Metaleptea

The ORTHOPTERISTS' NEWSLETTER

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In this Issue . . .

A MESSAGE FROM THE EDITOR

In all the years that I have been Editor of *Metaleptea*, and it has been more years than I care to admit, I cannot remember having completed my task of putting together an issue with more sense of satisfaction than this particular one. It is the first time, for example, that I didn't have to plead and scrape together an assortment of miscellaneous articles to make the issue big enough to produce. I made a single request to a sampling of our membership for information from them and received (almost immediately) a very high level of response. The articles and features in this issue are just a portion of that response. For those who sent in articles not appearing in this issue, I just want you to know that they will be in the next one, which should appear sometime in early March, 1991.

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I have sent in the same envelop along with this *Metaleptea* information regarding the publication of our new journal, the *Orthopterists' Journal*. This is an exciting event. Not since the unfortunate demise of *Acrida* have orthopterists had a publication devoted exclusively to research in their particular specialty group. However, because of a more sophisticated and enlightened concept of the phylogeny of the Orthoptera, the *Orthopterists' Journal* encompasses more than nine orders of insects, from the Phasmatodea to Orthoptera *sensu stricto*. We think the journal will be a big success. We are beginning on a conservative level, however, and will soon put together the first issue based on solicited papers from several world-respected authors. Thereafter, issues will appear as the need arises to deal with incoming papers. Dr. Nick Jago will be Editor of this series, and I personally wish him well in his efforts to make the journal a success.

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Regarding the *Proceedings of the Fifth Meeting of the Orthopterists' Society*, I can say that it is completed. Both you and I await our copies of the *Proceedings*. I expect its arrival to the membership within the next month or so. I must say that I haven't seen the final form of this volume, but I expect that Dr. Jaime Gosalvez has done an excellent job in completing the task of compiling all of the edited drafts which both the authors and I have sent to him.

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In the near future I hope to assemble the next issue of *Metaleptea*. As always, but especially now because I am getting excited at the new image of our Society and its publications, I ask each of you to submit any information, jokes, cartoons, illustrations, short scientific articles or manuscripts, anything pertaining to the orthopteroid insects, that might (even remotely) be interesting to our membership.

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In the meantime I wish each of you a Happy, Prosperous, and Productive New Year, 1991!

David A. Nickle
Editor, Orthopterists' Society

COMMENTS

THE EXECUTIVE DIRECTOR'S COMMENTS

S. K. GANGWERE

I spent last summer at the biological station that I direct for my university and early autumn on a research trip to the Balearic Islands, Spain. Though I am continuing on administrative leave for the remainder of the fall semester, I find myself back at my desk confronted by an imposing backlog of society business, professional correspondence, etc. I thank you for bearing with any unseemly delays in responding to your inquiries. Among items that required early attention were updating of the Society's membership rolls and mailing of its Fall 1990 billing and a ballot to approve a $15 supplemental publication charge. That done, I now turn to my report for *Metaleptea* 12(2).

6th International Congress . . . . . .

President Otte and I have been engaged in preliminary discussions with individuals from several Pacific rim institutions bidding for the 6th International Congress of the Orthopterists' Society, scheduled for 1992. We expect to make a final decision within a month or two and, assuming approval by the Board of Governors, will announce the successful bid in *Metaleptea* 13(1).

A new monetary Award Proposed . . .

The Board of Governors has just approved acceptance of a gift of money to bestow certificates entitled the "D. C. F. Rentz Award." These certificates will be given, one each, in recognition of outstanding research by either junior or senior orthopterists working in the following areas: systematics, ecology, behavior, and control. The gift will be used to prepare the certificates, and the residue of funds will draw interest and accrue to a second "Recognition" account to which the membership as a whole is invited to make donations. (Remember, the Orthopterists' Society is officially recognized as a tax-exempt organization by the US Government's IRS). According to the plan, the "Rentz Award" will be given to four deserving individuals, one or two of whom will also receive a "Recognition Award" consisting of partial travel to the society's next international meeting. The amount of travel to be given will be determined by fund availability. Inasmuch as the "Rentz Certificate" represents qualification for the "Recognition Award" rather than being additional to it, both will foster orthopterological research, yet neither will dilute the impact of the other.

I am informing you of this deserving new award program in hopes that many of you, both of the United States and of other countries, will want to make your donation before the end of Fiscal Year 1990. Simply specify that your contribution is to be used toward the "Recognition Award."

Endangered Orthopteroids . . . . .

I call your attention to Michael Samways' News Report No. 1 of the Species Survival Commission of IUCN (The World Conservation Union). The Commission has long enjoyed a leadership role in matters of international conservation through, among other activities, its Red Data Books and Action Plans. There are already Specialist Groups (SG) for a number of insect and mollusc taxa, and Dr. Samways proposes instituting a Specialist Group for Orthopteroidea. He has been in touch with me as your representative and as someone with a continuing interest in the Red Data Books. You may know that I am senior author of a recently written "Libro Rojo" of the Iberian Peninsula, and I am currently in early stages of preparation of such a book for northeastern United States. The Orthopterists' Society is an appropriate forum for the Orthopteroidea SG, so Dr. Samways asks all members interested in serving in the group to be in touch with him.

A new German Orthopterology Society . . . . . .

Dr. Gerhard Schmidt, of Hannover, Germany, has informed the Orthopterists' Society of formation, on 11 December, 1989, of the Deutsche Gesellschaft fur Orthopterologie. The 1st Annual Meeting of the new society was held at Erlangen, Germany, on 23-25 February, 1990, at which Dr. Klaus-Gerhard Heller, of Erlangen, was named first Chairman. President Dan Otte and the other officers and I of the Orthopterists' Society welcome this new organization into our midst because it provides us with yet another means to strengthen ties with the German scientific community and assists us in furthering the discipline, Orthopterology, that both of our societies serve.

More Finances . . . . .

The society's bank accounts have been seriously depleted by the recent 5th Meeting, and other commitments remain to be paid. Our 15 November, 1990, checking account balance is only $3,800.82 and our money market savings account balance only $3,329.00. I urge prompt payment of any dues owed. Your help will be appreciated. Kindly direct all payments and financial inquiries to Treasurer Roger Bland (Biology Department, Central Michigan University, Mt. Pleasant, MI 48859). Incidentally, Roger tells me that he occasionally receives foreign checks written on a US bank in US currency but lacking a computer routing code (a series of numbers and symbols). Roger is obliged to return checks lacking the code because of the necessary collection fee, often costing as much as the entire dues payment made. Please examine any check you send us for possession of a routing code.

NEW MONTANAN DECTICID, A GLACIAL RELICT

by

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We have been studying the population dynamics of grasshoppers at the National Bison Range near Molese, Montana since 1981. These studies have included the use of enclosed field populations to assess the importance of food limitation, interspecific competition, and predation in limiting grasshopper populations. In June of 1989, we established experimental grasshopper populations at a new site in the 9000 ha wildlife refuge. Unexpectedly, we found an abundance of a large decticid (Tettigoniidae) (3-5/m^2) at this site. Because there were insufficient numbers of several grasshopper species for us to initiate experimental populations, we stocked the excess enclosures with the decticid.

Our encounter with the decticid was serendipitous because we had been studying another site 100 m away on the other side of a rock outcrop for the previous 5 years without encountering them. To our surprise, the decticid is a new species of the genus *Steiroxys* (David Lightfoot is examining specimens). Adult females are large, attaining a body size of 1000-1400 mg fresh mass. More surprising, since finding this species, we have captured more than 1000 individuals without finding a male. The females are diurnally active, flightless, and slow-moving. We have searched without success for males at other times of the day and in the surrounding vegetation types. Furthermore, all of the recently emerged nymphs that we have captured are females. Female nymphs reared in the laboratory do deposit eggs as adults. Currently, we are trying to hatch the eggs to assess their viability and to determine whether any males are produced. But it appears that this species is parthenogenetic.

