METALEPTEA

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A News Forum for Acridologists
and Orthopterists
THE ORTHOPTERISTS' SOCIETY

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MESSAGE FROM THE EDITOR

This issue contains important information regarding this summer's meeting in Spain. Along with President Vickery and Secretary Gangwere, I urge everyone to try to attend and actively participate in the presentation of research on orthopteroid insects. Also in this issue is an outline of the papers to be included in the Field Guide of Pest Species of Grasshoppers and Locusts of the World. There are still a few topics awaiting an interested author. Anyone interested in writing those particular chapters should contact President Vickery.

Much of this issue is devoted to preliminary studies of the katydids and other orthopteroid insects of Peru, conducted by me (along with two colleagues from the University of Florida). This was an Earthwatch Project in 1987; the Project has just been renewed and I look forward in 1989 to research katydids in rain forest canopies northeast of Iquitos.

Our next issue of Metaleptea will include two research papers on Indian mantids and will highlight the orthopterists of Spain. We anticipate that the next issue will be released in early March.

I am looking forward to seeing you in Spain this summer!

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REPORT OF THE EXECUTIVE SECRETARY

Some members have expressed concern about their dues payments not being promptly credited to their account. Let me explain how this may happen. Treasurer Roger Bland banks all monies in his home town, Mt. Pleasant, Michigan, and updates the dues status of all members. He mails these data to me, at the Secretariat, in Detroit, Michigan, where I prepare the individual dues notices. I mail these notices to Editor Dave Nickle, in Washington, D. C., along with the brochures, other mailing materials, all the computerized mailing labels. Dave then loads, labels, and mails the individual envelops. Therein lies the difficulty. If there is delay in receipt of *Metaleptea* from the printer, the readied, labeled envelops may await mailing for one or more months pending arrival of the newsletter (steps have been taken recently to eliminate this problem!). If so, the enclosed notices may not reflect recent dues payments.

The ballots mailed with *Metaleptea* Vol. 9, No. 2, have been tallied but not yet certified by the Elections Committee, whose responsibility it is to monitor the election and inform the membership of the talley. Their report will be released at the forthcoming meeting in Valsain, Spain, in July. For now, it is sufficient to note that both the first proposition (revisions of the Constitution and By-Laws) and the second (modified dues structure) passed overwhelmingly. A copy of the ratified new Constitution and By-Laws is to be enclosed in a future mailing, and the increased dues are to take effect in 1989.

Plans are proceeding for the Society's 5th International Meeting to be held in Valsain (see attached announcement). Kindly help us plan for this important event by promptly registering for the meeting, reserving accommodations, and providing abstracts/resumes of papers that you wish to read. Registration is to be by mail, in advance, through the Secretariat, in Detroit, using the attached Registration Form. A registration fee of $100 (US currency) for Active Members and $25 for Student Members has been levied, providing payment is made at least three (3) months in advance of the meeting. (This fee is refundable in full upon official withdrawal within six (6) weeks of the meeting). Scholarship (gratis) registration is possible for those who find it difficult to arrange for the registration fee either personally or through their home institution.

A $10 (US currency) page charge for all papers published in the entirety and for each page of abstract has been set tentatively to cover the editorial process, administrative handling, printing, and mailing of 100 free reprints. However, it appears that the Society will receive a governmental subsidy allowing for scholarship (gratis) publication. If so, the only publication charge will be an across-the-board $10 (US currency) total fee for handling and mailing of the free 100 reprints.

The Society's bank account balance is $5,936 (US currency) as of today, October 20, 1988. This total is patently inadequate to meet the projected costs of our 5th International Meeting, so I urge prompt payment of your 1989 and any unpaid earlier dues.

S. K. Gangwere
Executive Secretary
Orthopterists' Society

A NOTE FROM THE PRESIDENT

Preparation for the next meeting, in Valsain, Spain, are coming along very nicely. We are indeed indebted to Dr. Morales Agacino, chairman of the Local Arrangements Committee, who is doing a magnificent job. Among other things, he has arranged with the Spanish government authorities to underwrite and publish the proceedings of our meeting. I have a copy of one of their recent publications which provides an excellent conception of what the ***Proceedings*** will be like. It is a very fine publication. Any of us who present papers will certainly be pleased to have them appear in such a fine format. Illustrations in colour are accepted, and I urge you to make sure that your illustrations are of top quality.

Our constitution has been tentatively updated to conform with our global status. The section on Honorary Membership has been altered so that two honorary memberships can be conferred upon two deserving people every two years. This was done in recognition of the fact that our "triennial" meetings have never been triennial but are at intervals of either two or four years.

Jeff Lockwood organized a workshop session for orthopterists at the Entomological Society of America in Boston last November-December. It was very successful. I understand that a similar session has been arranged for the meeting in December in Louisville, Kentucky, and I urge any who can attend to do so.

The Orthopterists' Society Handbook (or Field Guide) on the most serious grasshopper and locust pests of the world is well underway. There will be about 32 papers, each by a specialist in the area concerned. Each is to published separately and punched with three holes to fit in a specially designed binder, which will hold all or part of the series. I have six completed manuscripts now and I expect more very soon. We hope to have the entire series published by the end of 1989. To those of you who have agreed to write parts of this series, I urge you to complete your manuscripts and send them to me as soon as possible.

V. R. Vickery,
President, The Orthopterists' Society

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Background Information on the 'Field Guide of Serious Grasshopper and Locust Pests of the World

The Orthopterists' Society was formed following a meeting of concerned scientists at San Martin de Los Andes, Argentina, in December, 1976. In the beginning it was known as the Pan American Acridological Society. Three meetings of the society have been held, all well attended and successful; Bozeman, U.S.A.; Maracay, Venezuela; and Saskatoon, Canada. Two very successful training programs for students from South American countries were carried out (17 students). The society became global in January, 1986, with the new name 'The Orthopterists' Society'.

There are members in more than 40 countries. Dues have deliberately been kept low ($10.00 but probably increasing to $15.00 soon) so that persons in developing countries could afford to belong. The expected increase is necessary to keep the organization functioning. Another training program has been organized for prospective students from developing countries. This program has the support of F.A.O., Rome. The next course will be held in Canada and the U.S.A. for approximately 30 candidates in 1989.

The Society was formed as a service organization, to serve the needs of mankind in general, not only members of the society. To further this purpose the organization has begun preparation of A 'Field Guide of Pest Species of Grasshoppers and Locusts of the World'. There is no other publication of this scope.

The Field Guide will consist of a series of papers by world experts, each published separately, and each punched with three holes to fit in a three-ring binder developed to hold all or part of the entire series. We hope to be able to supplement the written text with illustrations of each species in colour. Other illustrations, mainly line'drawings, will be in black and white. Each paper on a specific pest will contain information sufficient for identification as well as details on preferred food, its life history, habits, distribution, etc. Most of the papers are now being written. Some manuscripts have been completed and have been edited. We intend to begin publishing the papers early in 1989.

In the list of Titles and Authors six topics have no authors listed. Two of these are not yet assigned but for the other four I am awaiting confirmation of acceptance of the invitation to write on the topics indicated. I felt it was better to have a paper delayed somewhat if necessary, in order that the paper would be written by the person most knowledgeable on the particular topic.

