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1st Brazilian Symposium on Orthoptera: "Orthoptera Knowledge in Brazil, State of the Art and Perspectives for the Future"

Migrating orthopterists from Argentina, Brazil and Germany have landed in the city of Recife last August to devour their favorite food: orthopterology.
Organized by Carlos F. Sperber and Marcos G. Lhano, the Symposium entitled "Orthoptera Knowledge in Brazil: State of the Art and Perspectives for the Future", held on August 8th as part of the XXI Brazilian Congress of Entomology (6 to 11 August), was a big success.
The event, supported by the Orthopterists ´ Society and the Brazilian research agency CAPES, was the first one totally devoted to orthopteroids to take place in Brazil - and perhaps in all South America. So, Sperber & Lhano just added a page to the history of orthopterology.
The presentations covered several fields of knowledge, such as: Biodiversity, Biogeography, Biological control, Cytogenetics, Ecology, Food preferences, Genetic structure of populations, Morphometrics, Nymphal development, Phylogeny, Taxonomy, Ultramorphology, and even the problem posed by the lack of Orthoptera experts in Amazonia and its implication on the maintenance of museum collections. We also gathered in a fruitful discussion forum focusing on the need of improving communication between South American orthopterists aiming at a more effective means of collaboration in terms of expertise, bibliographical sharing, access to collection specimens and student advisoring.
Participants were so involved in exchanging orthopterological ideas and experiences that none of us, Argentineans, Brazilians or Germans, had time to argue about soccer business. But everyone agreed in one thing: Sperber, Lhano, the Orthopterists' Society, and CAPES have made an amazing shot to goal.

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Abstract Index

CYTOGENETIC OF GRASSHOPPERS IN THE NORTHEAST REGION OF BRAZIL

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Acridoidea is grouped in six Acrididae families, Ommexechidae, Pauliniidae, Pyrgomorphidae, Romaleidae and Tristiridae. The neotropical grasshoppers, in general, have been cytologically studied according to the conventional staining. These studies have contributed to the characterization of different species, only in aspects related to diploid number, chromosome morphology and sex mechanism. Neotropical representatives have been less investigated with techniques of chromosomal differentiation, emphasizing Acrididae and Romaleidae, which have been characterized specially from the quantitative and qualitative point of view of the constitutive heterochromatin (CH) and identification of the nucleolar organizer regions (NORs). The karyotypic analysis of grasshoppers, especially those from the Northeast region of Brazil, has made possible a better chromosomal characterization of different species, according to a more refined cytogenetical analysis by the use of different techniques. Such as the C-banding, to evaluate the levels and the distribution of the CH; silver nitrate staining in order to determine the position and variety of the NORs; triple staining CMA3/DA/DAPI to analyze the constitutive heterochromatin on its base composition GC and AT; and the fluorescent in situ hybridization (FISH) with rDNA probes. Thus, the obtained information by different cytogenetical and molecular techniques, in a lot of kinds of grasshoppers, have allowed a greater understanding of the chromosomal phylogeny in this group, what will allow a better learning about the Orthoptera in Brazil, with the help of studies in other biological areas.

NEOCLASSICAL BIOLOGICAL CONTROL IN ARGENTINA: THE INTRODUCTION OF ***Paranosema locustae*** **(Microsporidia)** FOR THE CONTROL OF GRASSHOPPERS (Orthoptera: Acridoidea).