Since initially finding this species, we have located populations at three other sites on or near the Bison Range. John Henry has found a population approximately 35 km to the north, and Jeff Moorehead has found the species 50 km to the east in the Mission Mountains. The populations occur at elevations above 1300 m in lush meadows on north or northwest hillsides. These meadows are in small depressions (area less than 0.5 ha) where deep organic soils accumulate. Here the decticid feeds principally on forbs, such as lupine, yarrow, and dandelion (90% of crop contents).

Interestingly, all of these populations, except in the Mission Mountains, are found on hills that were islands in Pleistocene glacial-lake Missoula. Furthermore, the shoreline of this Pleistocene lake was just below 1300 m, the lowest elevation at which the decticid is found. The distribution of this new species appears to have been shaped by this 550 m deep lake that covered most of western Montana more than 12,000 years ago.

One might think that the habitat of this species is restricted to areas with microclimate conditions like those found in the Pleistocene. Using experimental populations of the species established in other habitats, we know this is not the case, since the decticid grows and survives better in habitats where it does not naturally occur. Competition with other Orthoptera cannot account for the decticid's habitat distribution, because it is a superior competitor reducing densities of grasshoppers in our experimental populations by 33-91%.

However, using tethered individuals, we found that this slow-moving and soft-bodied decticid is preyed upon by birds 3-4 times more heavily in the habitats where it does not occur. These areas have 40-70% bare-ground, while the inhabited areas are at most 20% bare. We believe that individuals of this decticid require vegetation cover to escape birds. Do predators limit the distribution of this locally successful herbivore?

We do not believe that predators alone limit the decticid's distribution. Does the availability of oviposition sites limit distributions? Could diseases, parasites or parasitoids limit distributions? What are the implications of parthenogenesis for this species? This new and unique species raises many interesting questions.

FOREST FLOOR KATYDIDS OF THAILAND

by

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Despite a great diversity of katydids which become active during the night, searching for Tettigonioidea in a tropical forest in the daytime is rather discouraging. Acridoidea gather at the forest edge or in larger clearings, but Tettigonioidea are hardly ever seen. An exception are species of the genus *Lipotactes* Brunner 1898 (Tympanophorinae) in southeast Asia, which already attracted my attention on my first visit to Thailand in April 1985. They live on the forest floor, usually on sparsely covered ground, where they are often found sitting on scattered herbs and grasses rising slightly above the litter.

I found two species: *L. montanus* Ingrisch 1990 in the mountains of northern and central Thailand and *L. silvestris* Ingrisch 1990 in lowland forests near the Cambodian border (Fig. 1). These rather small, brownish katy-

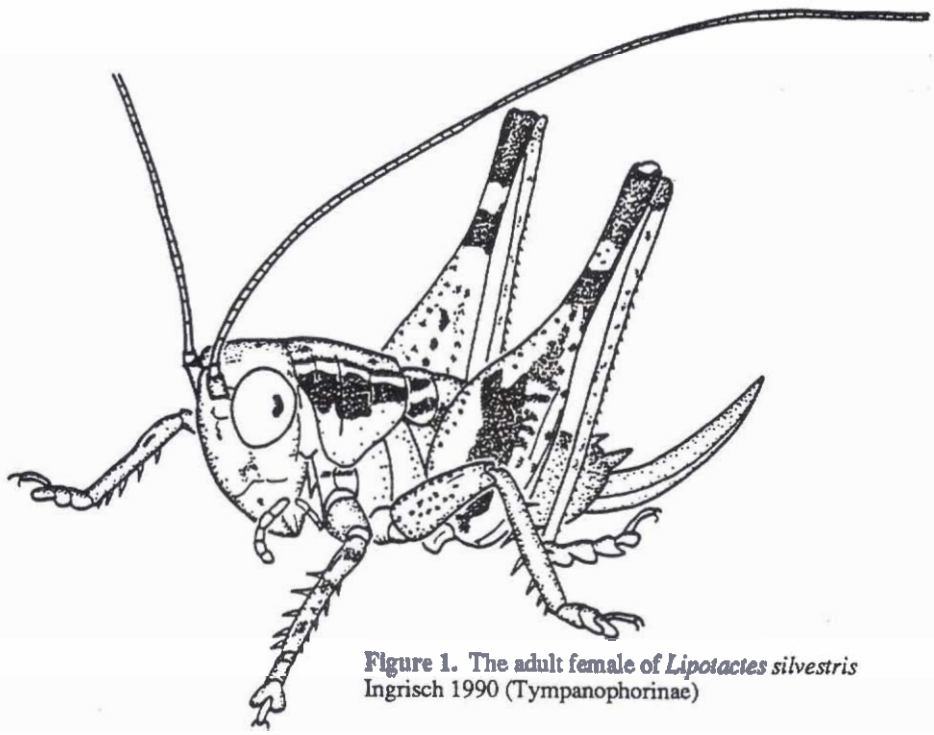

Figure 1. The adult female of *Lipotactes silvestris* Ingrisch 1990 (Tympanophorinae)

dids (8-14 and 13-21 mm body length, respectively) with reduced wings are striking for their large, triangular heads with voluminous eyes. They are hunters. Moving prey are fixed with the great eyes in a manner similar to the behaviour of mantids. It is interesting to watch them turning their heads toward flies running or flying nearby. If the fly becomes motionless for a while, *Lipotactes* quickly loses interest, but if it comes close enough and continues moving, *Lipotactes* will run to or jump on its prey from a distance of up to 20 cm, and grab it with the mandibles. It also uses the forelegs to hold larger insects. In the laboratory, I could breed larvae from hatchlings to adults, using *Drosophila* as the only food. Houseflies were also captured by the adults, and even pieces of *Tenebrio* larvae were readily eaten when given by forceps.

Stridulation is similar in both species. It is a continuous song, close to or in the ultrasonic range: a very faint "sssssss", which I was able to hear no farther than half a meter away.

The eggs, also similar in both species, are black, long-ovoid, and about 3 mm long. The surface of the chorion is stippled and bears a network of polyhedra with prominent borderlines. The eggs were readily laid in pieces of polystyrol standing vertically in the cages, a behavior usually found in species that oviposit in plant stems.

The eggs of *L. silvestris* developed, at 24° C and on moist filter paper, in about two months (65 + 5 days). Larvae of this species were bred in cages of 43 x 25 x 40 cm with a 60-Watt lamp as a source of light and warmth. Up to 26 young or 12 medium-sized larvae to adults could be kept in the same cage without cannibalism occurring. Plants stood in the cages for structural diversity or as hiding places but were never eaten by *Lipotactes*. Male larvae moulted seven times, female larvae eight times before becoming adults. Development time from hatching to imago varied between five and eight months (151-206 days in males, 185-233 days in females). Adding two months for egg development, total development takes seven to ten months, thus leaving two to five months for imaginal life. There is obviously only one generation per year. Since in addition I travelled to Thailand in different seasons, I collected information on the phenology in the field, which agrees with the breeding data. I found adults of *L. montanus* from April to June, young larvae in September and October, older larvae (mean = second to last instar) in January and February, and a few last instar larvae together with adults in April and May. (From the months not mentioned above no observations exist). Adults of *L. silvestris* were also found from April to June but not in October.