The Orthopterists' Society "Field Guide".

Topics and Cooperating Authors

A. Introduction

1a. Introduction to the Field Guide of Pest Species of Grasshoppers and Locusts.

1b. The structure of grasshoppers and glossary of technical terms (in 3 languages - English, French and Spanish). V.R.Vickery, Ste-Anne de Bellevue, Quebec, Canada.

B. General Topics

1. Population Monitoring and Dynamics. D. Johnson, Canada Agriculture, Lethbridge, Canada.

2. Periodism and Life Cycles. D.A. Nickle, Syst. Ent. Lab., Washington, D.C., U.S.A.

3. Biological Control: Infectious Diseases. J.E.Henry, U.S.D.A., Bozeman, Montana, U.S.A.

4. Food Habits and Feeding Behaviour. S.K. Gangwere, Wayne State University, Detroit, Michigan, U.S.A.

5. Chemical Control of Grasshopper and Locust Pests. A.B. Ewen and M.K. Mukerji, Canada Agriculture, Saskatoon, Canada.

6. Toxicology of Chemical used for Control of Locusts and Grasshoppers. Dr. W.N. Yule, Macdonald College, McGill University, Ste-Anne-de-Bellevue, Quebec, Canada.

7. Biometeorology and Migration. (not yet assigned).

8. (Additional topics ?) Suggestions are welcome.

C. Papers on Specific Pests.

1. Desert Locust, *Schistocerca gregaria* (Forskal). George Popov, O.D.N.R.I., London, England.

2. Migratory Locust, *Locusta migratoria migratorioides* (Reich & Fairmaire) in Africa. M. Launois and M.H. Launois-Luong, GERDAT, Montpellier, France.

3. Migratory Locust, *Locusta migratoria* subspecies in Asia. Y.-L. Chen, Beijing, China

4. Moroccan Locust, *Dociostaurus maroccanus* (Thunberg). R. Skaf, newly retired from FAO, Rome.

5. Red Locust, *Nomadacris septemfasciata* (Audinet-Serville). J.A. Whellan, Dee Why, Australia.

6. Brown Locust, *Locusta pardalina* (Walker). Dick Brown, Pretoria, R.S.A.

7. Senegalese Locust, *Oedaleus senegalensis* (Krauss). M. Launois, GERDAT, Montpellier, France.

8. Variegated Grasshopper, *Zonocerus variegatus* (L.). J. Mestre and J. Mestre-Chiffaud, GERDAT, Montpellier, France.

9. American Locust, *Schistocerca americana* (Drury). . J.R.Hilliard, Sam Houston University, Texas.

10. *Schistocerca piceifrons piceifrons* (Walker). ------

11. *Schistocerca piceifrons peruviana*, O. Beingolea, Lima Peru.

12. *Schistocerca cancellata* (Audinet-Serville), Norma Sanchez, Museo LaPlata, LaPlata, Argentina.

13. *Schistocerca pallens* (Thunberg). ------

14. *Rhammatocerus pictus* in South America. R. Skaf, FAO, Rome.

D. Regional papers (Grasshopper pests of the regions, other than those covered by individual papers).

1. South America. R. Ronderos and Maria Marta Cicgliano, La Plata, Argentina.

2. Mexico and Central America.

3. Europe, Mediterranean and Middle East.

4. Subsaharan Africa.

5. Western Asia (Iran to Bangladesh and Sri Lanka). S.Y. Paranjape, PUNE, India.

6. China. Chen, Yong-lin, Beijing, China.

7. U.S.S.R. S. Storozhenko, Vladivostok, U.S.S.R.

8. Southeast Asia and Pacific. D.K. McE. Kevan,Ste-Anne-de-Bellevue, Quebec, Canada.

9. Australia. Graeme Baker, N.S.W. Dept. Agr., Rydalmere, NSW, Australia.

10. North America. V.R. Vickery, Ste-Anne de Bellevue, Quebec, Canada.

Coordinator and Series Editor:

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Note: Papers covering pests of French-speaking areas of Africa are intended to be published in both English and French. Papers covering pest species of Latin America are intended to be published in both English and Spanish.

DIVERSITY '88

ESA National Conference
December 4-8, 1988
Galt House, Louisville, KY

-- Informal Conference 16 --

Grasshopper Workers' Conference

Factors Influencing Population Processes in Grigs

Tuesday, December 6, 1988

Tuesday Morning, December 6, 1988
Informal Conference - 16
Grasshopper Workers' Conference:
Factors Influencing Population Processes in Grigs
Part I
Old River (GH-3)

Moderator:
W.P. Kemp
USDA-ARS Rangeland Insect Laboratory
Montana State University
Bozeman, MT 59717

8:00 am 3060 Grigs that dig and grasshoppers that grovel. D. K. McE. Kevan, Lyman Entomol. Mus., Macdonald Campus, McGill Univ., Ste. Anne de Bellevue, PQ, CANADA H9X 1C0.

8:25 3061 Effects of Nosema locustae on population processes of rangeland grasshoppers. J. A. Lockwood, Dept. Plant, Soils, Insect Sci., Univ. Wyoming, WY 82071.

8:50 Update on Orthopterists' Society affairs. V. R. Vickery, Lyman Entomol. Mus. Res. Lab., MacDonald Coll., St. Anne de Bellevue, PQ, CANADA H9X 1C0.

9:15 3064 Experimental field inoculation of Mormon crickets with Nosema locustae and Vairimorpha n. sp. C. M. MacVean, Dept. Entomol., Colorado State Univ., Fort Collins, CO 80523.

9:40 Recess

9:50 3065 Sexual strategies in short-tailed crickets. T. J. Walker, Dept. Entomol. Nematol., Univ. Florida, Gainesville, FL 32611.

10:15 3066 Camel cricket populations on small islands in a freshwater lake. S. G. F. Smith and G. L. Gossler, Dept. Biol., Skidmore Coll., Saratoga Springs, NY 12866.

10:40 Grasshoppers Pheromones: Where do we stand today? D. W. Whitman, Dept. Biology, Illinois State Univ., Normal, IL 61761.

11:05 3068 Simulated damage to spring planted small grain crops. M. J. Weiss, Dept. Entomol., Hultz Hall, Box 5346, University Station, ND 58105.

11:30 Closing remarks and discussion. D. L. Johnson

Noon End.

Tuesday Afternoon, December 6, 1988
Informal Conference - 17
Grasshopper Workers' Conference:
Factors Influencing Population Processes in Grigs
Part II
Old River (GH-3)

Moderator:
J. A. Lockwood
Dept. of Plant, Soils, & Insect Sciences
University of Wyoming
Laramie, WY 82071

1:30 pm 3070 An historical look at an age-old problem: Grasshopper populations in southern Idaho. D. Fielding and M. A. Brusven, Div. Entomol., Univ. of Idaho, Moscow, ID 83843.

1:55 3071 Habitat type and grasshopper communities. W. P. Kemp, USDA-ARS Rangeland Insect Lab., Bozeman, MT 59717, S. J. Harvey, and K. M. O'Neill, Entomology Research Laboratory, Montana State University, Bozeman, MT 59717-0001.

2:20 3072 Wing-length and fecundity in rangeland grasshoppers. S. Gaines, School Biol. Sci., Univ. Nebraska, Lincoln, NE 68588.

