# METALEPTEA

THE NEWSLETTER OF THE ORTHOPTERISTS' SOCIETY


## President's Message

Dear Society Members,

As announced in the previous *Metaleptea* issue [32(2)], Dr. Glenn Morris has just left his position as the Editor of *Journal of Orthoptera Research* and has been replaced by Dr. Sam Heads, of the Illinois Natural History Survey, University of Illinois. Sam is already in office and has been working with Glenn and Doug Whitman in proofreading the second issue of *JOR* that will be out in September.

I would like to warmly thank Glenn for his enormous job and time invested in editorship and improvement of our journal. He worked on every volume meticulously to make sure that it would attain excellence and quality that our contributors expect from *JOR*. Since Glenn took office in 1999, he has made great progress and highly improved its quality. He has conducted this difficult and time-consuming task with great dedication and professionalism. Several improvements in *JOR* have been achieved during his office. Since 2000, *JOR* has been published regularly twice a year. In 2006 the first nine volumes of *JOR* became available on JSTOR. This retroactive conversion combined with BioOne to put all 21 volumes of *JOR* on the web. Through BioOne, JSTOR, Academic OneFile, our journal has been introduced to many institutions. Moreover, *JOR* is also covered by SCOPUS. Thanks to the

Open Journal System implemented by Glenn, all manuscript submissions and review processes can now be made on-line.

Without a doubt, Glenn's hard work has surpassed the goal of *JOR* to disseminate the ideas and insights arising from the study of orthopteran insects and to improve the accessibility of the subject to new generations. This position requires much knowledge, time and attention to detail which Glenn accomplished with huge responsibility and dedication for these many years. Our Society will always be indebted to him for making a great journal out of *JOR*.

### 11TH INTERNATIONAL CONGRESS OF ORTHOPTEROLOGY

Once again, I remind you that the 11th International Congress of Orthopterology will be held next year (August 11-15, 2013) in Kunming, Yunnan, China, under the theme: "Orthoptera in Scientific Progress and Human Culture".

New information on the organization of the Congress will be published soon on the Website of the Congress: (http://ico.greatlocust.com/).

Please feel free to contact me (cigliano@fcnym.unlp.edu.ar) and send me your ideas and suggestions for improving the Society, how we may better serve our members, and how we may better advertise our services to other biologists.

Sincerely,
**Maria Marta Cigliano**
*La Plata, Argentina*

# Summer 2012 Orthopterists' Society Research Grant Funded

The Committee received twelve grant applications from four countries (United States, Argentina, Germany, and India) and we funded eight. The Committee was in surprising agreement in our evaluation of these proposals. As usual, we had extensive communication with most of the applicants either to clarify various aspects or to offer advice.

Once again, income earmarked for Research Grants are limited, and we encourage our fellow orthopterists to contribute to this program.

**Castillo, Elio Rodrigo Daniel** (Brazil) – *Study of neo-sex chromosomes in a grasshopper genus.*
**Conroy, Lauren** (USA) – *Comparison of agonistic and antagonistic leg use in species of camel crickets.*
**DiRienzo, Nicholas** (USA) – *Role of juvenile experience and immune response in determining adult personality in a field cricket.*
**Ney, Gideon** (USA) – *Effect of geographic separation on population genetics and acoustic behavior in a cone-headed katydid.*
**Prokuda, Alexandra** (USA) – *Estimating female preference and preferred male trait in a field cricket: linkage disequilibrium or pleiotropy?*
**Schmidt, Ashley** (USA) – *Evolution of tremulation (seismic) communication in New Zealand wetas.*

*Melanoplus rotundipennis (Photo credit: Derek A. Woller)*

**Symes, Laurel** (USA) – *Effect of road noise on behavior and population dynamics in a variety of Orthoptera.*
**Woller, Derek A.** (USA) – *Male genitalic diversity and function in scrub endemic Melanoplus using micro-CT technology.*

# The Orthopterists' Society Grant Reports

## A physiological investigation of nutrient-allelochemical interactions in the generalist grasshopper *Melanoplus differentialis* (Orthoptera: Caelifera: Acrididae)

For insect herbivores, obtaining necessary amounts of nutrients (e.g., protein, digestible carbohydrates) often requires feeding on large volumes of otherwise nutritionally poor foods. This task is made more difficult given that plants also often contain non-negligible amounts of allelochemicals – chemicals produced by plants that exert a detrimental physiological effect on insect herbivores.

One of the major challenges of studying nutrition in insect herbivores is the dynamic nature of plant chemistry: nutrients and toxins both vary in space and time within a single plant. This problem was addressed, at least initially for protein and carbohydrates using experiments designed with the Geometric Framework (Raubenheimer and Simpson 1993, Simpson and Raubenheimer 1993). This framework (henceforth GF) takes into account the multiple interactions among mechanisms regulating the intake of different

***Figure 1.*** *Melanoplus differentialis feeding on wheat seedling (lab colony).*

classes of nutrients, and is designed to explore how animals solve the problem of balancing multiple and changing nutrient needs in a multidimensional and variable nutritional environment. The GF places a great emphasis on the physiology and behavior of individuals. Since it was developed, the GF has been used in multiple studies to demonstrate how insect herbivores simultaneously regulate the intake of multiple nutrients (Behmer 2009).

In 2001, Simpson and Raubenheimer used the GF to investigate the simultaneous effects of nutrients and plant allelochemicals on locust performance (Simpson and Raubenheimer 2001). Interestingly they found that the negative effect of plant toxins (they used tannic acid) where dependant of the macronutrient background. For instance, they found that a nutritionally balanced diet gave the insects immunity against tannic acid, even when it was present at a very high concentration. We also know that consumption of foods that contains absorbable allelochemicals is physiologically expensive in terms of expenditure of energy and material during detoxification and excretion of these toxins. These expenditures use metabolic energy that is not available to drive physiological processes involved in the acquisition and processing of nutrients from ingested foods. Thus, our research objective was to investigate how plant nutrients and allelochemicals interact, on a physiological level, to affect the performance and metabolism of other insect herbivores using a generalist grasshopper (*Melanoplus differentialis*) as a model.