From the above presentations as well as results from additional katydids of other subfamilies, I conclude that in tropical Asia many Tettigonioidea do not breed continuously, but only have one generation per year with a distinct phenology. Studying the factors that regulate seasonality might thus be as promising as with species from the temperate zone.

ORTHOPTEROLOGICAL STUDIES IN EASTERN ECUADOR (Part I)

by

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Despite its small area, Ecuador is a country of megadiversity and must be considered a real laboratory of evolution. Besides the well-known Galapagos Islands, the mainland contains an archipelago of "habitat islands", mainly determined by microclimate and altitude. Two Andean chains separate the great blocks of Pacific and Amazon rainforest, including all the ecological gradients from upper montane to lowland forest. The Amazonian part of Ecuador comprises 48% of the national territory. The area was nearly forgotten until 1967, when the discovery of oil stimulated the "development" of the region. Since then, public interest has shifted to the "Oriente"; roads were built and boomtowns came into being. With six indigenous lowland tribes, among them the warlike Waorani, the region is still considered to be wild and dangerous, and certainly the naturalist hopes that this will remain so.

When I first visited the Oriente in 1983, I planned to study communication behavior in Acridoidea. Financed by the department of Prof. Huber at the Max Planck Institute for behavioral physiology in Seewiesen, my project and my background were ethology and behavioral physiology. Having been imprinted with a European image of a grass-feeding, stridulating gomphocerine grasshopper, I found my first encounter with forest grasshoppers frustrating. Most species of Amazonian "grasshoppers" live up in the canopy, thus in no way confined to "grass", but feeding on dicotyledonous trees and epiphytes. Many species are brachypterous or apterous, with big eyes and long tarsi. Their inabilit to stridulate made my taping equipment superfluous, and I was quite happy when I finally found *Peruvia nigromarginata*, which is one of the few gomphocerine species and has a complex courtship behavior comprising optical and acoustical elements, similar to its well-known Old World relatives. This species inhabits riversides and patches of secondary growth. These "light gaps" are generated by fallen trees and go through a characteristic succession of plants—and grasshoppers! This fauna of pioneer species is much less diverse than that of the canopy, but several interesting species were represented with sufficient abundance for behavioral studies. Back in Europe, I contacted Christiane Amedegnato in Paris to determine voucher specimens from my behavioral studies and some other grasshoppers found in the old field communities and in the tops of freshly cut trees. To our surprise, this material contained several undescribed species and was distinctly different from the Peruvian material collected by C. Amedegnato and Marius Descamps. We realized that there were a lot of endemisms to expect in Ecuador which stimulated my hunting fever. Since then, on each field trip to Ecuador I dedicated some time to looking for unknown grasshoppers in the tree tops. There are lots of possibilities for getting material from there. Descamps collected systematically by cutting a hectare of forest. However, this is too expensive for a one-man expedition. Besides, it seemed senseless to cut trees in an area under heavy environmental stress, where new roads were being built daily. I therefore concentrated on searching in freshly cut trees along roads or in fields made for subsistence farming by the indigenous population.

Ecuadorian Amazonia is far from homogeneous. Several volcanoes rise above the Amazon lowland forest, and their specific mountain forests harbor a great variety of unknown endemic species. The altitudinal border for canopy grasshoppers is not known exactly—I collected specimens up to 1200 m which would mean that a lot of endemisms are to be expected in isolated mountain forests like those which girdle the volcanoes like Sangay, Sumbaco, and Reventador, or the sub-Andean mountain chain of the Cordillera de Cutucu.

In the following contributions to this miniseries I will describe my experience during several field trips between 1983 and 1989, especially with indigenous people of the Siona-Secoya tribe, and give preliminary reports about the material collected and analyzed. For anyone interested, most of this material is now deposited in the Museum Nationale d'Histoire Naturelle de Paris, and duplicates can be found in the laboratory of the PUCE,

the Pontifica Universidad Catolica del Ecuador, Quito, and at the Senckenberg Museum, Frankfurt/M, F.R.G. Most of them are Acridoidea, but a considerable number of Tettigoniidae have been collected also.

ADVENTURES WITH ANTITYPES AND ANTITHESES

by
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My most recent lab and field adventures have been with two atypical species. The first species, whose acoustic behavior I described at the 5th International Meeting of the Orthopterists' Society in Segovia, Spain, this last summer, was encountered during our search for chorusing katydids that would sing and mate in the laboratory. *Amblycorypha parvipennis* (Fig. 1) males chorus in a unique fashion; pairs of males alternate phrases frequently overlapping the end of the other's phrases and, where phrases overlap, they synchronize phonatomes (sounds produced by single wingstrokes). *Amblycorypha parvipennis* males produce much longer phrases (4-5 s) and much shorter intervals between phrases (3-4 s) than typical members of the subfamily Phaneropterinae (Shaw *et al.* 1990).

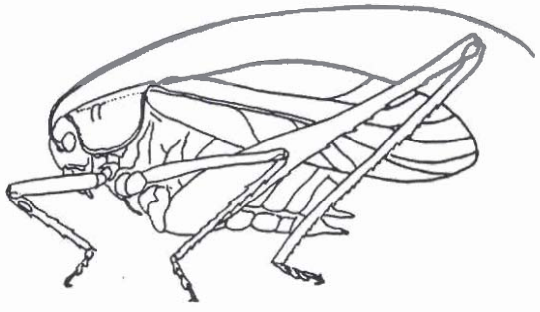

Figure 1. *Amblycorypha parvipennis* Still, adult male. *(Illustration by D. A. Nickle)*

Like females of other phaneropterines, *A. parvipennis* females advertise their presence by clicking at species-identifying intervals following the end of male song units. In most species, female clicks follow relatively short male phrases. *Amblycorypha parvipennis* females alternate 1-17 ($\bar{x}$ = 3.2) clicks with male phonatomes within a male's phrase. However, 75% of male ticks fall approximately equally just before or after the last phonatome of a male's phrase (Shaw *et al.* 1990).

After observing the aggressive and submissive displays of many animal species, Darwin stated his principle of antithesis. *Amblycorypha parvipennis* expresses antithesis in intrasexual as compared to intersexual communication and in response to hypotheses concerning its behavior. *Amblycorypha parvipennis* males compete for space by decreasing rate of sound output. An analysis of chorusing by pairs of caged males 3.3 m and 40 cm apart showed that males at 40 cm increased intervals between phrases as well as decreasing the degree of phrase overlap. In contrast, when clicking females were placed equidistant between the males, the rate of sound output increased because of decreasing phrase intervals, while phrase overlap increased (Galliart and Shaw, submitted).

One antithesis in this study was that eventual winners overlapped losers more when females were absent but less when females were present. We had predicted that the male that would win the female's "foot" would overlap the ends of the other male's phrases more not less. Mike Greenfield (1990) suggested that the nature of chorusing exhibited by each species was the result of males competing to keep the most informative portion of their song phrases free from overlap by the phrases of other males. The most informative portion of *A. parvipennis* male phrases would appear to be the end because the terminal phonatomes are louder than the initial ones. In addition, the female clicks occurring immediately before or after the last phonatome of a male's phrase usually are "jammed" by the phonatomes of an overlapping male. The phonatomes of overlapped and overlapping males slip out of phase because of slowing of phonatome rate by the male terminating his phrase. In lieu of our prediction, *A. parvipennis* males did the opposite, at least in the presence of the female.

The other atypical species I have become interested in is *Pterophylla beltrani*, (Fig. 2) the "migratory" katydid of northeastern Mexico. This species was the topic of a paper presented at the Segovia meeting by Dr. Ludivina Barrientos. I met Ludivina and *P. beltrani* on a trip to Mexico in 1985. Since then, I have published a paper on the acoustic behavior of this species (Shaw and Galliart 1987).