2:45 3073 Impact of predation risk on optimal foraging by grasshoppers. M. E. Ritchie, School of Natural Res., Univ. Michigan, Ann Arbor, MI 48109.

3:10 Recess.

3:25 3074 Ovariole development in some common rangeland grasshoppers. A. Joern, School Life Sci., Univ. Nebraska, NE 68588.

3:50 3075 Arthropod community dynamics in a mountain brush habitat. T. A. Christiansen, Dept. Plant, Soils, Insect Sci., Univ. Wyoming, Laramie, WY 82071.

4:15 3076 Competition between age classes of two rangeland grasshoppers. J. R. Moorehead, Dept. Biol., Univ. Michigan, Ann Arbor, MI 48109.

4:40 3077 The effect of oviposition date on offspring fitness in two species of nymph overwintering grasshoppers. K. B. Landa, Dept. Biol., Indiana Univ., Bloomington, IN 47405.

5:05 3078 Polymorphic development and life history of Melanoplus femurrubrum. R. G. Bellinger, Dept. Entomol., 114 Long Hall, Clemson Univ., Clemson, SC 29634.

5:30 End

GRIGS THAT DIG AND GRASSHOPPERS THAT GROVEL

by
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ABSTRACT. Factors influencing population pressures in grigs include various strategies for survival. To ensure survival, certain hazards must be avoided, among which are: 1. inclement climatic conditions and other physical factors; 2. inadequate food supplies; 3. unsustainable reproductive rate; 4. predators and other natural enemies. Grigs have often used the ground in various ways to assist in their struggle for survival. These include, in addition to oviposition in the soil, simple grovelling (combined with camouflage), shallow self-burial, scuffing amongst detritus and leaf-litter (usually combined with camouflage), shallow digging, making burrows (either temporary or long-term), and adoption of permanent or semi-permanent subterranean existence in tunnels and brood chambers. Examples are given of various kinds of adaptation in both Grylloptera and Orthoptera, s. str. A considerable degree of parallelism is demonstrated both between and within these orders. More than one type of hazard may be avoided (at least in part) by the adoption of any one strategy (ranging from simple grovelling to deep tunneling), but it would be as difficult to assign priorities to these as it would be to determine that of the chicken versus the egg.

EFFECT OF *Nosema locustae* ON POPULATION PROCESSES OF RANGELAND GRASSHOPPERS

by
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ABSTRACT. *Nosema locustae* Canning may significantly reduce populations of rangeland grasshoppers within 4 to 6 weeks of application. However, the greatest advantage of *Nosema* may be its indirect effects. Indirect effects may be defined as any alteration that *Nosema* has on a population other than mortality from infection. The purpose of this study was to assess the direct and indirect effects of a *Nosema* trial in north-central Wyoming.

A treatment block of ca. 3,250 ha. was treated on June 7 and 8, 1988, with 1.1 kg/ha of Nolo^{R} bran bait. High density (>9.6 grasshopper/m^2) and low density (<9.6 grasshopper/m^2) areas 0.1 km within and outside of the treatment block were chosen. Grasshoppers were sampled in two transects in each of two control and treatment plots in the high and low density treatment areas, every 2 weeks, from 1 week pretreatment to 7 weeks posttreatment.

Infection rates in treated, high and low density plots were significantly greater than in untreated plots than in control plats in weeks 3, 5, and 7 posttreatment. Infection peaked in week 3 posttreatment at 17% in high density plots and at 18% in low density plots. Of the diagnosed infections, 64% were trace and 26% were low to high. Populations in treated, high density plots were significantly lower in untreated plots in weeks 1 and 3 posttreatment, but were significantly higher than in week 5

posttreatment. Populations in treated low density plots did not differ significantly from those in untreated plots. A natural population crash in week 5 posttreatment obscured any direct effects that *Nosema* might have had later in the summer. Although there were no significant differences in low density plots, treated populations in high density plots has a significantly smaller proportion of males and a significantly greater level of cannibalism than in untreated plots. There were significantly fewer viable and total egg pods in high density treated plots than in cntrol plots in week 9 posttreatment. Perhaps most importantly, grass and total plant biomass were significantly greater in high density treated plots than in untreated plots at 7 weeks posttreatment. Forb biomass was significantly greater in low density control plots than in treated plots at 7 weeks posttreatment. There were no significant differences between treated and untreated plots in high and low density areas with regard to developmental rate, growth rate or community structure.

Nosema has potential economic benefits via indirect effects on fecundity, cannibalism and herbivory even without a distinct reduction in population density. The potential long-term benefits of using Nosema and thereby preserving beneficials and the possibility of interseasonal direct and indirect effects will be monitored in the coming year(s).

AN HISTORICAL LOOK AT AN AGE-OLD PROBLEM: GRASSHOPPER POPULATIONS IN SOUTHERN IDAHO

by

Dennis J. Fielding and Merlyn A. Brusven

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ABSTRACT. Data from annual USDA-APHIS grasshopper (GH) survey records were examined to reveal relationships between weather and GH population fluctuations. Long-term average GH densities were calculated for areas within a 20 km radius of each of 28 weather stations across southern Idaho. Significant weather variables were identified based on a one-way ANOVA between high and low density areas. Long-term average GH density was positively correlated with annual degree-day accumulation and with winter (Nov. through March) precipitation, and negatively correlated with summer (June through August) precipitation.

Next, climatic variables correlated with annual population fluctuations were identified, using one-way ANOVA between years with average GH density $\geq 4.0/yd^2$ and years with average GH density $< 4.0/yd^2$. High density years were positively correlated with total precipitation from November to June, and with the previous year's GH density. Monthly mean maximum or minimum temperatures showed no correlation with GH density.

These results indicate that in southern Idaho years of high GH density tend to coincide with years of above average precipitation when rangeland forage production is high and competition between GH and other forage consumers is not as intense.

HABITAT TYPE AND GRASSHOPPER COMMUNITIES

by
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[2]Entomology Research Laboratory, Montana State University,
Bozeman, MT 59717-0001

ABSTRACT. A study was conducted to evaluate the effects of vegetation on the complexity of grasshopper communities. The concept of habitat type was used as a basis for discriminating between groupings of sites with similar biotic potential. Emphasis here was placed on recognizing grasshopper community patterns, since we assumed *a priori* that the plant community was the basic level of organization. A total of 39 sites were selected that represented five recognized habitat types as well as two disturbed types (replanting within a known habitat type). Repeated sampling in 1988 of both the insect and plant communities yielded a total of 40 grasshopper (19,664 individuals) and 97 plant species. Detrended Correspondance Analysis (DCA) indicated that site classifications based on percent cover of plants were appropriate and showed good between-group separation for sites along gradients of precipitation/elevation and plant community complexity. Results from undisturbed habitats (*i.e.*, not replanted) showed that as precipitation and elevation increased, the percent of forb feeding grasshopper species increased, as did forb species. Evidence also suggests that grasshopper species composition, making up the two major groups (forb vs. grass feeders), changed over the environmental gradients identified. Results suggest that patterns found could be used to characterize expected grasshopper complexes based on habitat type.