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Paranosema locustae, a pathogen of orthopterans developed in the USA as a biocontrol agent of grasshoppers, was introduced into 9 localities of Argentina between 1978 and 1982. Since all grasshopper species of Argentina are native, the case is an example of "New Association or Neoclassical Biological Control". The fate of the pathogen remained unknown for years but following its detection in1991, monitoring of introduction areas has revealed infections in 16 species of grasshoppers of the western Pampas. Infections have not been detected in other areas of the country, except for a few cases in one of the two application sites in northwestern Patagonia (Gualjaina). Grasshopper outbreaks have not been reported in the establishment area since the introductions while they were recurrent before them and still occur outside of the area. A similar trend occurs in Gualjaina. Based on this, plus the higher prevalence in the western Pampas than those known where *P. locustae* is native (North America), the occurrence of epizootics in several species, and the intensity of infections, it appears that the pathogen is acting as it was originally conceived, as a long-term depressor of grasshopper abundance. Simultaneous to its action as a control agent, *P. locustae*, by being a generalist pathogen among the Acridoidea, might be altering the structure of grasshopper communities. The decline of what were, previous to the introductions, two abundant species in western Pampas, *Dichroplus maculipennis* and *Borellia bruneri*, is given as possible evidence. Four other species, *Dichroplus alejomesai, Diponthus communis, Ronderosia forcipata* and *Scotussa daguerrei,* are identified as potentially under risk. Anyway, the degree of ecosystem alteration in the Pampas, from grasslands to agroecosystems, is such that the impact produced by *P. locustae*, although far from negligible, is just one of many other virtually irreversible factors modeling grasshopper assemblages in the region since long ago.

ACTUAL KNOWLEDGE OF THE ECOLOGY AND GENETIC STRUCTURE OF THE GRASSHOPPER *Cornops aquaticum* (BRUNER, 1906)

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Cornops aquaticum is host specific on *Eichhornia spp*. and *Pontederia spp*. (Pontederiacae). Its present distribution ranges from Mexico to Argentina. The number of juvenile instars (5–7) apparently mirrors the photoperiod and temperature pulses of different climatical conditions in the respective geographical regions. Based on life-history data, three working hypotheses are being investigated, to answer what determines instar number in this grasshopper species. It is being tested whether the varying number of juvenile instars represents a phenotypic plasticity of a single genotype or an adaptation that is genetically fixed, due to an evolutionary relationship of the host with its host-plant.

MORPHOMETRY, DEVELOPMENT, AND FOOD ACCEPTANCE IN *Cornops aquaticum* (**Acrididae: Leptysminae**) FROM ARGENTINA

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Cornops aquaticum Bruner (1906) is widely distributed in Latin America and has its life cycle associated with Pontederiaceae, in particular the waterhyacinth Eichhornia crassipes and E. azurea. Determination and identification of immature stages are needed to study population structures in a specific region. Food tests in nymphs and adults are important as this grasshopper is considered a possible biological control agent of the waterhyacinth, an introduced pest on artificial and natural water bodies around the world. The purpose of this study was (i) to evaluate which morphometric characters can be used to define immature stages; (ii) to determine the number of nymphal instars under different conditions of temperature and insolation; (iii) to compare food acceptance of nymphs and adults on vegetables and on macrophytes coexisting with E. azurea and E. crassipes. First-stage nymphs were reared at two localities (Corrientes: n=29, 28, 24; Santa Fe: n=26, 16). Morphometric characters taken were: length from fastigium to end of tegmina (A), length from fastigium to end of abdomen (B), length of hind femur (H), fresh weight, length of antenna (L), and number of antennal segments. Length of the hind femur (H) was the most constant and precise character in each nymphal instar, subject to little measuring bias and easy to obtain when working with high population densities. The number of developmental stages depended on sex, with male nymphs having five and female nymphs five or six instars. Food tests with about fifteen different macrophyte and vegetable species offered to 30 nymphs on each plant species during 12 days showed that survival was highest on E. azurea and E. crassipes.