For those of you unfamiliar with this genus, *Pterophylla* males typically sing at night from the tallest trees at intermale distances of 15 m, and females are rarely seen. *Pterophylla beltrani* males sing day and night, and males and females form dense aggregations at the ends of branches of relatively small live oak trees in the eastern Sierra Madre. Unlike any other *Pterophylla* species with which I am familiar, this species has two color phases (purple and green) which

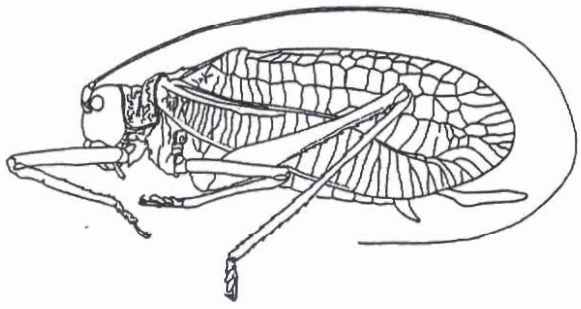

Figure 1. *Pterophylla beltrani* Bolivar, adult male. *(Illustration by D. A. Nickle)*

are density dependent. Rearing two or more individuals in a cage results in the purple phase, whereas insects reared in isolation are green. Like migratory locusts, this species may produce very dense populations. Populations exploded in 1970 and 1980 and the insects defoliated 1,200,000 hectares of forest in the eastern Sierra Madre in 1980 (Barrientos 1988).

Ending on an anticlimactic note, populations of *P. beltrani*, like those of *P. camellifolia*, exhibit differences in song and morphology (Alexander 1967, 1968; Shaw and Carlson 1969; North and Shaw 1975). Using these differences, Ludivina (Barrientos 1988) has identified four populations of *P. beltrani*, after collecting over a small portion of the probable range of this species. Using these same differences, she clarified taxonomic confusion between two sibling species, *P. beltrani* and *P. robertsi*. The ease with which these Mexican species are collected and the remarkable and easily detected population differentiation have stimulated Ludivina and me to seek funding to extend her morphological, acoustic and initial breeding studies as well as initiating molecular genetic studies. As with *P. camellifolia*, we hope to encounter contact zones and evidence of interbreeding between *P. beltrani* populations and even between *P. beltrani* and *P. robertsi*. A preliminary isozyme analysis of 56 specimens from one population of *P. beltrani* resolved thirty presumptive gene loci with 43% of these loci polymorphic (Krasfur and Shaw, unpublished). The level of average gene diversity ($\bar{H}8$ = 0.16) is high enough to support interpopulation hybridization (Barton and Hewitt 1985).

ARTICLE

GRASSHOPPERS AT THE UNIVERSITY OF ARIZONA

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Liz Bernays and I arrived in Tucson about 18 months ago, and we thought others might be interested to hear about work on grasshoppers in our labs. All the work is more or less directed towards our long term interest in food selection and feeding behavior of grasshoppers.

Liz Bernays has been working mainly on various aspects of learning in relation to food selection. She already has shown that *Schistocerca* exhibits food aversion learning, that is, if the insect has a bad experience after eating a particular food, it subsequently avoids that food. She also has shown food aversion to a particular plant, spinach. When it first encounters spinach, the insect takes a good meal, but on second and subsequent encounters it eats less and less, until finally it rejects spinach altogether (can you blame it?). However, if it encounters another type of food, it will eat readily enough. So this is a specific association with spinach. But we had no idea what was wrong with spinach. Recently, however, Don Champagne joined the lab as a post-doc. He did his Ph.D. in Vancouver with Neil Towers, a very well-known plant chemist. Don dug out the information that one of the peculiar things about spinach is its sterols. All insects require a dietary source of sterols because they cannot manufacture them and, many years ago, Rex Dadd, now at Berkeley, showed that locusts could use only certain types of sterol. The sterols of spinach were amongst those that Rex had shown were not utilizable. So adding two plus two to make five, Don suggested that perhaps this was the basis of the food aversion learning Liz had found. And believe it or not, they found that the addition of cholesterol or other usable steroids to spinach made it perfectly acceptable; the meal size did not decline and the insects just kept eating it.

So apparently the insect can detect the lack of an essential dietary constituent after just one meal and soon comes to reject the inappropriate food altogether. This is important because, in a natural situation it would result in the insect moving to another plant which, probably, would have the right balance of sterols. It also gives us some ideas about why these insects are polyphagous, and clearly it is much more complex than just getting the right amounts of proteins and carbohydrate. We do not know if similar mechanisms operate with respect to other essential dietary constituents, but they probably do; even slugs are known to exhibit food aversion learning to a food with the wrong balance of amino acids. If slugs can do it, surely grasshoppers can!?

Of course, the question we all want to answer is "What happens in the field?" Most grasshoppers are very sensitive about being watched and either disappear out of sight or freeze for long periods, so it is impossible to build up a picture of their normal behavior, except very indirectly. We decided that the answer might be to look at the aposematic species. We assumed that these insects were designed to be visible, and our previous work in Africa with an aposematic species, *Zonocerus variegatus*, had shown that it was easy to observe without disturbance. So we looked around for a suitable subject in Arizona. At first we started on *Dactylotum*, but our most extensive studies have been on the horse lubber, *Taeniopoda eques*. Although I say "we," nearly all the work has been done by a visiting grad student from Oxford University, Dave Raubenheimer. Dave has remarkable stamina and has been able to spend whole days, from dawn to dusk, recording the activities of individual grasshoppers so that we know everything that individual did in every minute of the day. Recordings were made on a hand-held computer used as an event recorder. The data sets are impressive, but so far Dave has done little more than take the cream off the data. One interesting point is that though these insects are known to eat a wide range of plants, in the course of a day an individual rejects or only takes small meals on nearly all the plants it encounters. Most individuals had only one or two full meals during the day, although they sampled a large number of plants. Interestingly, it was also true for most plant species that the insects ate progressively less on each successive encounter—just like *Schistocerca* on spinach! We think we have a lot to learn from these observations.

Another post-doc, Jerry Howard, is looking at what affects food selection by individual grasshoppers. We know, of course, that some species are polyphagous, but are all the individuals that make up the species equally polyphagous? It seems not, because Jerry finds that some individuals show distinct preferences for a subset of the plants eaten by the species as a whole, while others are more generalized. This is true for *Taeniopoda eques*, *Schistocerca albolineata* and *Melanoplus differentialis*, on which most of his work has been done. Interestingly, though, the insects on mixed plants always do better, in terms of survival and growth rates, than insects on single plants, even though they may prefer to eat a single plant.

Much to his relief, Jerry is approaching the end of a massive experiment in which he is examining the genetic component underlying different patterns of food selection in *M. differentialis*. He is rearing 27 pairs of families with the same father, but different mothers. The feeding preferences of the adults are known, and then the behavior and performance of the offspring are examined. So far it appears that all families, regardless of any preferences expressed by the parents, perform best on mixed diets. In some families, but not in all, the diet may be modified by experience, but so far it is not possible to say if this is related to the preferences of the parents.