THE IMPACT OF PREDATION RISK ON OPTIMAL FORAGING BY GRASSHOPPERS

by
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ABSTRACT. Field experiments indicate that female grasshoppers (*Dissosteira carolina*) face a five-fold greater risk of bird predation when they occupy substrates of a non-matching color. In the laboratory, females were allowed a choice of gray (matching) and white (non-matching) substrates. Natural plant food was placed on the white substrate to simulate low risk feeding conditions. Females feeding at high risk reduce they daily feeding time compared to females feeding a low risk. In both cases, feeding times of females correspond to those predicted on the basis of maximizing fitness gained from foraging relative to fitness lost from predation risk. Grasshoppers also choose diets that maximize their daily energy intake within their feeding time. Consequently, female grasshoppers appear to forage so that their net fitness is maximized.

ARTHROPOD COMMUNITY DYNAMICS IN A MOUNTAIN BRUSH HABITAT

by
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ABSTRACT. The role of population dynamics in mediating nutrient cycling, root:shoot ratios, and biomass and litter decomposition was examined in a sagebrush and bitterbrush habitat located at an elevation of 2400 m, in southeastern Wyoming. Habitat manipulation (brush management) consisted of unaltered, control plots, mowing to a 20 cm stubble, aerial application of the herbicide, 2,4-D butyl ester or burning. Arthropod populations were manipulated by application of malathion and carbaryl to half of the plots, every 2 weeks.

Arthropod population dynamics encompassed 63 arthropod species in foliage and 146 arthropod species in litter. Mowing and herbicide application significantly changed density of 16 of the 46 major foliage species and 51 of the 63 major litter species. Diversity increased in all arthropod orders, except Hymenoptera and Coleoptera, in both mowed and herbicide-treated plots.

Arthropods mediated root and shoot biomass in managed and unmanaged habitats. Foliage biomass generally decreased in both brush and grass microhabitats, regardless of the brush management practice. In areas dominated by brush or grass, effects of insecticide treatments on root and shoot biomass were greatest in mowed and unmanaged areas. The root:shoot ratio decreased following insecticide application under all brush management practices, in virtually all microhabitats.

Elimination of arthropods reduced the rate of litter decomposition in unmanaged areas, indicating the important role in decomposition and nutrient cycling played by these organisms. In untreated areas, arthropods increased nitrogen, magnesium, calcium, potassium, and phosphorus in grass litter, but generally decreased these nutrients under shrubs. Arthropods increased magnesium and calcium, but decreased potassium and phosphorus in grass foliage. In mowed areas, arthropods increased magnesium, calcium, sodium, and phosphorus in shrub litter. Magnesium, potassium, phosphorus, and mitrogen decreased while calcium and sodium increased in grass litter in mowed areas. Arthropods decreased magnesium, calcium, sodium, potassium, nitrogen, and phosphorus in new growth in burned areas.

Given the importance of arthropods in nutrient cycling in grass and brush habitats within a sagebrush/bitterbrush system, it may be important to consider the impact of large-scale applications of broad spectrum insecticides for control of rangeland grasshoppers. Most work has concentrated on the impact of these chemicals on non-target and beneficial arthropods, but little attention has been paid to the resultant effects on nutrient cycling within grassland systems. Alterations of the arthropod community may have significant impacts not only on future grasshopper outbreaks but on the functioning of the grassland ecosystem with respect to nutrient availability at all trophic levels.

COMPETITION AMONG AGE CLASSES OF TWO RANGELAND GRASSHOPPERS

by
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ABSTRACT. I have examined the role of competition in structuring a rangeland grasshopper assemblage on the Palouse prairie of western Montana. My research employs caged populations in a design that addresses the foolowing three questions:

l) Is competition for food resources a significant factor in the population dynamics of the two dominant species: *Melanoplus sanquinipes* and *Ageneotettix deorum*?

2) Are there significant differences in the outcome of intra- and interspecific competition when it occurs among different life stages (late nymphs and adults) ofeach species?

3) How do stage-dependent resource requirements interact with seasonal changes in resource availability to produce a particular outcome of competition?

In both 1987 and 1988, the changes in population density and relative abundance of species in the cages were in statistical accordance with those occurring in the free-roaming populations, indicating that the conditions in the cage mimic the outside environment. In particular, competition for food appears to be the predominant factor of mortality because the observed changes were density-dependent.

Analysis of expreimental caged populations indicate that nymphs of *A. deorum* are at a competitive disadvantage with regard to the adults and the two stages of *M. sanguinipes*, whereas nymphs of the latter are the least affected by competition with the other classes. Adults of the two species compete strongly. These relationships provide an explanation for different outcomes in two separate years. In 1987, where the higher abundance and quality of the vegetation resources persisted throughout the summer, *M. sanguinipes* dominated the adult species assemblage. In 1988, where the decline of resources was much faster, *A. deorum* was dominant. A large-scale failure of *M. sanguinipes* nymphs to recruit to the adult stage gave *Ageneotettix* an advantage in adult competition. This advantage was not present in 1987 where the recruitment of *M. sanguinipes* nymphs to adults was much higher.

The role of body size in structuring communities must incorporate the aspects of developmental time in relation to the seasonal availability of stage-specific resources to assess the advantage of different adult body sizes.

THE EFFECT OF OVIPOSITION DATE ON OFFSPRING FITNESS IN TWO SPECIES OF NYMPH-OVERWINTERING GRASSHOPPERS

by
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ABSTRACT. Knowledge of how variation in the timing of life cycle events affects individual fitness is important for understanding the selective pressures that shape the phenology of an insect species. In this paper, I will describe how the timing of oviposition affects offspring fitness in two species of bandwing grasshoppers, ***Arphia sulphurea*** (F.) and ***Chortophaga viridifasciata*** (DeGeer). Unlike most grasshoppers, these species overwinter as nymphs, mature to adults early in the Spring and lay non-diapausing eggs which hatch out in the sameseason that they were produced. Oviposition, and therefore hatching, occurs over an extended period of time and determines the environmental conditions to which the nymphs will be exposed. The most striking result is that later offspring have a lower survival to maturity, because they reach a smaller body size before winter and overwinter survival is size-dependent, with smaller nymphs having a higher mortality. Late nymphs also mature later the following Spring and produce fewer pods than early nymphs. The seasonal changes in offspring fitness result in a strong selection for early reproduction in these two species and mayunderlie seasonal increases in offspring size observed among females of both species.

POLYMORPHIC DEVELOPMENT IN RELATION TO THE LIFE HISTORY OF *Melanoplus femurrubrum* (DeGeer)

by
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ABSTRACT. The effects of polymorphic development on the life history of the red-legged grasshopper, *Melanoplus femurrubrum* (DeGeer), were investigated. In a population reared from field-collected eggs, the developmental threshold for six- and seven-instar groups was the same (17.1 °C). Most mortality occurred in the first stadium. Developmental times of males and females in the same instar group were not different. At 26.5°, 30.0°, 35.0°, and 38.0°C, seven-instar grasshoppers took 18.8, 11.1, 5.4, and 5.5 days longer to develop, respectively, than did six-instar grasshoppers. Differences in developmental times between the six- and seven-instar grasshoppers were principally because of the length of the differential stadium (the fifth stadium of the seven-instar group) (11.5, 7.6, 5.8, and 5.4 days, respectively) at the four rearing temperatures and because of differences in the length of other stadia at 26.5° and 30.0°C. Within either instar group, females werelarger than males, and within either sex, seven-instar individuals were larger than six-instar individuals. Females in field cages that became adults later in the season lived a shorter time and laid fewer egg pods because of the shortness of the remaining season.