THE LACK OF ORTOPTEROLOGISTS IN THE AMAZON AND IMPLICATIONS FOR SCIENTIFIC COLLECTIONS - A CASE STUDY

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The lack of taxonomists and other researchers on the insect order Orthoptera in the Amazon region is a sad reality that calls for solutions to the problem of dealing scientifically with these insects. The Amazon region comprises an extensive biome with a variety of environments and plant formations, with high biodiversity, where the Orthoptera stand out because of their often high abundances and number of their species. The lack of ortopterologists who dedicate themselves to the study, inventory, and identification of these insects is directly reflected in the inadequate quantity of corresponding entomological material in museums. In the Entomological Collection of Museu Paraense Emílio Goeldi (MPEG), in Belém, for example, the Acridoidea (grasshoppers) are represented by approximately 0.11% of the total number of pinned insect specimens. Until mid 2002 this situation was due to the absence of a researcher dedicated to the study of this group. Currently, the holdings of Orthoptera in the collection have increased by more than 100%, and the number of identified species and genera has also improved significantly. Most orthopteran specimens in the Entomological Collection came from sporadic field samples, and generally the more widespread and abundant species were captured since collectors searched casually and used nets. As a result, many duplicate specimens and a generally poor level of taxonomic identification can be observed in the Orthoptera collection of the MPEG, hindering, at the same time, the training of new specialists in the group.

ULTRAMORPHOLOGY AS A TOOL FOR CRICKET'S TAXONOMY

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At present, many structures can be better analysed by methods usually not often used in the taxonomy of different taxons. Scanning electron microscopy analysis has been helpful in answering some questions. In crickets we can cite some examples: Pars stridens: The analysis of this structure has provided a better characterization of some cricket groups, for example, genus Gryllus. This genus is composed of cryptic species, distinguished by the analysis of the calling sound and this analysis has contributed a lot in the distinction between species. Besides the ultramorphology, morphometric study is also used, having very good diagnostic characteristics. The metanotal gland: these structures have been previously cited, especially in papers about crickets' behaviour, but without a precise description of its morphology. Studies performed with the genus Eidmanacris showed specific differences in the group of structures that form the metanotal complex. The analysis of these structures in this genus puts the species in well-defined groups. Proventriculus: this structure was analysed in crickets of the genus Gryllus and Endecous. Some characteristics observed in the species of genus Endecous, taken from different habitats, permitted the suggestion that some consideration be given concerning the diet of these crickets.
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TAXONOMY OF THE NEOTROPICAL ACRIDOIDEA

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For the treatment of this subject, it seems necessary to separate it in two important sections. The first one refers to the composition of the Neotropical fauna of these insects; the different taxonomic groups in it; their relations with other groups of the world fauna, and the possible origin of each of these groups. On one side are the acridoids of a strict Neotropical origin, such as those belonging to the families Xyronotidae, Proscopiidae, Tristiridae, Ommexechidae, Paulinidae and Romaleidae. On the other side, the groups belonging to the world fauna: Pyrgomorphidae, Eumastacidae and Acrididae. But, within the very large family Acrididae, its different subfamilies have different distributions, and possibly too, different origins. Some of them, such as Proctolabinae, Copiocerinae, Leptysminae, Ommatolampinae and Rhytidochrotinae, are limited to the New World. Others, such as Acridinae, Gomphocerinae and Oedipodinae belong to the World fauna. And there is too, the doubtful case of Cyrtacanthacridinae, whose origin might be either African or American. And Melanoplinae, considered until recently of North American origin, and for which a South American origin has been recently proposed. By the fact of being the Insects a very ancient group, it is necessary to take into account for the study of the origin and distribution of its different groups, certain elements such as those related to Continental drift, past glaciations and other climatic changes of the past. That would be, in a nutshell, the strictly taxonomic aspect of the present subject. The other aspect of the subject is historical, in the sense of human history, not geological one. It is related essentially to the beginning and the evolution of the knowledge of the orthopterous fauna, through the work of the different authors who have studied it. It begins obviously with Linnaeus, as it happens with almost all the Zoological and Botanical taxonomy. Among the many European naturalists who continued Linnaeus taxonomical work, many of them studied insects, and some particularly the Orthoptera. Among the last, we must mention in the first place the Swedish ones: Thunberg, DeGeer, Stål. In France, Audinet-Serville and Blanchard. In Germany, Charpentier, Burmeister and Gerstaecker. In Austria Brunner von Wattenwyl, born in Switzerland, but who worked mainly in Vienna. Giglio-Tos in Italy. Carl, Pictet and Saussure in Switzerland. Stoll in Holland, Bolivar-Urrutia in Spain. And in England, Westwood, Walker and Burr. After this first period of the European scientists, the study of the taxonomy of our acridoids moves, at least in part, to America, beginning in the USA with Scudder, Caudell, Hebard and Rehn. But also in Europe, some entomologists continue the study of our acridid fauna. In England, Uvarov, Dirsh, Kevan and Jago. Willemse in Holland. And in more recent times we can say that the study of this particular part of the insect fauna has been taken by entomologists of diverse countries. In Argentina we must of course mention José Liebermann, to whom we owe a good share of the identification of our acridoids. And Ronderos, who continued his work with more modern and strict criteria and techniques. In Brasil, Mello-Leitao, Costa-Lima and Toledo-Piza. And also Campos-Seabra, who made the most comprehensive collection of acridoids of Brazil, now kept in the Museu Nacional of Rio de Janeiro. But the list of recent entomologists who worked on the Neotropical acridid fauna is of course much larger. And, to mention only those who are no longer with us, we must remember Descamps, Kevan, Grant, Roberts, and Jago. Making an only exception I will mention, because of her importance, a living entomologist, young and very active: Christiane Amedegnato, who made the system of classification of the Neotropical acridids which is now universally used for this part of our insect fauna.