My own principal interest is in sensory physiology and with a post-doc, Ann Ascoli-Christensen, I have been working on the physiology of chemoreceptors on the tibia and tarsus. The chemoreceptors of grasshoppers seem to differ from those of other insects that have been studied in having nerve cells that are relatively unspecialized. For example, the same cells apparently respond to sodium chloride as to sucrose, despite the fact that the chemicals produce opposite behavioral effects at higher concentrations. We also know that a different cell responds to nicotine and our recent work has attempted to answer the more general question how grasshopper chemoreceptors respond to chemicals that, from behavioral observations, are known to be feeding deterrents. Working with compounds from several different chemical classes, we conclude that deterrents may have their effects by stimulating a specific cell that presumably signals unpalatability. In addition, or instead, the deterrent compounds may inhibit the activity of other cells so that, if sucrose is present, for example, the input from the sugar-sensitive cells is suppressed. Consequently, the insect is not even aware that it has encountered something palatable. Interaction between receptors seems to be a very common phenomenon and probably is especially important when the insect encounters mixtures of chemicals as it does when feeding on a plant.

Most of this work has been done on *Schistocerca* spp. which are polyphagous, but we have recently extended our work to ask the question "is the difference in food acceptance by closely related grasshoppers with different feeding habits a consequence of differences in their sensory systems, or do their sensory systems provide basically similar information that is then interpreted differently within the central nervous system?" To answer this question we are looking at the behavioral and physiological responses of three gomphocerines, *Cibolacris parviceps* (polyphagous), *Syrbula montezuma* (graminivor-

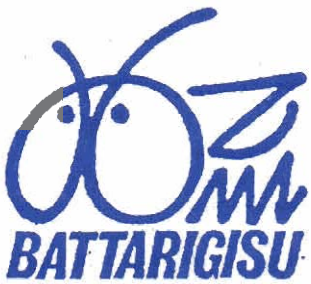
ous) and *Bootettix argentatus* (monophagous on creosote bush). We are part-way through this work, but so far the analysis of the sensory input is not far enough advanced to make any predictions.

As in any lab, these main lines of research are supplemented by a variety of other related minor projects carried out by ourselves with students. We are lucky to have an excellent undergraduate research program, and this gives us the chance to interact with some very bright young people.

We are not the only people here working on grasshoppers. Ed Arbas in the Division of Neurobiology is interested in the changes in neural mechanisms that occur when grasshoppers become brachypterous, and Bill Bowers, in Entomology, uses them extensively in his search for compounds that inhibit juvenile hormone. Several people in the Department of Biochemistry also use grasshoppers in some of their work, so overall there is a lot of interest in grasshopper biology.

'BATTARIGISU'

Sinzo Masaki
Laboratory of Entomology
Faculty of Agriculture
Hirosaki University, Japan



This is a synthetic word created by the (Japanese) Society for the Study of Orthoptera to name its publication. 'Batta' means grasshoppers. 'Gisu' is the suffix for katydid names derived from 'kirigirisu' which stands for *Gampsocleis burgeri*, the most conspicuous (in both size and song) of the katydids in Japan. These two parts are connected by 'ri' to unite Caelifera and Ensifera, and also to make a five syllable word that sounds comfortable as a Japanese word.

The Battarigisu Society was founded in April, 1978, and on the list of members distributed several months later were 28 people, including school children, university students, public officials, shop owners, school teachers, and local museum curators. There are many societies of amateur entomologists in Japan, but in most cases the members of these societies tend to be involved in collecting beautiful butterflies, moths, bizarre beetles, or watching bees, wasps, ants, etc. The Battarigisu Society seems, at least to my limited knowledge, to be the first group of non-professional Orthopterists in the history of entomology in Japan and perhaps also in the world, although listening to insect songs is (was?) one of the traditional seasonal entertainments in autumn. The Society grew rapidly, and more than 100 people are on the member list issued in 1988. You will find several professional scientists in the list, including myself, who are not necessarily Orthopterists but want to support the Society because of its sound activities making meaningful contributions.

The Battarigisu is published irregularly. It started as an 11-page brochure of xerox-copied hand-written articles mainly on collecting trips, records of distribution and discoveries of undescribed or poorly known species of Orthoptera. It has grown in both size and quality, though its informal nature and format have been intentionally retained. Some articles are reminiscent of those appearing in the *Metaleptea*. Among others, M. Kawai and Y. Kano, who are both public workers in Nara and Osaka, respectively, have devoted most of their free time to editing and distributing each issue of the Battarigisu. By the end of the last year, the Battarigisu attained a total of 84 issues with 3089 pages, indicating the great efforts of the two enthusiastic Orthopterists.

The Battarigisu is not a place for formal descriptions of newly recognized species or other original observational and experimental data, but it offers most useful columns for exchange of hot news. Discoveries of such and such forms which might be previously unknown appear from time to time, stimulating efforts for further research. As a result, more than 10 species of crickets and katydids have been properly named and described in appropriate scientific journals by members of the Battarigisu Society. Many others that have already been reported in the Battarigisu are waiting for formal publication.

One of the notable activities of the Battarigisu Society is the annual field meeting. This is regularly held in autumn for the obvious reason—the best season to collect mature crickets and katydids and listen to their songs. Through this excursion, the late Ichiro Matsuura played a leading role and had a great impact on the scientific development of the Society. He was an acoustic engineer by profession but his real interest seemed to be in singing insects, particularly crickets and katydids. He travelled widely not only in this country but also in southeast Asia and recorded songs of many species of crickets. His collection covers almost all the known (including unidentified) species of crickets in Japan. He showed the importance of songs in identifying crickets and katydids and the method of recording songs. He contributed short notices to the Battarigisu from time to time, but published a long series of papers on Japanese crickets in an entomological journal and illustrated oscillograms of most species. He had been a coworker of the late Professor F. Ohmachi, who pioneered the study of karyotypes of Gryllidae. Matsuura had, however, never studied the chromosomes of crickets. He listened to the songs and discovered that different species were intermingled under single names in *Teleogryllus* and *Loxoblemmus*. He gathered biological data by rearing such species, observed developmental characteristics, carried out crossing experiments and reached the conclusion in a very scientific way.

He was an inexhaustible source of information about the Japanese crickets, and always willing to offer much help to anyone, including myself, who studies Orthoptera. Sonagrams and oscillograms appearing in articles by Battarigisu members were provided by Matsuura. Everyone who knew him must have felt painful sorrow hearing of his death last autumn at the age of 78. The Battarigisu Society compiled his writings which amounted to 377 pages.

Matsuura left two enormous manuscripts on his desk, apparently intended to be published as separate books. Although the author himself could no longer open the pages, the two books have appeared this year. One is entitled "Natural History of Singing Insects" and the other "Why Do Insects Sing?—Science of Insect Sounds". The first one not only deals with the general biology of various species of crickets but also cites "Haiku" and "Waka" poems or old classic stories referring to crickets. The second one describes the song characteristics, geographic distributions and seasonal prevalence of various species of crickets and katydids, and discusses the mechanisms of sound production and thermal effects on the carrier frequency. This book is amply illustrated with many oscillograms, and about 32 forms of katydids and 75 of crickets are more or less referred to. In spite of its scientific value, it is written in Japanese of a rather informal style, and for that reason may attract more attention of laymen than professional scientists.

Because of the language barrier, the usefulness of these books is restricted. I believe, however, they would have long-lasting impacts on members of the Battarigisu Society and other interested people, and would help to develop able scientists who can make substantial contributions to our understanding of the poorly known fascinating world of Orthoptera.

Symbol mark of the 'Battarigisu' Society was designed by Miss Yasumi Fujita.