SEXUAL STRATEGIES IN SHORT-TAILED CRICKETS

by
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ABSTRACT. *Anurogryllus arboreus* is a univoltine, burrow-dwelling, flightless, subsocial cricket occurring in well-drained soils in southeastern United States. During the brief springtime mating season, males call each evening for about one hour. A male's first calling is usually from his burrow entrance, and if a female is attracted, she mates and takes over the male's burrow. In any case, males soon leave their borruws and do their calling from tree trunks and other perches. When perch-calling males cease calling, they descend and spend much of the night searching for females' burrows. Upon finding one, they generally gain entrance, mate with the female, and leave.

Soon after the final molt, females will admit males to their burrows and mate with them. At ca. 6 days, they will go to males calling at nearby burrows; and at ca. 10 days, they will go to perch-calling males 1 m or more away. Mated females will usually mate with males that find them in their burrows but will seldom go to perch-calling males.

PAPERS ON ORTHOPTEROID INSECTS PRESENTED IN OTHER MEETING SECTIONS

Forage destruction potentials of two shortgrass rangeland grasshoppers: Implications for economical control strategies. D. C. Thompson, Dept. Entomol. Plant Pathol. Weed Sci., New Mexico State University, Las Cruces, NM 88003; A. Torell, Dept. Agric. Econ. Agric. Bus., New Mexico State University; J. Davis, New Mexico Dept. Agric., New Mexico State University; and E. W. Huddleston, Dept. Entomol. Plant Pathol. Weed Sci., New Mexico State University.

Expert system technology and rangeland grasshopper treatment selection. W. P. Kemp and J. A. Onsager, USDA-ARS, Rangeland Insect Laboratory, Bozeman, MT 59717; and H. E. Lemmon, USDA-ARS, 800 Buchanan, Albany, CA 94710.

Opportunities for mate choice in the wood dwelling termite, *Zootermopsis*. J. S. Reeve, Dept. Entomol. Comstock Hall, Cornell University, Ithaca NY 14853.

Speciation and biogeography of United States Orthoptera. D. Otte, Acad. Nat. Sci. Philadelphia, Nineteenth and The Parkway, Phialdelphia, PA 19103.

Small and often neglected [orthopteroid] orders of insects. D. A. Nickle, SEL, USDA, U. S. Nat. Mus. Nat. Hist., Smithsonian Inst., Washington, DC 20560.

Impact of soil particles on tunneling behavior of subterranean termites. M. K. Rust, Dept. Entomol., Univ. California-Riverside, Riverside, CA 92521.

Effects of population pressure on tunneling behavior of subterranean termites through termiticide-treated soil. S. C. Jones, USDA-FS, P.O. Box 2008, GMF, Gulfport, MS 39505.

The effect of insecticide exposure on the tunneling behavior of the western subterranean termite, *Reticulitermes hesperus*. J. L. Smith and M. K. Rust, Dept. Entomol., Univ. California-Riverside, Riverside, CA 92521.

Penetration of pressurized aerosol insecticide through plastic tubes into simulated subterranean termitaria with *Reticulitermes flavipes*. H. L. Katz, Berkshire E 3076, Deerfield Beach, FL 33442; and D. Stout, Whitmire Labs. 3578 Tree Court Indust. Blvd., St. Louis, MO 62122.

Patterns of feeding damage on wood blocks in two genera of subterranean termites. K. S. Delaplane and J. P. LaFage, Dept. Entomol., 402 Life Sci., Louisiana State University, Baton Rouge, LA 70803.

Evaluation of three insect growth regulators as bait-toxicants for Formosan and eastern subterranean termites. N. Y. Su, Ft. Lauderdale Res. Educ. Cent., IFAS, 3205 College Ave., Univ. Florida, Ft. Lauderdale, FL 33314; M. I. Haverty, , USDA-FS, Berkeley, CA 94701; R. H. Scheffrahn, Ft. Lauderdale Res. Educ. Cent., IFAS, 3205 College Ave., Univ. Florida, Ft. Lauderdale; M. Tamashiro and R. Yamamoto, Dept. Entomol., Univ. Hawaii, Honolulu, HI 96822.

Methods for measuring termiticide applications. E. M. Thoms and C. E. Millard, Dow Chemical, 5100 West Kennedy Blvd., Suite 450, Tampa, FL 33609.

Cockroach allergens: Sensitization potential in humans and effect of control strategies on aeroallergens levels. R. J. Brenner, USDA-ARS, Insects Affecting Man and Animals Res. Lab., P.O. Box 14565, Gainesville, FL 32604; and R. M. Helm, Allergic Dis. Res. Lab., Mayo Clinic Foundation, Rochester, MN 55905.

Minimum development rates of two strains of the smokybrown cockroach, *Periplaneta fuliginosa*, at five temperatures. E. P. Benson and P. A. Zungoli, Dept. Entomol., Long Hall, Clemson Univ., Clemson, SC 29634.

Seasonal abundance and population structure of urban populations of *Periplaneta americana*. N. Bao and W. H. Robinson, Urban Pest Control Res. Cent., Dept. Entomol., VPI & SU, Blacksburg, VA 24061.

Effect of synergists on insecticide resistance in the German cockroach. D. G. Cochran, Dept. Entomol., VPI & SU, Blacksburg, VA 24061.

Relative repellency of several insecticides in nymphal *Blattella germanica* (L.). S. J. Barcay and G. W. Bennett, Dept. Entomol., Purdue Univ., West Lafayette, IN 47909.

Susceptible periods in German cockroach nymphal and oothecal development when exposed to chitin synthesis inhibitors. J. J. DeMark and G. W. Bennett, Dept. Entomol., Purdue Univ., West Lafayette, IN 47909.

Activity of the sulfuramide LCT-100, a mitochondrial respiratory inhibitor, against nymphal German cockroaches, *Blattela germanica*. B. L. Reid and G. W. Bennett, Dept. Entomol., Purdue Univ., West Lafayette, IN 47909.

[display]. Studies on eggcase exchange with gravid German cockroaches, *Blattella germanica*. K. R. Tignor and D. E. Mullins, Dept. Entomol., VPI & SU, Blacksburg, VA 24061.

[display]. Nutrient transport across German cockroach *Blattella germanica* oothecae: In vitro studies. D. E. Mullins and K. R. Tignor, Dept. Entomol., VPI & SU, Blacksburg, VA 24061.

[display]. Temporal isolation of events of spermatogenesis in the cricket *Teleogryllus commodus* using DNA flow cytometry. R. Atkinson, Dept. Entomol. Parasitol., Wellman Hall, Univ. California, Berkeley, CA 94720; S. Sherwood and R. Schimke, Dept. Biol. Sci., Stanford Univ., Stanford, CA 94305; and W. Loher, Wellman Hall, Univ. California, Berkeley

Evolution and systematics of the termites. B. L. Thorne, Mus. Comp. Zool., Harvard Univ., Cambridge, MA 02138 and Biol. Dept., Northeastern Univ., Boston, MA 02215.