The two key nutrients we manipulated were protein and carbohydrate because these two macronutrients are known to be highly variable in plants and are strongly regulated by grasshoppers (reviewed by Behmer, 2009). We used three protein-carbohydrate treatments (carbohydrate biased, balanced, protein biased) and four allelochemical concentrations (control (=0%), 0.5%, 1% and 2% dry weight). These concentrations were chosen because they encompass the natural range of secondary compounds in plants. The allelochemical chosen was gramine, an alkaloid present in the Poaceae, and thus likely to be encountered by generalist grasshopper. In total 12 nutrient-allelochemical combinations were tested, and each treatment was replicated 10 times (5 males and 5 females). Each grasshopper was reared individually through the entire 6th-stadium in arenas containing the test foods plus water for drinking. For each grasshopper, we recorded the following variables: food consumption, development time, mass gain and body lipid levels. A week after the beginning of the experiment, we measured $CO_2$ production and $O_2$ consumption (i.e. metabolic rate) from each insect for a 2h time period.

We found that at the highest concentration (2%), gramine had a significant negative effect on performance (i.e. mass gain, development time, survival) and metabolism. We expected that the metabolism would be elevated in presence of gramine as a consequence of the energy spent detoxifying and found the opposite result. One possible interpretation is that detoxification happens quickly after the ingestion of food and by measuring the metabolic rate of the animals at rest we missed it. The lower metabolic rate might indicate that gramine is inducing food stress, which can lower the metabolic rate

***Figure 2.*** *Melanoplus differentialis nymph feeding on artificial diet.*

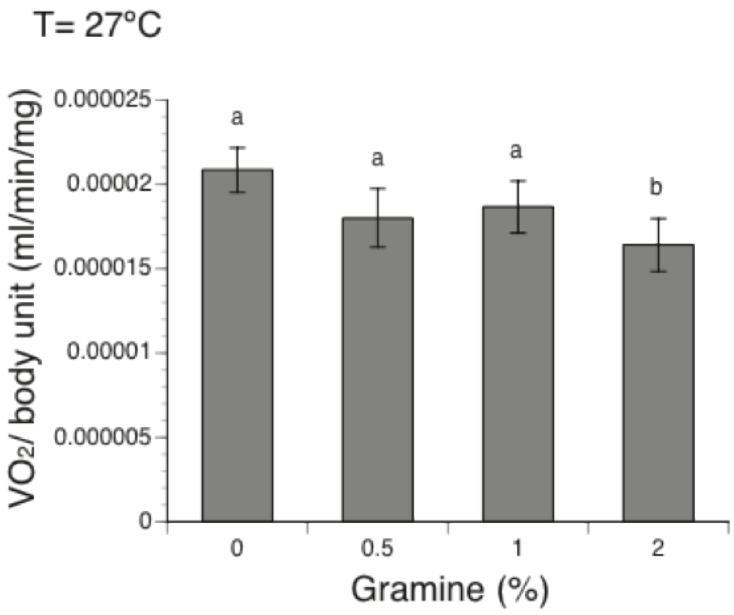


***Figure 3.*** *Rate of oxygen uptake by unit of weight in function of the quantity of gramine present in the food.*

(Chown and Gaston 1999). However, the negative effect of gramine was independent of the macronutrient content in the diet. Interestingly we did find an interactive effect of gramine and macronutrient on the grasshopper consumption. In the control diets, *M. differentialis* consumed more of the carbohydrate-biased food (likely in order to compensate for the protein deficiency of that diet), however when gramine was added to the food, this regulatory behavior disappeared and the protein intake was lower than for the other two treatments. We observed that mortality was also higher on that treatment (43% compare to 23 and 13% for the protein biased and balanced treatment). However, statistically there was no significant interactive effect of gramine and macronutrient content.

In conclusion, we found that gramine had negative effects on *Melanoplus differentialis* performance and metabolism. We also found an interactive effect of gramine and macronutrient content on insect consumption. There was, however, no effect on insect performance. Since then we have tested *M.differentialis* on other types of diets varying in their macronutrient ratio and concentration (we used concentrations closer to plant natural macronutrient content (Lenhart et al., in prep.)) and we were able to detect a significant interaction between macronutrient and gramine content on performance (Le Gall and Behmer, in prep).

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# Skin hydrocarbon composition as a pre-mating barrier between *Gryllus firmus* and *G. pennsylvanicus*

The field crickets *Gryllus firmus* and *Gryllus pennsylvanicus* have been the subjects of extensive studies (Harrison and Arnold 1982, Harrison 1983, 1985, Maroja et al. 2009a, Maroja et al. 2009b). They are so closely related that they are still able to hybridize and exchange genes, providing researchers an excellent subject with which to understand genetic changes that lead to speciation. The crickets form an extensive (but narrow) hybrid zone from North Carolina through Maine (Fig. 1). These hybrid zones have been described as windows into the evolutionary process and can reveal which genes are responsible for species identities along with what genes can cross the species barrier. Furthermore, the closely related species have not had a chance to accumulate differences after divergence, thus the existing differences are likely to be (or have been) playing a role in the early stages of speciation and divergence (Coyne and Orr 2004).

It is interesting that even though the crickets are closely related (less than 1% mtDNA difference and no differences in most of the genome), they already have many barriers to gene exchange. Barriers to gene

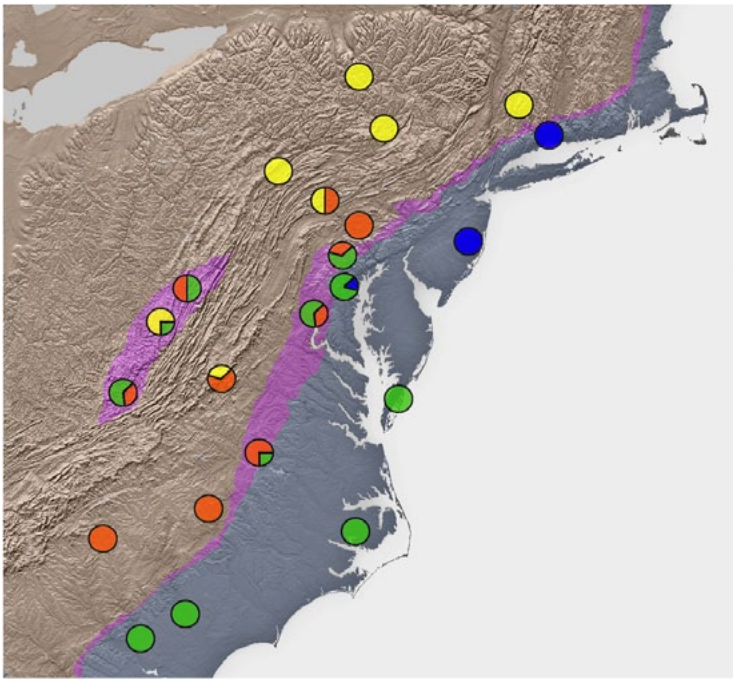

***Figure 1.*** *Eastern North American map showing the known location of the hybrid zone (in purple) and range of each species (blue G. firmus; brown G. pennsylvanicus). Circles represent well studied populations colored according to mtDNA haplotypes (Green and blue G. firmus; orange and yellow G. pennsylvanius). This is a mosaic hybrid zone because pure species crickets can be found near (or within) hybrid populations).*