ECOLOGICAL STUDIES APPLIED TO GRASSHOPPER MANAGEMENT (Orthoptera: Acrididae) IN THE SOUTHERN PAMPAS, ARGENTINA.

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Since 1996, different issues of the grasshopper communities are being studied at 27 different sites in Benito Juárez county, Buenos Aires province, Argentina, The sites were classified as: native grasslands, halophilous communities, pastures, and moderately and highly disturbed pastures. Grasshopper mean density, species relative abundance, and species composition were estimated at each site via standard flushing and sweep net techniques. A total of 23 grasshopper species were collected. Melanoplinae was the most abundant subfamily in all sites, except for halophilous communities that were characterized by the presence of one dominant Acridinae species, Covasacris pallidinota. Cumulative species richness was 17 in native grasslands, 14 in halophilous communities, 19 in pastures, 18 in moderately disturbed pastures and 14 in highly disturbed pastures. Grasshopper and plant community relationships were examined. Direct gradient analysis showed relationships of grasshopper species to the vegetation variables. Covasacris pallidinota was located in halophilous communities, Dichroplus pratensis was in native grassland, Dichroplus elongatus and Scotussa lemniscata were located in seeded and disturbed areas.
Temporal changes in grasshopper communities were estimated over a 6 year period (1996-2001). Results allowed us to categorize years into non-outbreak (1996-99), transitional (2000) and outbreak (2001) based on the spatiotemporal characteristics of grasshopper density trends. On average, grasshopper density was over 7 times greater in 2001 than in the non-outbreak years. Species richness changed significantly in outbreak versus non-outbreak years. Nearly twice as many species were collected during the outbreak year vs. non-outbreak years. Results showed that a small number of species influence overall abundance from non-outbreak to outbreak conditions. D. elongatus contributed the most to the overall shifts in grasshopper density. Among the 23 species collected, D. elongatus was the most broadly distributed of all. Historically, Dichroplus maculipennis has been known as the most conspicuous species in the studied area. However, our results suggest that nowadays D. elongatus is the most common species. The data obtained was also integrated into a Geographic Information System (GIS), so overall density and specific abundance maps were generated for each year. Also, the land use maps were obtained from satellite images processing and changes in agricultural units were detected along the years. This analysis allows the identification of zones with high density of pest species, and becoming an useful tool for farmers and extensionists. Field experimental studies to evaluate the effects caused by different densities of D. elongatus (20 and 40 ind/m2) in soybean (Glycine max) plots with no till practice (first and second seedtime) were carried out. Results suggest that the two tested densities decrease the yield of this crop (between 12% and 41.7 %). Analyses are being conducted to assess the relationship between grasshopper and climatic factors.