Effect of diflubenzuron on mortality and age structure in German cockroach populations. B. A. Moser, R. W. Wadleigh, and P. G. Koehler, Dept. Entomol. & Nematol., University of Florida, Gainesville, FL 32611.

Factors influencing the control of the German cockroach, *Blattella germanica* with pyrethroid insecticides. D. A. Reierson and M. K. Rust, Dept. Entomol., Univ. California, Riverside, CA 92521.

Performance of bait formulations for control of German cockroaches: field and laboratory studies. A. G. Appel, Dept. Entomol., 301 Funchess Hall, Auburn Univ., Auburn, AL 36849.

Toxicity of several blatticides to adult German cockroaches. S. F. Abd-Elghafar, A. G. Appel, and T. P. Mack, Dept. Entomol., 301 Funchess Hall, Auburn Univ., Auburn, AL 36849.

Food selection by *Cryptocercus punctulatus* (Cryptocercidae): comparison with subterranean termites (Rhinotermitidae: *Reticulitermes*). D. A. Waller, Dept. Environ. Studies, Sweet Briar College, Sweet Briar, VA 24595.

Similarity of hydrocarbon patterns within and among geographically distant populations of the Formosan subterranean termite. M. I. Haverty, USDA-FS, Pacific Southwest For. & Range Exp. Sta., P. O. Box 245, Berkeley, CA 94701; and M. Page, Dept. Biochem., Univ. Nevada, Reno, NV 89557.

Genetic variation in U.S. populations of the Formosan subterranean termite, *Coptotermes formosanus* Shiraki. A. K. Korman and L. P. LaFage, Dept. Entomol., Louisiana State Univ., Baton Rouge, LA 70803.

Latin American katydids (Orthoptera: Tettigoniidae): diversity, ecology, behavior, and acoustics. J. Belwood, Dept. Entomol. & Nematol., Univ. Florida, Gainesville, FL 32611.

IN MEMORIAM
Sonja Sofija Mikšić

It is with deep regret that we have learned of the death, in 1988, of Dr. Sonja Sofija Mikšić, not long after that of her late husband, another entomologist of note, Dr. René Mikšić. Unfortunately, as yet we have no further information, so that an appropriate obituary is not possible. Sofija (or Sonja, as she seems to have been more familiarly known) was employed earlier by The Biološki Institut in Sarajevo, Herćegovina, Yugoslavia), but about 1958 or 1959, she transferred to The Zemaljski Muzej (State Museum) in the same historic city, where she carried on the long tradition of Serbo-Croat studies on orthopteroid insects. She published at least 20 papers in this field (most of them without co-authors). So far as I am aware, she used the name Sonja in only one of these (in 1961) in the Proceedings of the 11th International Congress of Entomology in Vienna, 1960 (at which she was actually registered as "Miss" Sofija Mikšić). So far as I can recall, that Congress was the first (but by no means the last) time that I met this large, energetic, and friendly woman. She spoke virtually no English or German, but her command of French was impressive. Circumstances prevented her from contributing even more to Balkan orthopterology than she did. Now, alas, we must say, rest in peace.

IN MEMORIAM
Władysław Bazyluk

We also regret to learn of the death of Doz. Dr. Ks. (Father) Władysław Bazyluk in July, 1988. Father Bazyluk was for many years the leading Polish authority on orthopteroid insects, upon which he published about 25 works since 1947. Most of his contributions were on the Polish fauna and without co-authors, but he did sometimes publish with others and on the fauna of other countries. Particularly useful have been his contributions to the series *Klucze do Oznaczania Owadów Polski* (Keys to the Insect Fauna of Poland) IX-XII (Blattodea, Mantodea, Saltatoria, and Dermaptera), published in 1956 by Polski Związek Entomologiczny (The Polish Entomological Society), Warszawa (their series of keys, nos. 11a,b, 17 and 12, respectively). Father Bazyluk will be greatly missed by his colleagues.

Keith D. McE. Kevan
Lyman Entomological Museum

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KATYDIDS OF THE PERUVIAN AMAZON

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In 1987 I had the opportunity as one of the principal investigators of an Earthwatch research project to study katydids and other orthopteroid insects in the Amazon drainage system east of Iquitos, Peru. Studying these fantastic insects with me were Drs. James L. Castner and Jacqueline J. Belwood, both of the University of Florida. We were joined, during the course of three separate trips to the region, by six teams of Earthwatch volunteers, totalling more than 55 individuals. Earthwatch Foundation is a funding organization (one of the top three in this country) which essentially helps scientists conduct research by providing funds for travel and equipment and by recruiting individuals, usually nonscientists, to assist in field studies. For the scientist, it is a tremendously successful means of gathering information, because he or she has not one set of eyes, ears, and hands, but many. Each Earthwatch Team is comprised of six to ten volunteers who have selected a particular project, each for his or her own reason. Volunteers bring an unusually high degree of interest and desire to help and learn, and everyone--scientist and volunteer--benefits from the synergism.

I am continually asked why did I choose katydids to study, out of the vast diversity of organisms in the rain forests of Peru. Katydids are a dominant element in the nocturnal insect community, both in numbers and diversity, and are an important food source for many carnivores. In fact, they may be the primary source of animal protein for insectivorous and omnivorous birds, monkeys, bats, rodents, reptiles, and amphibians. Because of their acoustic behavior, we have been able to study several aspects of their biology both in the field and laboratory. For example, he have studied aspects of communication, pair formation, population dynamics, and daily activity cycles by monitoring singing behavior through time. Katydids have other qualities that have made them our subjects of choice for research. They can be mass-reared easily in a laboratory environment, and are large enough (some are as large as a small bird!) to be observed with the naked eye: all features which greatly enhance our ability to gain understanding of the behavior of these interesting animals. And these animals have a vast array of behaviors worthy of study: acoustical communication, radically different diurnal and nocturnal activities, mimicry, and predator-prey interactions. Many of these features can be studied and the results used to predict behavior in other organisms that are less accessible in nature or more difficult to control in the laboratory.

For myself, and for my coworkers, Jim and Jackie, perhaps the main reason for choosing katydids is a deep regard for their sheer natural beauty, a quality that seems to transcend them above their biological status as insects. Our rain forest communities of the world are in danger of being destroyed beyond repair. The large mammals, such as jaguars and monkeys, that captured the interest of the public to preserve such areas for posterity, have been reduced in numbers or are completely destroyed by the encroachment of the human species on this fragile frontier. Insects are the one class of animals still surviving in relatively large numbers. Of these, katydids are among the few groups that are aesthetically pleasing to the general

public. I am beginning to believe that katydids may become the spokesmen for saving the rain forests.

Perhaps nowhere in the world is the katydid fauna as great or as diverse as in Peru. A little over one-tenth the size of the United States, Peru has more than 270 species of katydids, compared with 107 for the United States: Peru has two and a half times as many described species. Compared with the entire fauna of the continent of South America, Peru's fauna represents 44% of the total of 615 species. What we have found so far is that this number is low, perhaps very low, that the katydid fauna of Peru may be much greater than we have believed.