exchange have been traditionally described as pre-zygotic (e.g. mating behavior) or post-zygotic (e.g. hybrid sterility) barriers and more recently a new category, post-mating/pre-zygotic (e.g. sperm competition). *Gryllus firmus* and *G. pennsylvanicus* have one post-mating barrier, a one-way directional incompatibility; F1 hybrids can only be produced from *G. pennsylvanius* females because *G. pennsylvanicus* sperm is unable to fertilize *G. firmus* eggs (Harrison 1983, 1985). However, the most important barriers to gene exchange that prevent a higher percentage of hybridization are the pre-mating barriers that act earlier in the life cycle. Among those are temporal barriers (the species mature at somewhat different times), ecological barriers (*G. firmus* occur in sandy soils while *G. pennsylvanicus* occur in loamy soil) and a time to mate barrier (the crickets mate faster when with conspecifics) (Harrison and Arnold 1982, Ross and Harrison 2002, 2006, Maroja et al. 2008, Maroja et al. 2009b). The latter barrier had been previously interpreted as female choice (Maroja et al. 2009b), as the female has to take the ultimate decision to mount the male and the couple needs to cooperate for spermatophore transfer. However, our studies showed that the time to mate is likely a result of male courtship effort (unpublished data, fig. 2). Males court conspecific females faster and more intensely than heterospecifics, and females are quick to respond to intense courtship behavior. While the mating barriers have been well described, the mechanism for species recognition remains elusive. Morphologically, the two species are similar (*G. firmus* tends to be slightly bigger and lighter), their courtship songs are not distinguishable (there are lots of differences between individuals, but none between species), and females respond quickly to a heterospecific male as long as he courts intensively. We proposed to look into skin hydrocarbon (chemical) composition as a potential mechanism for species recognition. Together with the volatile pheromones, skin hydrocarbons are an important means of short distance communication in insects and have been rapidly evolving in the Hawaiian *Laupala* genus (Mullen et al. 2007).

We collected crickets from four populations (two of each species) and scored over 150 crickets (fig 3). We found differences in both abundance and composition of chemical compounds between sexes and species. However, while females had drastically different skin hydrocarbon composition ($P<0.02$), males had no differences ($P>0.05$). To further test the importance of skin hydrocarbon in courtship, we presented males with dead females that had been stripped of all skin hydrocarbons or stripped and "repainted". Males only responded (a few actually started courtship) to females that were repainted. As it is clear that chemical communication is essential for mating success (crickets are constantly touching the other with their antenna previous to courtship or mounting) skin hydrocarbons might be the phenotypic cue that males use to adjust courtship effort. Because females respond mainly to courtship intensity, they will be mating more frequently to conspecific males, even though for them it might be difficult to differentiate conspecifics from heterospecifics!

*Acknowledgments:* All the experiments and analyses have been

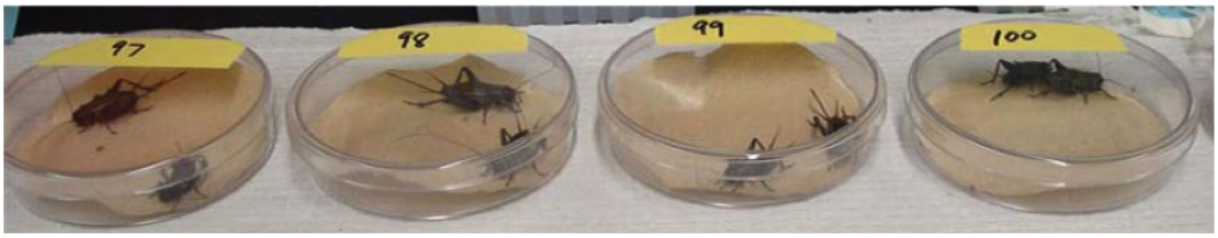


***Figure 2.*** *Experimental set up. Mating choice and male courtship intensity experiments*

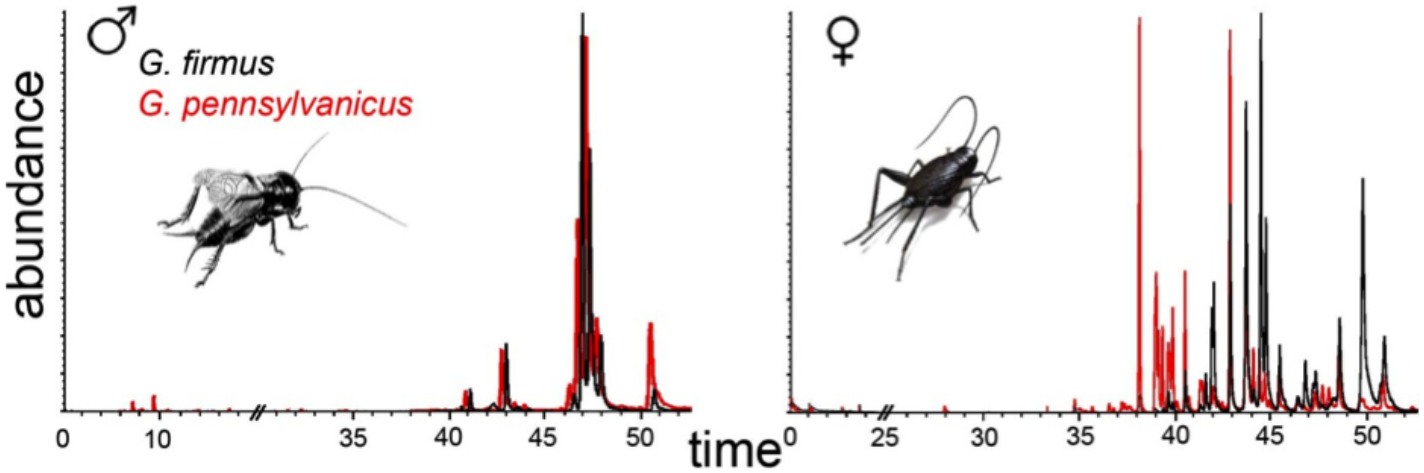


***Figure 3.*** *Skin hydrocarbon composition for males and females of each species, each pattern represents a typical individual of each species, peaks represent different chemical compounds. While males are very similar (the slight difference in peak location is caused by machine error of ± 1min), females are different both in abundance and composition (peaks in one are inexistent in the other).*

conducted with the help of the following Williams College undergraduates: Zachary McKenzie, Elizabeth Hart and Joy Jing.