COMMENTARY

BATS AND KATYDIDS: REMARKING ON OBSERVATIONS BY OTTE AND ALEXANDER IN MALAYA

D.C.F. Rentz
CSIRO, Division of Entomology
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As one of the perpetrators of the "bat predation on rainforest tettigoniids" hypothesis, (see Rentz, *Entomological News*, 1975, 86: 129-140), I feel I must urge a bit of caution on the scope of its applicability. The idea that bat feeding activity might be responsible for the general lack of continuous stridulation on the part of Costa Rican rainforest katydids at Finca La Selva was prompted by the contrast between the generally continuous acoustic activity of other species on the outside of the forest, sometimes only a few meters distant, and the lack of such activity within the forest, even though the diversity of species in the forest was much greater. Discussion with a number of bat-people revealed that there were "leaf-gleaning" bats that scooped such creatures as lizards, frogs, and insects from the surface of leaves within the forest. When I asked whether these bat species flew outside the forest, the answer was negative, they were restricted to the rainforest alone. That was when I started to feel that the erratic, sporadic nature of the stridulatory activity within the rainforest might be a defensive device to reduce the chances of an acoustically-oriented organism homing in on a stationary sound source. Concomitant with this I suggested the generally longer antennae of rainforest katydids, usually presented drooping (see figure 1 in the above publication) might be useful in detecting the wind generated by the beat of bat wings and the usually longer claws of such katydid species which are often "dug into" the tissues of leaves when disturbed might also be an adaptation to prevent a bat on-the-wing from picking off the unsuspecting katydid.

The above was meant to help explain the situation in the La Selva rainforest. But it cannot be the explanation for katydid activity everywhere. I suspect there are a great many other factors responsible for tettigoniid acoustic behaviour and that the bat-predation explanation should not apply in all situations. But having suggested caution with regard to making blanket explanations regarding katydids, I report on the situation in Australian tropical rainforests where there are apparently no leaf-gleaning bats. Interestingly, the rainforest katydids here have continuous stridulatory activity similar to those outside the forest. They also prominently display themselves on leaves and branches. I have no idea what the explanation is for the situation in the Malaysian rainforests that Otte and Alexander report [see *Metaleptea* 12(1)] where a wide range of frequencies and a generally noisy situation was observed. But I don't think bats can be invoked to explain every situation.

As an addendum to what Otte and Alexander reported on the Malaysian rainforests, I can state that Australian tropical rainforests are generally depauperate for Orthoptera. There are few grasshoppers, only a few pyrgomorphs and a biroelline eumastacid genus or two, no tree-top species and no litter acridoids. The dominant group is the crickets; among tettigoniids, probably the phaneropterines are the most numerous, followed closely by the agraeciine conocephalines. And the numbers are very low compared to the situation in New World rainforests.

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RECENT ACTIVITIES OF VIC VICKERY

Past-President, Orthopterists' Society
Coordinator-Editor, *Field Guide* Project

I have not been known as one who is a regular meeting attender, although I had managed to attend all meetings of the PAAS-OS from 1976 to 1989. In 1989, I also attended the annual meeting of the Entomological Society of Canada in St. Johns', Newfoundland, and also the meeting of the Entomological Society of America in San Antonio, Texas. These were in addition to our meeting in Valsain, Spain. My wife and I considered driving from Montreal to San Antonio as we had done the year before to the E.S.A. meeting in Louisville, Kentucky, but we decided that winter conditions made that a bit risky.

Now—just to let you know that I have not become too decrepit—my wife and I have just returned from an 8000 km (5000 miles for you Americans) trip by car to attend the Entomological Society of Canada meeting in Banff, Alberta, Canada. My attempt to collect more specimens of the elusive Grylloblatta were frustrated by a heavy snowfall in the mountains. We managed the snow on the roads better than some other travellers we saw. Enough is enough, so we decided not to go to New Orleans for the Entomological Society of America meeting in December.

We touched base at several universities en route across Canada, and I was able to make some identifications for them and to solve some taxonomic problems.

Don't let anyone tell you that retirement means a life of ease. I suppose it could be, but I have been just as busy since I retired in 1986 as I was before—perhaps more so. I now have a computer in my office at Macdonald College (ditto at home), and my briefcase usually holds diskettes that I can work on at either end. I am also becoming known as a genealogist.

The printing firms that are dealing with the Orthopterists' Society *Field Guides* requested diskettes in WordPerfect so I had to make the transition from Wordstar 2000 (that I still use for many things) to WordPerfect, version 5.1. I seldom have problems switching from one to the other now, though at first it was difficult.

As I have mentioned the *Field Guides*, I expect a note on progress is in order. The first seven *Field Guides* (A1E, C2E, C2F, C7E, C7F, C8E, C8F)—see the last issue of *Metaleptea* (12(1): 5,7) for titles—should be printed within three weeks. More than 20 others have been edited. The edited versions, cleared by authors, are on diskettes, and diskettes and hard copies are in the hands of printers that are preparing "set-up" copies, or are ready for the printers.

The funds allocated in the original contract with CIDA (Canadian International Development Agency) will not be sufficient to publish the entire series, and I will soon be soliciting additional funds.

A number of authors who had agreed to write papers for the *Field Guide* series have not sent manuscripts to me, even though some of these were promised for last June. I hope these people will soon produce these papers. I don't expect to live beyond the age of 100, and I would like to have the project completed in 1991, not 2021.

Research—I still have time for some research. I am revising the genus *Timema*, the strange, small stick-insects that are known only from southwestern North America. The project is nearing completion. I thought it was nearly finished some time ago but since then have been sent two more undescribed species. I have three new ones now, one of which may be parthenogenetic. I have to wait until collections in 1991 either confirm this or reveal the males.

I completed a paper on the mantids of Baja California and am making progress on two more papers, one on the stick-insects of Baja California and the other on the crickets (other than *Gryllus*) of the same region.

Most orthopterists don't know that I have entomological interests other than orthopteroid insects. As a matter of fact I have worked with honey bees, both in research and in practical matters, for many years, longer than I have been involved with orthopteroid insects. I taught Agriculture for many years. I have now completed a book on honey bees. This was requested by my students (numbering in the thousands) over the years. The book, *The Honey Bee: A Guide for Beekeepers*, although it was published only late in September of this year, has already received excellent reviews and is showing signs of becoming a best-seller, at least among Canadian beekeepers. It has already been adopted as a text by several colleges and universities.

CHANGES OF ADDRESS
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NOTICES

NOTICE

ORTHOPTEROIDEA SPECIALIST GROUP

Species Survival Commission - IUCN

News Report No. 1

Many Orthopterists are concerned with the abundant and notorious species. Other specialists are interested in the curious or stridulatory, and yet others are interested in the threatened ones. It is to those of you who are interested in endangered Orthopteroidea that I appeal.

Firstly, let me introduce the Species Survival Commission. It is a component of IUCN (The World Conservation Union) and is a network of the world's most qualified specialists in species conservation who serve on a voluntary basis. Since its formation in 1956, the Commission has consistently provided international leadership for the conservation of species, their diversity and their habitats. It publishes Red Data Books and Action Plans, and provides biological information for instigating conservation measures. Among the invertebrates there are already Specialist Groups (SG) for Odonata, Ants, Lepidoptera, Cave Species, and Molluscs.

In view of the scarcity—and in the case of the Antioch Katydid, the extinction—of many orthopteroids, it was considered appropriate to consider a Specialist Group for Orthoptera *sensu lato*. Last year I wrote to several specialists who I thought might be active participants, and I really do thank them for the trouble they took to pass back to me their comments. Overwhelmingly, the feeling was that it should be an Orthopteroidea SG rather than an Orthoptera SG.