WHAT ´S THE IMPORTANCE OF STUDYING THE BIODIVERSITY OF ACRIDOIDEA (**Orthoptera, Caelifera**) IN RIO GRANDE DO SUL?

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Because of its geographic positioning, Rio Grande do Sul presents ecological characteristics influenced by the type of soil, vegetation and the Atlantic Ocean, that together, can establish a great number of habitats, presenting very rich characteristics in its fauna and flora. In Brazil few papers are distinguished about researches that have focused the records and identification of species of grasshoppers associated to the pastures, native or cultivated plants. The necessity of a deeper study appears from there, especially from those that inhabit the wild vegetation. Thus, a gap from the knowledge of the native species of the Rio Grande do Sul and its host plants persists, especially in areas of environmental preservation, which limit us on the delineation of possible sustainable strategies to handling species that are plagues. Ecological indexes as result of studies are going to serve as subsidies for magnifying the integrated pest management, preservation and restoration of the natural ecosystem diversity seeking to find out and define more adequate ways of the human being to interact with the environment. The knowledge of the biodiversity of Acridiofauna in the State is scarce and the specialized bibliography records restricted information on the Acridoidea from this part of the country. In such case, surveys of biodiversity and papers about the taxonomy of grasshoppers in the State are priority and essential to the conservation and the management of these insects. Until the moment, no comparative and quantitative study of the biodiversity of acridiofauna, in a unit of conservation on Rio Grande do Sul, was brought up. Because of the lack of the data, the needs of this kind of work in the Southern part of Brazil is justified.

KNOWLEDGE ON THE GENUS ***Gryllu***s LINNAEUS, 1758 IN BRAZIL.

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The species of the genus *Gryllus* have been poorly studied in the neotropical fauna. The catalogue and synopses of the neotropical crickets are ancients and some of then were elaborated from museum specimens, based most of them on the external body and only some on genitalia morphology, which sometimes do not has enough variations between species. In this manner, former works do not allow us correct identification of species of the genus *Gryllus* that has several cosmopolitan and sometimes cryptics species. Nowadays the genus *Gryllus* includes nearly 80 described species, 13 of them with type locality in South America with only 3 in the Brazilian territory: *G. parilis, G. vicarius and G. assimilis*. It is verified that the diversity of species of *Gryllus* in the Brazilian territory is significant, however the general biology and the taxonomic knowledge is scarce. To solve the Brazilian *Gryllus'* classification problems, would be necessary over all, an intensive collecting work, describing the new species, considering the morphological structures allied to other taxonomic elements as bioacoustic and cytogenetics. Its makes indispensable an identification, revision and re-description, if necessary, of the described species. Bearing this in mind, this study shows the importance of the bioacustic together with the song producer structures, the cytogenetic and the male concealed genitalia sclerites in the identification of the field crickets of the genus Gryllus from São Paulo State, Brazil. The calling songs of the specimens analyzed were taped in the field, allowing to separate the crickets in four distinct groups. In each group, the pars stridens structures were studied under light and scanning microscope presenting peculiar features. Further cytogenetic observations showed consistent interespecific chromosomal differences among the four groups, as well as the presence of intraespecific chromosomal polymorphism in at least two species. The male concealed genitalia were basically the same in the four species. The song structure is enough to separate the four species here studied and the specific level is confirmed by consistent chromosomal differences.

SEMI-AQUATIC GRASSHOPPERS (ORTHOPTERA: ACRIDOIDEA: LEPTYSMINAE): THEIR IMPORTANCE, EVOLUTION AND STATE OF THE ART

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Grasshoppers are usually associated to dry and low humidity habitats. However, many species of the subfamily Leptysminae live in semi-aquatic habits and they are frequently associated with macrophytes plants. This Neotropical subfamily is at present composed by three tribes, divided into 22 genera and 86 species. One of this species (*Cornops aquaticum*) has been cited as a potential agent of biological control of waterhyacinth (Eichhornia crassipes and E. azurea). The general characteristics of the group focusing on their systematic, biology, ecology and etology will be briefly introduced here. Besides, the studies that are being conducted on the systematics and phylogeny of the tribes Tetrataeniini and Chloropseutini will be presented. This study is being finantially supported by CAPES (Brazilian Ministry of Education).