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# Special Reports on Orthoptera Conservation

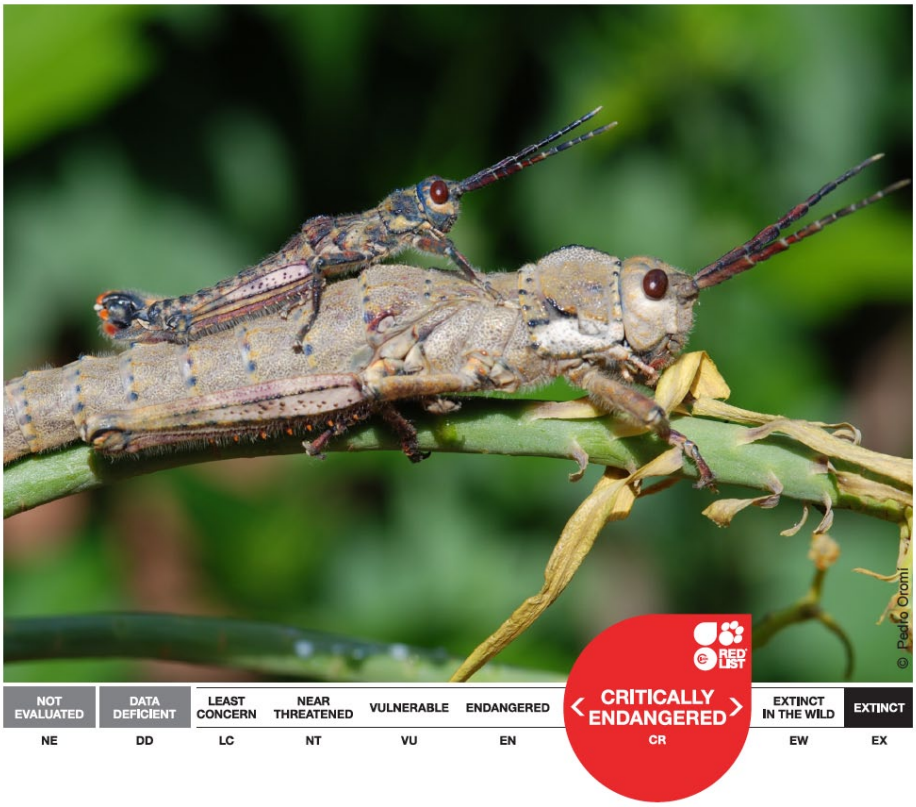
## News from the IUCN/SSC Grasshopper Specialist Group (GSG)

The global deterioration, fragmentation and destruction of habitats due to anthropogenic land use severely threaten our study objects - Orthoptera. In Central Europe, Orthoptera used to play an important role in environmental impact assessments as they are useful bioindicators for land use intensity and easy to map compared to other insect groups. However, this central role has nearly ceased due to the implementation of the EU habitats directive, which only lists very few Orthoptera species compared to other taxa. On a global scale, Orthoptera are hardly visible in the nature conservation community. Most conservation projects deal with 'charismatic vertebrates' (panda, orang-utan, tiger, rhino, elephant or birds). This bias is some-

what natural, as we all love these large animals, but it makes it much harder to convince potential donors to support Orthoptera conservation projects. It is, therefore, of vital importance, to raise the profile of Orthoptera among conservationists first, in order to stop the ongoing loss of Orthoptera diversity.

The IUCN (International Union for Conservation of Nature) is the world's oldest and largest environmental network, running thousands of field projects around the globe. Within the IUCN, the Species Survival Commission (SSC) is a network of more then 7,500 volunteer experts engaged in the preservation of biodiversity, which are organised in more than 100 specialist groups. Although the number of vertebrate specialist groups is still much higher than the number of those dealing with invertebrates, the 'Invertebrate Conservation Sub-Committee' of the IUCN (chaired by Michael Samways) is working hard to increase the representation of invertebrate specialists in the IUCN. However, it is even much more important that these specialists actively promote the conservation of insects. A positive example is the IUCN/SSC Dragonfly Specialist Group, which managed to publish comprehensive red list assessments of many dragonfly species. This raised the representation of dragonflies in several conservation projects, such as the 'Sampled Red List Index' or the 'Pan-Africa Freshwater Biodiversity Assessment'.

Since its formation in January 2010, the IUCN/SSC Grasshopper Specialist Group (GSG) supports and coordinates Orthoptera conservation projects all over the world. It is called the 'Grasshopper' SG, because the IUCN has to relate to a wide public audience and a well-known common name is, therefore, more appropriate than a technical term. The GSG does, however, cover katydids, crickets, mantids and phasmids as well as grasshoppers. The group currently (as of September 28, 2012) consists of 56 members from 27 countries. However, we are still happy to accept new members, who are willing to support us in red list assessments or are actively involved in practical conservation projects. We particularly lack members from South and Central America (except Argentina), Asia (except Turkey), Africa (except South Africa) and Australia. Our mission is to conserve Orthoptera diversity by stimulating, developing and executing practical programs to conserve Orthoptera and their habitats around the world. The IUCN provides an ideal platform for us due to its large network of experts and projects as well as its flagship knowledge products, such as the IUCN red list (www.iucnredlist.org).