Because katydids are active at night and impossible to locate during the day, most of our collecting was done at night between nine p.m. and two a.m. We initiated our volunteers to the wonders of the rain forest at night with both fun and a sense of reverance for nature. From the noisy edge of the forest, where coneheaded katydids are buzzing and subterranean mole crickets are whining, one enters the much quieter depths of the inner forest. Here the sounds differ, because the species are not the same as those in the more disturbed open areas. Selection pressure from acoustically-orienting predators (primarily bats) has resulted in radically different pair-forming signals among these forest-dwelling katydids. Many have reduced their singing times to a few short intervals per night, and air-borne signals have been replaced, at least for some species, by substrate-vibrational signals.

In this, our first part of the study, we have examined only the first twenty feet of the forest's understory. The canopy species have yet to be studied, and it is there that we expect to encounter many more species, each with its own blueprint of specialized behavior patterns. Volunteers captured specimens by hand on the foliage and returned them alive to our makeshift field laboratory, where they were photographed (alive) and kept in cages for tape recording, lab rearing, etc. A series of the material was killed and prepared for museum collections to be distributed between the US National Museum in Washington and various Peruvian Institutions.

The number of new species that we found in the understory was far greater than we had expected: within some groups, at least one quarter of the species were previously unknown. It is difficult to explain to someone not familiar with these insects the extreme variety of shapes, colors, sizes, and adaptations found among these katydids. We have collected katydids resembling leaves, sticks, lihens, tree bark; katydids as large as a sparrow and as small as the fingernail on one's little finger; gentle species and those that draw blood when they bite. Perhaps the most amazing one that we studied was the species ***Aganacris pseudosphex***: instead of following the normal pattern of mimicry by resembling its background environment, this species has evolved to look and act like a sphecid wasp. Other aspects of mimicry were equally impressive, however, especially among the pseudophylline katydids of the Tribe Pterochozini (=the true leaf mimics). We have identified more than 10 species from the study area alone.

The Earthwatch grant recently has been renewed and we will be continuing our studies on the behavior, ecology, and systematics of this fascinating group of insects. For those interested in a breakdown of our faunal study, I have included a series of Tables meant to give us information about the microfauna of each of three study sites in the area of Peru east of Iquitos. This is the first, but not the last, update of our research.

PRELIMINARY RESULTS OF FAUNAL STUDIES OF THE ORTHOPTEROID INSECTS OF THE PERUVIAN AMAZON

by
David A. Nickle

The following information consists of preliminary statistical data regarding the spatial and temporal distribution of the insects collected by Teams I-VI, 1986-1987. It does not include data on the termites, which as yet have not been evaluated. It is not intended to demonstrate anything other than trends, *e.g.*, the likelihood of finding species at one site at one time of the year. This information benefits us by making us (1) aware of the species of each collecting site and (2) cognizant of where and when we can expect to study them.

During the course of our program we collected at three locations: the Explorama Inn (40 km from Iquitos, on the Amazon), the Explorama Lodge (80 km from Iquitos, again on the Amazon), and the Explornapo Camp (160 km from Iquitos, on a tributary of the Rio Napo). These are resort facilities of the nature-oriented Exploraciones Amazonicas, owned by Peter Janzen with headquarters in Iquitos.

We distributed the Teams into three phases of 1986-1987 in a preliminary attempt to evaluate seasonal differences in species numbers and the possibility of seasonality of certain groups. Teams II and III were active during the beginning of the rainy season (February), when water levels of the rivers were rising at a rate of nearly 6" per day. In their combined efforts, 61 species (15.2% of the total number of species collected) were found only during this period. Teams IV, V, and VI, collecting in July and early August when the water levels were at their lowest, collected 99 species (24.6% of the total) that were collected at no other time of the year. The collections of Team I in November (a dry month) yielded 61 species (15% of the total species) unique for that period of time. In all, more than half of the species collected were found only at one time of the year. Although these data are preliminary, they suggest that behavioral studies of some species might be limited only to certain times of the year. We are only beginning to evaluate the species we want to study in greater detail. Future trips to Peru will be timed to maximize our chances of successfully locating these species again in the field, based on the information provided by Teams I-VI.

In a review of species found only at one collecting site, we found a significant number of species unique for each region. Preliminary data suggest that at least some of the species we collected may be restricted in distribution, and that each locality has a proportion of its fauna that is unique to the area. Excluding the phaneropterine (bush katydid) fauna, 25 species were unique to the Explornapo Camp area, 55 were unique to the Lodge and 67 were found only at the Inn. Combining those species found only at two consecutive sites along the transect connecting the sites with those species unique to only one site, it was determined that 83.6% of the species were limited in distribution, compared with 16.4% found (or potentially found) at all three localities. Again, this information will alert us to the possibility that some sites may not yield the species we are trying to study.

It may be instructive to explain the procedures involved in transforming field collected orthopteroid insects into permanent museum specimens. When the specimens collected by Teams I – VI were brought to the National Museum, it was necessary first to curate the assemblage in order to study it in detail.

The initial step, practiced by most Team members, involved killing the specimens, either in cyanide jars or through a lethal injection of ethanol into the body cavity. After specimens were dead, the digestive tract, fat body, and internal reproductive organs were removed to help prevent rotting. An insect pin was then inserted through the prothorax, and a temporary label was attached. To prevent the growth of molds, specimens were then placed on layered, absorbant material, sun-dried as quickly as possible, and sealed into boxes to be returned to the Museum.

At the Museum, specimens were removed from the layers, usually at a rate of 50 per day, and placed into a relaxing chamber – a plastic container with enough water in the bottom so that when sealed, the container developed a humid microenvironment which in 24 – 36 hours softened the specimens and made them as pliable as when freshly killed. Each specimen was then positioned carefully so that forelegs extended forewards, midlegs reflexed and positioned close to the body, and hindlegs reflexed and extended posteriorly. This positioning was accomplished by placing a series of numerous stay pins around and between the legs and other body parts.

Stay-pinning and positioning insects is a time-consuming, tedious procedure, often requiring 3-5 minutes per specimen. After positioning the specimens, they were air-dried for 2-3 days. The procedure was then reversed, and as with the care required to play "pick-up-sticks", the stay pins were carefully removed so as not to break the now-brittle, dry specimens. The properly positioned specimens were then placed into unit trays in insect drawers.

When all specimens were curated in this manner, the next step was to replace the field labels with finer quality, permanent labels. Labels were printed on sheets of high quality paper and hand cut to uniform size. For the project, a total of 27 different labels were used to indicate dates, localities, and Teams. Each temporary label had to be replaced with the permanent label that had the same information. This too was a time-consuming procedure, requiring weeks to complete.

The specimens, now consistantly positioned and permanently labelled, were ready to be sorted. At this stage, they were randomly distributed in 30 insect drawers. Step one of the sorting process was to get all the mantids in one drawer, all the walking sticks in another, all the grasshoppers in another, etc.

The process was then refined as all the specimens for each group were studied in fine detail in order to segregate species. Although some species were easily recognized as being distinct, others were very similar and could be separated only by microscopic examination. Each species isolate was placed in its own unit tray.

The final step is usually the most difficult one – the process of identifying the species isolates. This involves matching the specimens with actual names in

the literature. It requires a thorough knowledge of the literature. Specimens are compared with both literature descriptions and actual identified specimens already in the collection (or in other collections, such as those at the American Museum of Natural History in New York or the Academy of Natural Sciences in Philidelphia).