Also, I wrote to Professor Gangwere as it seemed right to ally the Orthopteroidea SG with the Orthopterists' Society. Also, the group has to be ratified by the IUCN General Assembly. For that it was necessary to send a brief draft proposal, a copy of which you can see in this issue of *Metaleptea*. I really do thank everyone who replied, and Professor Gangwere for his help with the draft proposal.

Originally I wrote to several specialists of whom I knew personally or who I thought might represent their geographic areas. But please, ANYONE WHO IS INTERESTED IN PARTICIPATING PLEASE LET ME KNOW. The Orthopteroid Specialist Group is not meant to be exclusive. If you wish to participate, please let me know. Once the General Assembly has agreed to its inception I shall send you the registration forms and then we shall be underway. The initial aims would be to draw up a Red List and perhaps to produce a volume on Threatened Orthopteroids of the World. Let me know your ideas. In the meantime, I shall continue to report the group's progress through a news item in *Metaleptea*. Let's keep in touch.

Michael J. Samways
IUCN (The World Conservation Union)

ORTHOPTEROID SPECIALIST GROUP OF THE SPECIES SURVIVAL COMMISSION—A PROPOSAL

What constitutes "Orthopteroids"?

The general consensus of opinion of leading orthopterists on the formation of an Orthopteroid Specialist Group (ORSG) is that the Group should focus on the Superorder Orthopteroidea (*i.e.* Polyneoptera), and not just on the Order Orthoptera. The following taxa would then be encompassed:

Mantodea—mantids
Blattodea—cockroaches
Cylindrachetidae—cylindrachetids
Eumastacoidae—monkey grasshoppers
Acridomorphoidea—grasshoppers
Tetrigoidea—tetrigids or pygmy grasshoppers
Tridactyloidea—pygmy mole crickets
Gryllacridoidea—dune crickets, leaf-rolling crickets, camel crickets, cave crickets, king crickets
Grylloidea—true crickets, tree crickets
Gryllotalpidae—mole crickets
Cooloolidae—*Cooloola* monsters
Tettigonioidea—Bush crickets or katydids
Grylloblattodea—grylloblattids
Dermaptera—earwigs
Plecoptera—stoneflies
Embioptera—embiopterans or web spinners
Phasmatodea—stick- and leaf insects
Isoptera—termites
Zoraptera—zorapterans

Significance of Orthopteroids

About 40,000 Orthopteroids have been described, including many fossils. Still many remain to be discovered. Many are large, conspicuous species that grace the landscape and have featured strongly in folklore.

A total of 64 species have already been listed in the 1988 IUCN Red List of Threatened Animals, and 10 species have been described in the IUCN Invertebrate Red Data Book. Several countries extend legal protection to certain orthopteroid species.

Although some species, particularly in the Acridomorphoidea and Isoptera, are widespread and sometimes serious pests, many species are localized. Some geographical areas show very high percentage endemism at the species level—even South Africa on the southern tip of a continent has 75% endemism among its tettigoniids, while most oceanic islands have almost total endemism.

With their often distinct habitat preferences, sometimes associated with threatened biotopes, *e.g.*, streams for stoneflies, caves for some Gryllacridoidea, moist tropical forest for some Tettigonioidea, they are good "indicator" or "flag" species. This is especially so as many "sing", making them readily identifiable without capture or disturbance.

Representation within an Orthopteroid Specialist Group

From the circular sent to prominent orthopterists, there is a clear indication that there is a need for such a Specialist Group. There is certainly a core of specialists willing and able to participate, either on a taxonomic or geographical basis. Although most specialists are centred in the north-temperate countries, many are undertaking research in the tropics. Conservation appraisals by such specialists are invaluable.

As with all IUCN Specialist Groups, the level of activity of the participating members determines the particular Group's success. Also, it must represent the general world opinion on the particular fauna in question. For Orthopteroids, the activities of the Orthopteroid Specialist Group would coincide with those of the Orthopterists' Society, a renowned international organization to which most leading specialists belong. Such members, representing approximate taxonomic groups, and/or geographic areas, would be invited to participate.

Aims of an Orthopteroid Specialist Group

Aims would include revising the IUCN Red Data List, developing an Action Plan, and producing a workable handbook of "Threatened Orthopteroids of the World". This would include species, habitats and biotopes. Reviews, taxonomic and/or regional, would be important contributions.

Conclusions

Discussions with invertebrate conservationists, field conservation officers and specialists has clearly identified the need for an Orthopteroid Specialist Group, especially as many orthopteroid species are large and have restricted distributions. The international Othopterists' Society would be closely consulted.

As it is now timely to instigate such a Group, it is requested here that the IUCN General Assembly seriously consider ratifying an official Orthopteroid Specialist Group.

NOTICE

Members needing additional copies of past Pan American Acridological Society or Orthopterist' Society publications (*Metaleptea*, *Proceedings*, *Occasional Papers*) and new members having current publications but not past ones are reminded that a small number of virtually all volumes and numbers is on hand at the Secretariat. Prices (in US currency) are as follows: *Metaleptea* $1.50 per number or $3.00 per volume consisting of 2 numbers; *Proceedings* $10.00 per volume; and *Occasional Papers* $4.40. Please advise of the volumes and numbers desired and send remittance to: Prof. S. K. Gangwere, Executive Secretary, Orthopterists' Society, c/o Department of Biological Sciences, Wayne State University, Detroit, MI 48202, USA. Orders may also be placed by invoice; simply ask to be billed.

NEWS FROM ANDREW HARVEY IN AFRICA

I was based in Kabul, Afghanistan, from April through August, 1990, on an FAO/UNOCA project to organise control of locusts and Sunn pest (Pentatomidae) in northern Afghanistan. Moroccan locust (*Dociostaurus maroccanus*) and, to a lesser extent, Italian locust (*Calliptamus italicus*) have always been pests on the dry land wheat-growing areas on the foothills above the valley of the Amu Darya (Oxus River). Since 1935, there have been annual control campaigns, assisted by Soviet experts and equipment, but this was interrupted by the war. As a result of this and perhaps other ecological factors, locust numbers have built up to a disastrous level and are threatening the area, once a wheat-exporting region, with famine.

It is reckoned that half a million hectares will have to be treated against Sunn pest and locust if shortages are to be prevented. Since most of the affected area lies outside government control, a conventional campaign is out of the question. Instead, locally recruited extension workers are to be trained in the use of hand-held ULV sprayers and provided with supplies of insecticide. This will also have the advantage of phasing out BHC dust, which has been used up until now, and of reducing the enormous logistical problems of distribution.

WANTED: INFORMATION ON REARING TECHNIQUES

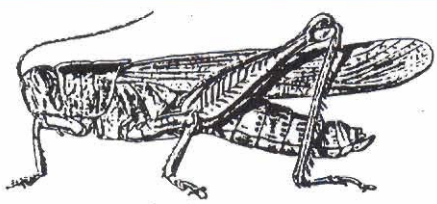
The Cincinnati Zoo has 30 species of Orthopteroid and Dictyopteroid insect species in its inventory. It is seeking from anyone interested in insect rearing techniques information regarding food plant preferences and oviposition requirements for the species they rear. For a list of those species, send name and address to Eric R. Eaton, Insectarium, Cincinnati Zoo and Botanical Garden, 3400 Vine Street, Cincinnati, OH 45220. The Zoo is also interested in acquiring additional species for exhibits.

From Christian Lange

I have been working with Prof. v. Halversen on the bioacoustics and ecology of Acrididae and together we are preparing a book on songs of most of the European Gomphocerinae. In August I went to northern Greece and Romania (Carpathes) to study endemic species and their songs.