*The **La Palma Stick Grasshopper**, Acrostira euphorbiae, has not yet been officially evaluated for the IUCN Red List of Threatened SpeciesTM, however, it is listed as 'Critically Endangered' on the Spanish Red List. It was discovered and described quite recently in 1992, and it is endemic to La Palma, Canary Islands, Spain. (Taken from http://gsg.myspecies.info/content/iucn-red-list-species-day)*

Increasing the number of red list assessments for Orthoptera is one of our central goals as the red list is highly recognized as a source of information on threatened species. In 2009, only 74 Orthoptera species, one mantid and two phasmids were listed on the IUCN red list. With the next red list updated (2012.2, in October 2012), the number will have increased to 178 assessed Orthoptera species, 2 mantids and 8 phasmids. Of course, this is still a minor fraction of the approximately 30,000 hitherto described species within these groups and if we continue with this speed, we will not manage to finish the assessments in the next 300 years. However, we just have started to learn to use the IUCN categories and criteria as implemented in the Species Information System (SIS) provided by the IUCN. Comprehensive assessments of all European Orthoptera and the South-African bush-crickets are planned to be completed within the next IUCN Quadrennium (2013-2016) and initiatives to assess

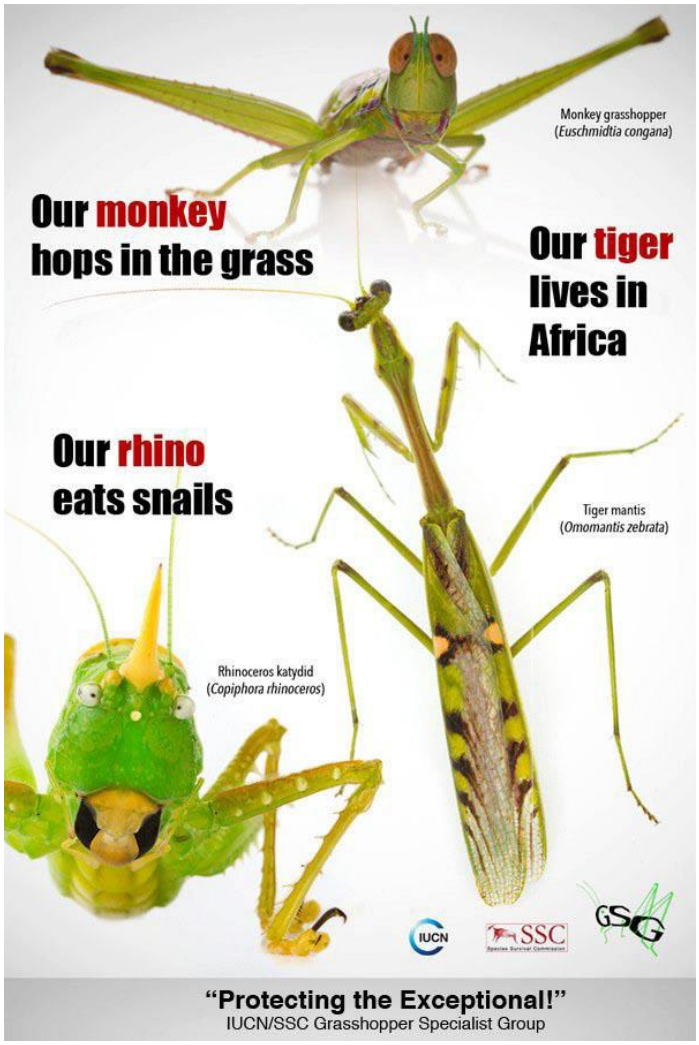
the status of South American and East African Orthoptera have been started as well. It is worth mentioning that only we, the Orthopterists, are able to fill the gaps in the IUCN red list as our expertise is needed to assess Orthoptera species. We, therefore, need the help of regional Orthopterists, who can provide data on the distribution or population trends of Orthoptera. Baudewijn Odé (our red list authority focal point), Roy Kleukers and Luc Willemse (all from Leiden, Netherlands) coordinate the European Red-listing of Orthoptera (ERO). The group uses an open platform (Facebook) for discussions (search 'European Redlisting of Orthoptera' on Facebook). A red-listing workshop is planned for this winter. The South-African Red-Listing Initiative (SARLI) is coordinated by Corinna Bazelet. Dragan Chobanov and Michèle Lemmonier-Darcemont currently prepare a national red list for Macedonia.

While red list assessments are certainly important to raise the profile of Orthoptera in the conservation community, we also need to steadily promote their diversity, beauty, importance and threats. This can only be done, by increasing the number of events, publications (also to a wider audience), info material etc. related to Orthoptera conservation. Funding for practical conservation exists, but the number of practical conservation projects dealing with Orthoptera is rather limited. It is thus not surprising that funds, such as the Mohammed bin Zayed Species Conservation Fund, receive mainly application from conservation projects dealing with birds or mammals and hardly any dealing with Orthoptera. One principal problem is that funding for explorative research is scarce, which is urgently needed to map the distribution and abundance of Orthoptera. This information is necessary to perform red list assessments, but also to start conservation projects. Furthermore, many conservation projects, such as the Alliance for Zero Extinction, focus on taxa, where complete global assessments are available (which will probably not be reached in Orthoptera within the next decade). This underlines the urgent need to promote Orthoptera as subjects for conservation projects.

*Prionotropis hystrix rhodanica (Photo credit: Laurent Tatin)*

Another important problem in Orthoptera conservation is that Orthoptera are better known as pests than as endangered species. While bees are known to provide important ecosystem services as pollinators, it is hard to find a similar role for Orthoptera. The term 'ecosystem service' is mainly understood as 'service to humans' and not to the ecosystem. Of course, many Orthoptera play key roles as herbivores in grassland ecosystems and others are important predators, but this role is not valued in a similar way as pollination. We, therefore, need to search for arguments for Orthoptera conservation. The role of Orthoptera as food for many endangered vertebrates, such as birds (egrets, kestrels, rollers, bee-eaters, bustards, storks, shrikes, hornbills), mammals (monkeys, suricates, hyaenas), amphibians and reptiles, is often a better argument for their conservation as their diversity. Furthermore, we need to stress the importance of Orthoptera as bioindicators. Two major functions come to mind: (1) bioindication of land use (agricultural practices, forestry), (2) bioindication of biodiversity hotspots (due to their high levels of endemism). In addition to these functional approaches, we need to consider that most humans are mainly driven by emotions when they decide to become involved in conservation. Therefore, pictures are very important. Although we cannot present pictures of hunted rhinos or strangled albatrosses, we can offer amazing pictures of their diversity.

