremidium* in the Afromontane forests and the inselbergs in the Drakensberg Escarpment. Daniel Otte and I received this grant a couple of years ago and this was the second time that I traveled to South Africa for this project. I traveled with my students, Ricardo Mariño-Pérez and Bert Foquet, and Greg Cowper from ANSP, and joined Adrian Armstrong and Clint Carbutt from KZN Ezemvelo in South Africa for the first leg of the expedition in KwaZulu-Natal. Of all the international collecting expeditions that I have conducted over the years, this South Africa trip stands out as special because this was the first time that I took a helicopter to find grasshoppers. The inselbergs in the Drakensberg Escarpment are the highest flat topped peaks in South Africa with an elevation over 3,000 meters. They are isolated and impossible to climb up, and the only way to reach there is by helicopter. We sampled on top of seven inserbergs and found *Eremidium* on all of them. How these apterous grasshoppers were able to colonize the remote mountain tops is one of the many questions that Dan and I will try to answer in the next few years. Needless to say, the experience was fantastic and I will never forget the amazing panoramic views from the top of the inselbergs. At least when I was collecting these tiny grasshoppers, I did not have to think or worry about papers, grants, or anything else. Nothing else mattered because it was me versus the grasshoppers, hunting in the purest sense. As Wallace said more than 60 years ago, grasshoppers are fun and this is why I love what I do.

This is another fine issue of *Metaleptea* and I would like to thank everyone who has contributed to this issue as well as 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 May of 2019, so please send me content promptly. I look forward to hearing from you soon and I hope to see many of you in Agadir!