PHYLOGENY OF NEW WORLD PHASMATODEA

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The New World Phasmatodea are only superficially been researched. About 900 species are described to date, and many more await their discovery. The phylogeny of the New World Phasmatodea has been investigated recently (Zompro, 2004). One of the main results is that they form monophyletic units at the family level, rarely below. With the suborder Agathemerodea, represented by the single genus Agathemera STÅL, 1875, the fauna of South America includes the basalmost phasmids known to date. Five families of the other suborder, Verophasmatodea, are present in the New World. The superfamily Aschiphasmatoidea is represented by the Prisopodidae and two families in Madagascar and Asia, while the two families of Pseudophasmatoidea, Pseudophasmatidae and Heteronemiidae, are endemic to the New World. The Prisopodidae is the only family with members outside the New World. The systematic position of the representatives of the families Diapheromeridae and Phasmatidae, formerly assigned to the historical suborder “Anareolatae”, is still unclear, but at least up to the subfamiliar level the taxa are endemic to the New World. The superfamilies Bacilloidea and Phyllioidea are absent.

CRICKET ADAPTATIONS TO PERIODIC FLOODING IN CENTRAL AMAZONIA: PHENOLOGICAL RESPONSE OF *Aclodes n. sp.*

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The rivers Solimões, Negro and their affluents fluctuate their levels yearly, dividing the forest in two regions: one that is never flooded and another which is seasonally inundated. We analyzed crickets sampled with pitfall traps and canopy fogging, in periodically inundated forest (igapó, várzea and mixed-water inundated forest), along the water reflux period within one year (nine months), and in non-inundated forest (terra firme) along the whole year. Seasonality was analyzed adjusting mixed effects polynomial statistical models and logistic regressions. We studied a new species of *Aclodes* (Orthoptera: Grylloidea: Phalangopsidae), which was abundant on the litter of black-water inundated forest (igapó). *Aclodes sp. n.* presented regressed wings, and was absent in canopy samples. Adult females were most abundant in the beginning of the water reflux period, on September, while nymphs increased in abundance towards the end of the reflux period, on May. The probability of capturing adult females and males was highest in the higher altitude sites, which were the first to dry with the water reflux, and lowest in the lowest altitude sites, the last to dry. There were different sized nymphs all over the water reflux period and adult females presented eggs all over the reflux period, suggesting at least three main oviposition periods. We suggest that these crickets colonize the seasonally inundated forest mainly as adult females, which have already copulated, ovipositing during the water reflux period.

CRICKET EVOLUTION IN THE BRAZILIAN ATLANTIC FOREST

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The species of *Aracamby* and *Ectecous*, two genera of phalangopsid crickets with low vagility and high ecological fidelity to the forest environment, inhabit small endemic areas along the coastal forests of southeastern Brazil and their ranges are essentially parapatric. The widespread coincidence of endemic areas for species of both genera and also for harvestmen of the genus Gonyleptes strongly suggest that speciation in those taxa were mainly promoted by vicariance episodes, the only type of event that would replicate distribution patterns (and branching sequences in cladograms). The best model to explain this case is the one that considers forest fragmentation during drier periods of the Quaternary with retention of populations isolated in small forest refuges favored by localized orographic rain. Other putative cases of cricket distribution following a similar or coincident pattern regard the genera *Strinatia* (Phalangopsidae), Paranurogryllus (Gryllidae), *Amanayara* and *Zucchiella* (Trigonidiidae, Nemobiinae) but those need further investigation.

Symposium Participants l
Edison Zefa, Maria Laura de Wysiecki, Soledad Capello, Marcos Lhano, Carl
Carlos Sperber (standing), Ana Lucia Nunes, Kati

isted from left to right:
los Lange, Francisco A. G. de Mello, Mello's friend, Celeste Franceschini,
a Matiotti, Carmem Fontaneti, Oliver Zompro.