Among the few practical conservation projects for Orthoptera, the project on the Crau Plain Grasshopper (*Prionotropis hystrix rhodanica*) is particularly worth mentioning.




This subspecies is endemic to the Crau steppe in southern France. Little is known on its population size and distribution. A recently started mapping project has only discovered two new subpopulations in addition to the two already known subpopulations. One of the most well-known subpopulation is found in an area owned by the French Army, which plans to construct new buildings on this site. Our members Laurent Tatin and Antoine Foucart lead a project to stop these plans and ensure the survival of this impressive grasshopper.

The Grasshopper Specialist Group is also involved in other projects. For example, Anton Koschuh from Austria started a project on the status on Pseudopodisma fieberi in Austria. In another project, funded by the Mohammed bin Zayed Species Conservation Fund, our Mantid coordinator (Roberto Battiston) re-discovered Apteromantis bolivari in Morocco, which has not been relocated since its description. Currently Roberto, José Correras and Pedro Cordero work on a taxonomic revision of the genus Apteromantis. Roberto also coordinates the red-list assessments of European Mantodea.

The Grasshopper Specialist Group has meanwhile been represented also in several IUCN publications. We usually present updates of our work in the newsletter of the IUCN Species Programme, 'Species'. We also contributed several taxa in the 'Amazing Species' initiative, which is weakly updated on the web page of the IUCN red list. Furthermore, we managed to name one species, the Beydaglari Bush-Cricket (Psorodonotus ebneri) for the book 'Priceless - or Worthless', which presents the 100 most threatened species on earth (can be downloaded for free on the website of the London Zoological Society). Although it is likely that there are many more Orthoptera, which would have qualified for this book as well, it must unfortunately be acknowledged that our data is very scarce for most species. Another book, which is worth mentioning, is 'Spineless' - a report on the status of the world's invertebrates (which can also be downloaded from the website of the London Zoological Society). Unfortunately, in the printed version of this book, photos of several Orthoptera are erroneously identified (we did not get any proofs to correct this). I already asked to correct at least the pdfs on the internet.

In September 2012 the IUCN World Conservation Congress was held in Jeju, Korea. At this congress the Grasshopper Specialist Group was represented by several posters, illustrating the diversity of Orthoptera. Furthermore, Klaus Riede organized a 'knowledge cafe' at this congress dealing with 'Bioacoustic Monitoring and Red List Assessments' (see report by Klaus Riede in this issue). The World Conservation Congress is a very useful platform with many highly motivated participants dealing with conservation and ideal for networking. I am convinced that based upon the new contacts that emerged during this congress, some new conservation projects on Orthoptera will be started.

In order to further raise the awareness on the threats to Orthoptera, we welcome any involvement of new members, which we will be happy to accept for the next IUCN Quadrennium. Membership is for free and only requires that you are willing to contribute to conservation projects, red list assessments, management plans and other activities. You may also become member of our Facebook 'Grasshopper Specialist Group'. If you are interested in participating, send an e-mail to Axel Hochkirch, Chair of the IUCN/SSC Grasshopper Specialist Group (hochkirch@uni-trier.de).

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# Bioacoustics for species monitoring – a new tool for Red List assessment?

As early as 1962, Rachel Carson observed the loss of birds by pesticides, resulting in a "silent spring" without bird songs. It might be necessary to re-read this book, because our world is getting more silent and dull with every species going extinct, and a new generation of pesticides – the neonicotinoids – are right now accumulating in the environment, with catastrophic effects on all insects and, consequently, sooner or later for birds. Sound monitoring data are necessary for a timely documentation of these and other detrimental effects. Bioacoustic monitoring of vocalising animals is a novel monitoring approach, and its potential for Orthoptera assessments is evident. Most crickets and grasshoppers produce species-specific songs, and at least with respect to the number of species, Orthoptera dominate most insect soundscapes and habitats, ranging from grasslands to rainforests.

The Knowledge Café session at the IUCN World Conservation Congress in Jeju, South Korea, September 2012 (see article by A. Hochkirch), titled "Bioacoustics for species monitoring - a new tool for Red List assessment?" brought together experts working on birds, frogs and grasshoppers (see http://portals.iucn.org/2012forum/?q=0317). Experts agreed that bioacoustic monitoring provides an excellent opportunity for automated, hence cheaper, monitoring. Even though limited to actively calling animals, it provides data particularly for inaccessible regions or nocturnal rainforests, where species can be easily overlooked, but never overheard!

Our knowledge café took place in the afternoon on September 8th 2012, in a large room together with 10 parallel sessions, arranged on round tables and under difficult acoustic conditions. Due to the limited available time and lack of projectors we abstained from traditional power point talks – surprisingly, the resulting brainstorming proved to be quite effective!

Bruce Beehler, an ornithologist working with Rapid Assessments at Conservation International, reminded participants of experts, such as the late Ted Parker, were able to recognize all South American birds by their songs. Recordings could be made accessible to such experts via internet, and they could help to identify species in soundscapes recorded in endangered habitats. As an example, I mentioned our autonomous recording stations already deployed by the EU-funded Life+project AmiBio in Attika, Greece (www.amibio-project.eu, see *Metaleptea* 31(1)), a cooperation between our Zoological Research Museum of Bonn, Germany, and the University of Patras, Greece. Stations are now functional, generating terabytes of sound data since 2010. Similarly, in marine ecosystems, whales and dolphins are already being surveyed by a wide network of hydrophones or regular surveys (http://whale.scientificamerican.com/). Huge amounts of data are now stored in a long-term archive established at ZFMK, but participants agreed that other large sound archives such at Macaulay sound library, Cornell University, or Tierstimmenarchiv Berlin should agree on common data exchange protocols, eventually supported by sponsors from IT industry. In addition, such huge amounts of data require automatic species recognition. Co-organiser Uwe Riecken from the Federal Agency of Nature Conservation in Germany (BfN) reported on a workshop on Computational Bioacoustics held in 2008 in Bonn. The publication (available at http://www.bfn.de/fileadmin/MDB/documents/service/skript234.pdf) compiles promising results for automatic song recognition and classification, but even until today there is no killer app available. Automatic classification remains a big challenge, particularly when analysing complex multispecies recordings from rainforests. Hopefully, these technical issues can be discussed in more detail during a follow-up workshop at ZFMK in Bonn, Germany, in June 2013, while bioacoustic aspects referring to Orthoptera will be deepened during a special session at the 2013 Orthoptera congress in Kunming. Axel Hochkirch (Trier University, Germany), who is leading the IUCN SSC Grasshopper Specialist Group (GSG), emphasized that insects do have highly stereotyped songs, and was optimistic that automatic grasshopper song classification will be available in not-too-distant future. Jaime Garcia Moreno, executive director from the amphibian survival alliance, was equally optimistic about reliable semi-automatic detection of frogs and toads sounds, and pointed out an urgent need for continuous monitoring of a high number of critically endangered amphibians. However, a concerted effort of engineers, computer specialists, and eventually support from big companies working in the field might be needed to solve computational challenges, which will be discussed in more details in a follow-up workshop to be held in June 2013 at the ZFMK Bonn Museum. Uwe Riecken pointed out that the German Federal Agency and other European nature conservation governmental organisations are highly interested in developing more streamlined biodiversity monitoring protocols, providing input for pan-European biodiversity indicators, FFH species monitoring