From Nina Wedell
Dept. of Zoology, University of Stolkholm, Sweden

Presently I am working on studies of paternity assurance, sperm compitition, and male investment in the tettigoniids. I received a grant from the Royal Swedish Academy of Sciences for my Ph.D. project, "Comparative studies of the evolution of Orthopteran mating systems."



DRAWINGS WANTED

Figures, line drawings or graphics of your favorite grasshoppers, crickets, katydids, or other orthopteroid insect. These will appear as fillers in future issues of Metaleptea. Send them to David A. Nickle, Editor.

THE ORTHOPTERISTS' SOCIETY

The Orthopterists' Society (formerly *Pan American Acridological Society*) is an international scientific organization devoted to facilitating communication among those interested in Orthoptera and their allies. Research and publication are fostered in all aspects of the biology of these insects from ecology and taxonomy to physiology, endocrinology, cytogenetics, and control measures.

The Society was founded in 1978 by some 50 orthopterists meeting at San Martin de los Andes, Argentina. Its constitution and by-laws were adopted in 1979, and it was accorded tax-exempt status by the United States government shortly thereafter. The meetings held since San Martin have been at Bozeman (United States), Maracay (Venezuela), Saskatoon (Canada), and Valsain, Segovia (Spain). The next meeting will be in 1992 at a site to be selected in 1991.

Symposia, round table discussions, and research papers presented at the Society meetings are published in the *Proceedings of the Orthopterists' Society*, and a newsletter, *Metaleptea*, is issued semi-annually. Information regarding these publications can be obtained from the editor, Dr. D. A. Nickle, USDA, c/o National Museum of Natural History, NHB 168, Smithsonian Institution, Washington, D.C. 20560, USA.

The 1990-1994 Governing Board comprises President Daniel Otte (United States), President-elect R. F. Chapman (United Kingdom), Past President V. R. Vickery (Canada), Treasurer Roger Bland (United States), Regional Representatives Aiola Richards (Australia), Al B. Ewen (Canada), and B. Bacetti (Italy), Executive Secretary S. K. Gangwere (United States), Editor, D. A. Nickle (United States), and Editor of the new *Orthopterists' Journal*, N. D. Jago (United Kingdom).

Society business and finances are handled by the Executive Secretary, Prof. S. K. Gangwere, Department of Biological Sciences, Wayne State University, Detroit, MI 48202, USA.

All correspondance relating to *Metaleptea* or the *Proceedings of the Orthopterists' Society* should be addressed to the Editor, Dr. David A. Nickle, USDA, Systematic Entomology Laboratory, c/o U.S. National Museum of Natural History, Smithsonian Institution NHB-168, Washington, D.C. 20560 USA.

Correspondance and information regarding the new journal series, *Orthopterists' Journal*, should be addressed to Dr. N. D. Jago, Overseas Development Administration, Tropical Development and Research Instituion, College House, Wrights Lane, London W8 5JS, United Kingdom.

MEETINGS: Meetings of the Orthopterists' Society are held on a triennial basis, in the United States, Latin America, Canada, or other location, worldwide, in rotation. Symposia, research papers, and business conducted at the Meetings are published in the *Proceedings of the Orthopterists' Society*.

MEMBERSHIP: Membership is open to anyone expressing an interest in Orthoptera and related orders. Annual dues for members are US $15 for Active Members and US $7 for students. Members receive all publications of the Society.

PUBLICATIONS: The Society's publications include a newsletter, *Metaleptea*, which is published as news becomes available, but on at least a biannual basis, the *Proceedings of the Orthopterists' Society*, which is published triennially in conjunction with the Meetings, *Occasional Papers*, an irregularly published journal for medium- to large-sized papers dealing with research on any aspect of Orthopteroid orders, and a new journal series, the *Orthopterists' Journal*, a refereed journal devoted to research articles of a small to medium size. For information regarding any of these publications, contact the Editor, Dr. David A. Nickle, USDA, Systematic Entomology Laboratory, c/o U.S. National Museum of Natural History, Smithsonian Institution NHB-168, Washington, D.C. 20560 USA.

BOOKS

RAINFORESTS: A GUIDE TO RESEARCH AND TOURIST FACILITIES AT SELECTED TROPICAL FOREST SITES IN CENTRAL AND SOUTH AMERICA

A book by James L. Castner, Ph.D. with foreword by Dr. Peter H. Raven

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Tropical rainforests are being destroyed at the rate of approximately 100 acres per minute. Each day more of the irreplaceable flora and fauna that lives within these complex ecosystems disappears forever. Global concern for rainforests has prompted government support of tropical forest conservation and encouraged biologists to conduct research in those rainforests remaining. Yet to date, there have been no references available evaluating and describing specific sites and facilities for those interested in conducting research, or for those merely visiting rainforests to enjoy their beauty and biological diversity. The book RAINFORESTS: A GUIDE TO RESEARCH AND TOURIST FACILITIES AT SELECTED TROPICAL FOREST SITES IN CENTRAL AND SOUTH AMERICA attempts to fill that empty 'literary niche'.

RAINFORESTS deals strictly with the New World tropics, treating sites in seven of the most accessible countries. The author methodically describes and evaluates select locations in each country. Data are provided on location, logistics, seasonality, forest types, trail systems, and costs. Additional information allows readers to contact lodge owners and field station directors or their representatives directly. Following the description of sites evaluated in each country is information regarding books, maps, tourist information sources, conservation organizations, and scientific organizations/institutions.

In addition, RAINFORESTS contains a partially annotated bibliography of over 200 titles dealing with tropical jungles and the plant and animal life within them. These books are conveniently classified into sections for laymen, biologists, adventure and travel books, flora and fauna guides, and regional guides. Another chapter discusses 'Hands-On' Organizations that allow laymen and biologists to work and study in the field together. The final chapter discusses Sources of Funding available to biologists and other individuals interested in conducting research in rainforest habitats. Appendices contain information about traveling in Latin America, provide a useful list of specialized vocabulary in Spanish and English, and also present a list of the major companies, organizations, and institutions that offer natural history tours.

TO ALL PERSONS INTERESTED IN GRASSHOPPERS IN AFRICA

New Field Guide, *Nymphs of the Sahelian Grasshoppers*, by George B. Popov, is available for free upon request. This volume is a full-color manual meant for use in the field to assist in the easy recognition of the hopper stage of the main Sahelian grasshopper species. The manual was recently printed with partial funding from A.I.D. (AFR/TR/ANR -- AELGA Project).

Nymphs of the Sahelian Grasshoppers: An Illustrated Guide

published in 1989 by the Overseas Development Natural Resources Institute (ODNRI), U.K. This 11 x 18 cm, 150 page manual with a sturdy paperback binding, describes and illustrates -- in paintings and photographs -- 78 grasshopper nymphs (hoppers) judged to be the most important of the over 300 species in the Sahel. Useful synoptic information is provided for all species on: survival strategies, number of generations, habitat choice, hopper development, and practical recommendations on hopper identification.

Copies may be obtained (also available in French as *Les Larves de Criquets du Sahel*) from Walter I. Knausenberger, AID, Bureau for Africa, Office of Technical Resources, Washington, DC 20523-1515, or through David A. Nickle, U.S. National Museum of Natural History, Washington, DC 20560. Outside of North America, it is available for a $ fee through ODNRI, Publications Officer, Central Ave., Chatham Maritime, Chatham, Kent ME4 TB, United Kingdom; PRIFAS, Acridologie Operationelle, B.P. 5035, F-34032 Montpellier-Ceex 1 France; Department de Formation en Protection des Vegetetaux, B.P. 12625, Niamey, Niger; or CILSS-INSAH, UCTR/PV, B.P. 1530 Bamako, Mali.