and Natura2000 site management. Consequently, bioacoustic monitoring initiatives have to establish links between IUCN Red List assessment and other indicators, such as the Biodiversity Indicator Partnership (BIP: http://www.bipindicators.net/), the pan-European "Streamlining European Biodiversity Indicators" initiative (SEBI: http://www.eea.europa.eu/publications/technical_report_2007_11), and the developing network of observatories such as GEOSS and Lifewatch (http://www.Lifewatch.eu)). Nick Holmes from California-based Island Conservation initiative (www.islandconservation.org) reported on an on-going acoustic monitoring of island seabirds, using custom-made autonomous recording units and the first prototypes of software capable of detecting calls of cryptic petrels, or even estimate the size of seabird colonies. Participants came to a conclusion that better cooperation is needed, bringing together the aforementioned fragmented monitoring initiatives. Common protocols on recording, data storage and exchange could add value to the existing data sets, because properly archived island or amphibian recordings could also be analysed by insect specialists. Existing sound archives such as Cornell, Macaulay or Tierstimmenarchiv will play a crucial role in such a network, providing validated reference recordings to be used by experts and IT programmers. It is therefore timely that OSF has recently been enriched by a considerable number of Orthoptera recordings, formerly hosted by the somewhat hidden SYSTAX database (tick the "sound" box at http://www.biologie.uni-ulm.de/systax/index2_e.html?navigate=nav_e.html&display=http://www.biologie.uni-ulm.de/cgi-bin/portal/portal.pl?lang=e). In addition, archives should be accessible for the general public: the Tierstimmenarchiv has already opened up its archives by connecting thousands of bird songs to the Europeana cultural heritage database (http://www.europeana.eu/portal/search.html?query=europeana_dataProvider:%22Museum+fuer+Naturkunde+Berlin,+Tierstimmenarchiv%22, supported by EU-funded OpenUp! Project (http:www.open-up.eu). Finally, participants brainstormed on how bioacoustic information can help IUCN conservation efforts. Following a suggestion by ASA director Jaime Garcia Moreno, participants agreed that critical sites identified by the Alliance for Zero Extinction (http://www.zeroextinction.org/sitesspecies.htm) would be a good starting point, particularly because 600 critically endangered frog and toad species still vocalise within the 900+ critical habitats, and often in strictly confined areas, which (unfortunately!) often can be covered by only one recording unit. The resulting data set, including reference song recordings, should somehow be fed directly into the Redlist database.

We decided that we should try to organise concrete pilot projects, especially with respect to monitoring vertebrates on islands and within critical sites. But these monitoring efforts will certainly include grasshoppers, even though it will require considerable additional effort to establish the acoustic reference libraries and define the precise protocols necessary for monitoring results which are really useful for grasshopper redlisting.

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# The Institute IFAN: A forgotten entomological treasure

During one of my trips in November 2011 to Dakar, Senegal with my colleague Dr. Kotaro Ould Maeno, an acridology post-doc from Japan working in the Anti-Locust National Centre (CNLA) in Nouakchott, Mauritania, we visited the Entomology Section of the IFAN Institute at the University of Cheikh Anta Diop. It was amazing to see all the entomological collections (more than 10,416 specimens) that were still reasonably well preserved after more than 60 years. The representation of Orthoptera was also quite impressive – it included almost 500 species. Therefore, we found it interesting to share the institute's existence with the rest of our colleagues at *Metaleptea*.

We must remember that the IFAN Institute originated as the French Institute of Black Africa (the Institut Français d'Afrique Noire, or IFAN) around 1938. After Senegal gained political independence from France, IFAN then became in 1960 the Fundamental Institute of Black Africa (Institut Fondamental d'Afrique Noire). Located at Place Soweto in the heart of the Dakar Plateau, IFAN had been relocated in 1960 to the campus of the University Cheikh Anta Diop to facilitate the building of the museum, which remains a department of IFAN.

The following information is from the institute's French-language website (http://ifan.ucad.sn/index.php?option=com_content&task=vie

***Figure 1.*** *Holding a collection of locusts at the IFAN Institute in Dakar, Senegal are: (left) Dr. Med Abdellahi EBBE (OULD BABAH), Director General of the Anti-Locust National Centre (CNLA) in Nouakchott, Mauritania and Regional Representative of the Orthopterists' Society; and (right) Dr Abdoulaye Niang, Entomologist at the IFAN Institute. (photo courtesy of Dr. Kotaro Ould Maeno)*

w&id=7&Itemid=27).

### *History of the Laboratory*

The Entomology Section of IFAN was founded in 1945 by André Villiers and supported by Thierno Leye. It later became the Laboratory of Terrestrial Invertebrate Zoology. Several researchers, technicians, and staff, listed below, have successively set to work to build a collection that is now one of the largest, if not the largest, collections in Africa.

### *Establishment of the Insect Collection*

Insects were collected through numerous field missions, not only in Senegal but also in other countries in the region, particularly in Mauritania, Guinea, and Côte Ivoire. In addition, an old collection by Edmond Fleutiaux that identified many African beetles was acquired in 1948. The addition of other collections followed, such as those of P. Daget, and of T. H. E. Jackson. André Villiers himself was primarily responsible for the identification of new captures, especially of Coleoptera and Hemiptera, while Mr. Condamin was mainly dedicated to Lepidoptera. R. Roy was in charge of Orthoptera and Dictyoptera. S. H. Han turned his attention to the Isoptera (termites), A. A. Niang identified Diptera, and A. B. Ndiaye focused on Isoptera. Their work, along with the assistance of technical staff Babacar Faye, Daniel Lapolice, Marie Mbengue, and Boubacar Faye, created one of the largest collections of West African insects.

Many researchers outside the laboratory have contributed to enrich it, including Theodore Monod, who volunteered his time long after he had stepped down as Director of IFAN. Contributors also include Pierre-Louis Dekeyser, Jean Risbec, Bohumil Holas, Abdallah Ould Mohamed Sidia, and many others. Many specimens were obtained by exchanges.

### *Inventory of the Collection of Insects*

The specimens, classified according to the order, family, subfamily, genus, subgenus, species and subspecies, are well maintained in collection boxes or vials and tubes containing alcohol, and kept in a room where humidity and temperature are continuously monitored.

An inventory of the specimens in the collection began in December 1992 with the goal of identifying all information relating to the specimens: the name of the species and its taxonomic status, the date and place of capture, the collector, the author and date of determination, the number of samples, the stage / sex (larva, pupa, imago, male and female), the box number, the radius and shelf. The samples are well-documented.

The total number of samples in IFAN's collection at the University of Cheikh Anta Diop is estimated at over 300,000 classified in 3,003 boxes.

The number of species identified in this collection is 10,416. They are divided as follows among the different orders:

- Coleoptera (beetles): 5669
- Lepidoptera (butterflies): 1445
- Heteroptera (bugs): 1112
- Orthoptera (grasshoppers): 483
- Hymenoptera: 448
- Homoptera: 359
- Dictyoptera (praying mantises, cockroaches): 316
- Diptera (flies, mosquitoes): 301
- Odonata: 101
- Neuroptera: 87
- Dermaptera: 49
- Isoptera (termites): 45
- Phasmida: 1

### *Computerization and Data Management*

For safe and effective management of the collection, a computer database was created in 1993 using 4th dimension (or 4D) database management software. The computerization of the collection took place from 1993 to 1996 and has continued since 1999. Data on

Heteroptera, Diptera, Lepidoptera, Orthoptera, Odonata and some of the beetles have been entered.

As of June 21, 2004, the number of records entered (each comprising samples or sets of samples: males, females and larvae) was 42,354, including 8,467 species of insects from 2,400 towns and more than fifty countries, primarily in Africa.

### *Cooperation*

Nationally, the Laboratory of Terrestrial Invertebrate Zoology is working with local institutions through research programs, student supervision, and identification of insects (by IFAN). Collaborators include:

- ISRA in Dakar
- CDH in Cambérène
- ADRAO in St. Louis
- IRD (formerly ORSTOM)
- Centers in Dakar and in Montpellier
- Faculties of Science and Technology of the University of Dakar, Department of Animal Biology and Department of Chemistry.

Internationally, collaboration focuses on the following activities:

- the exchange of specimens and identification with more than 15 museums in Africa and Europe. In particular, these include the National Museum of Natural History in Paris, the British Museum London, and museums in Besançon, Tervuren, Congo, and Benin.
- acquiring new identification techniques, such as molecular identification taught at the University of Salford in England and the development of computerized identification keys as part of a collaboration with the IRD in Montpellier since 1997.
- the hosting of European student interns, as is the case with the Haute Ecole Provinciale du Hainaut Occidental.

### *Scientific and Technical Personnel*

*Researchers:*
André Villiers: 1945-1956:

***Figure 2.*** *Dr. Kotaro Ould Maeno and Dr. Med Abdellahi EBBE (OULD BABAH)*

Michel Condamin: 1950-1973 and 1978-1988
Roger Roy: 1958-1992
Bernadette Soltani: 1988
Aïssatou Drama: 1988-1991
Heat Han Sun :1992-1996
Abdul Aziz Niang: since 1992
Abdoulaye Ndiaye Baïla: since 2001
*Technical Staff:*
Thierno Leye :1943-1972
Babacar Faye: 1947-1982
Daniel Lapolice
Marie Mbengue:? -1994
Boubacar Faye: since 1985
*Other Outside Researchers:*
Theodore Monod, Pierre-Louis Dekeyser, Jean Risbec, Bohumil Holas, Abdallah Ould Mohamed Sidia, J. L. Cadenat, L. Chopard, M. Lamotte,. P. Lepesme

### *Conclusion*

This African entomological treasure should be preserved and supported in order to make the best use out of it in Africa and the rest of the world.

### *Acknowledgments*

Many thanks for Hanson Joleen, (Ph. D.Assistant Professor Professional Communication and Emerging Media Program Department of English and Philosophy University of Wisconsin – Stout) and her friendly students for kindly accepting to review and correct the English of this article. Thanks also are due to Charles Bomar for having kindly facilitating the connection between this group and me. This kind of help is very useful for the non-English speakers as widely present in our region.

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# Editorial

This past summer, I attended the International Congress of Entomology (ICE 2012), which was held in Daegu, Korea. There were more than 2,500 entomologists from all over the world presenting their latest research. Dr. Stephen J. Simpson, best known for his work on locust phase polyphenism, was the plenary speaker at the opening ceremony and a recipient of the the Wigglesworth Award from the Royal Entomological Society. It was a great meeting, but I wished there were more orthopterists in attenance. I am often struck by how few orthopterists there are compared to those who work on other groups of insects. Orthoptera is such a fascinating group and I feel that we need to do a better job of recruiting students. Our society's Facebook page is being populated by many who are interested in Orthoptera and hopefully this kind of interest can be translated into more orthopterists in the future.

*Metaleptea* is member-supported. I thank our members who have contributed articles and images, and I will continue to rely on our members to provide quality contents. To be published in *Metaleptea*, please send me any articles, photographs, or anything related to Orthoptera at song@ucf.edu with a subject line starting with [Metaleptea]. 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 in January 2013, so please send me the articles promptly. Also, please do not hesitate to send me feedback regarding *Metaleptea*. I look forward to hearing from you soon.

**HOJUN SONG**
**Editor**

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## Lichen Grasshopper (*Leuronotina ritensis*)

*Lichen Grasshopper (Leuronotina ritensis Rehn), Canelo Pass, Santa Cruz Co., AZ, 5 July 2012 (Photo credit: Robert A. Behrstock)*