From beginning to end, the average time required per specimen is 12-13 minutes, excluding the time spent identifying the specimen to species. Given that 2000 specimens were curated, it required a total of 416 man-hours to prepare the material for study. Identifying the material required considerably more time and effort. The average time involved to put a name on a species (or to determine that it has not yet been named and described) was about 20 minutes. Since we collected about 400 species, more than 8000 minutes or 133 hours will have been spent getting the species list on the following pages assembled.

Finally there is the effort of writing descriptions of new species. Besides the description itself, research is required to relate the new species with those already known to science. Figures of the species must be rendered, measurements taken, etc., in order to produce a publishable manuscript.

During the course of the Project the combined collections of the six Teams totalled 1966 dry-mounted specimens. In addition, a substantial collection of orthoperoids were preserved in alcohol - primarily during the month of February (Teams II and III) when sunlight was a rare commodity and air drying of specimens was difficult. Approximately 300 specimens representing all orthopteriod groups were so preserved. This collection will be valuable when internal morphological characters of soft tissues are compared for the first time with standard external morphological characters of chitenous material.

The breakdown of the Collection of dry-mounted material is summarized in Table 1. 44 specimens of mantids (Mantodea) represinting 14 as yet undetermind species were collected. 225 specimens of cockroaches (Blattodea)(= 33 species), 108 specimens of walkingsticks (Phasmatodea)(= 28 spp.), 314 grasshoppers (Acrididae)(= at least 64 spp.), 111 crickets and molecrickets (Gryllidae and Gryllotalpidae)(= 34 spp.), and 1066 katydids from six subfamilies of the Family Tettigoniidae (= at least 237 spp.) were collected. Many have been named; others probably have names, but I have so far been unable to match names with the specimens; finally several species are definitely new, undescribed forms. My conservative estimate is that 25 - 30% are undescribed.

It is important also to realize that the species we have collected represent only a small proportion of the species present in the three forests we sampled. We selectively collected only the species present in the lowest 14-20 feet of the forest understory. Many species, including several grasshoppers (of which we collected a few fallen individuals), live only in the upper and middle canopies. To sample them will require special techniques, such as fogging sampling employed by Terry Erwin in his Earthwatch Project. Fortunately for us, we have access to the material he has collected, and we look forward to evaluating it.

As already mentioned, many of the species collected are new to science. I am at a loss to put names on several forms, and I am certain (based on my knowledge of particular groups) that as many as 25% are undescribed. However, I

hesitate to describe these species until more material is available in order to evaluate the range of variation for each undescribed species. I have decided to name many species after Team members, first, to give the species a name, and second, to show my deep appreciation to individuals who have helped us in our research. As we describe these species, we will be sending our reprints to those who continue to have an interest in the project.

Team V led the Earthwatch Teams for the number of species collected uniquely: 50 species (or 12.4% of all the species collected during the project). Teams I and III tied for second place, with 42 species collected (10.4% of the total). Although Teams II and VI were low on numbers of unique species, they should not feel slighted. Team II was the unlucky Team to be saddled with the Most Rainy Evenings, and Team VI, by virtue of its position as the "Clean-up Team", had the least number of days to collect for us. What is interesting to me is that nearly half of the species collected were collected uniquely by only one Team and were not collected again by any of the other Teams. With 187 species, and at least 25% of them new, the chances are high that everyone will be the namesake of at least one new species.

Table 1. Specimens collected by Earthwatch 1987 at three collecting sites of the Exploraciones Amazonicas, Iquitos, Peru. Specimens are located at the National Museum of Natural History, Smithsonian Institution, Washington, DC 20560.

GROUP	CAMP						LODGE						INN						
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI	TOTAL
BLATTODEA	9			1	37		3			1	12		2			32	24	3	124
MANTODEA	1		1	1	2		1				4		5		8	3	13	5	44
PHASMATODEA	1	1	11	3	12		4	2	2	1	20		4		5	16	20	6	108
ORTHOPTERA:																			
Gryllidae			2	2	7		8	3	2	3	7		4		2	12	9	2	63
Gryllotalpidae							3	13	3		1				3	7	13	1	44
Tetrigidae			2	1			16		1	1	10		5		2	2	3	14	57
Proscopidae								2				3	4		8	2	2	1	22
Eumastacidae			2	1	1		6			1			2		4	1		1	19
Acrididae	3	3	20	11	10		31	14	14	3	23	3	32	1	61	46	24	14	313
Tettigoniidae:																			
Listrocelinae			3				5		1				2	2	2	3	1		19
Agraeciinae		4	5		5		3	7	10		4	1	13		12	14	13	5	96
Conocephalinae			1				4	5	3							1			13
Copiphorinae		5	7		7		7	5	12	5	5	2	16	6	16	2	42	14	151
Pseudophyllinae	11	6	22				50	12	97	1	10	21	28	6	33	2	18	16	333
Phaneropterinae		3	10	1	6		30	2	19	1	17	9	134	50	56	27	210	33	608
OTHER INSECTS	12		3		10		36	4	5	24	31		29	10	10	28	20	7	229
TOTAL	37	22	89	21	97		207	69	169	41	144	39	280	75	222	198	412	122	2244

Table 2. Species of walkingsticks (Phasmatodea) collected by Earthwatch Teams, 1986-1987, at Explornapo Camp, Explorama Lodge, and Explorama Inn, all facilities of Exploraciones Amazonicas, Iquitos, Peru.

SPECIES	CAMP						LODGE						INN					
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
PHASMATODEA																		
undet. PH-1																2	6	
undet. PH-2					1											3	1	
undet. PH-3											3		1				4	1
undet. PH-4					1					1	4					2	2	
undet. PH-5								1										
undet. PH-6																		
undet. PH-7			1															
undet. PH-8				2							2		1		2	1	1	
undet. PH-9					1													1
undet. PH-10					1													
undet. PH-11							1				1							
undet. PH-12			1								1				1			
undet. PH-13	1																	
undet. PH-14													1					
undet. PH-15			1				2	1			2		1			2	1	
undet. PH-16			1															
undet. PH-17			1		2													
undet. PH-18																		1
undet. PH-19			3		2				1								1	
undet. PH-20			1															
undet. PH-21			1															1
undet. PH-22				1	3						5					4	2	2
undet. PH-23									1							1		
undet. PH-24					1		1				1				1	1	2	
undet. PH-25											1							
undet. PH-26															1			
undet. PH-27		1																
undet. PH-28			1															

Table 3. Species of praying mantids (Mantodea) collected by Earthwatch Teams, 1986-1987, at Explornapo Camp, Explorama Lodge, and Explorama Inn.

SPECIES	CAMP						LODGE						INN					
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
MANTIDAE																		
undet. M-1													1					
undet. M-2					1								1		1	2	2	1
undet. M-3																	1	
undet. M-4							1								2			
undet. M-5															2			1
undet. M-6											2		1				2	1
undet. M-7				1														
undet. M-8																	1	
undet. M-9											1							
undet. M-10	1		1								1		2		1	1	1	1
undet. M-11															2		2	
undet. M-12																	1	
undet. M-13					1												2	
undet. M-14																		1
undet. M-15																	1	

Table 4. Species of cockroaches (Blattodea) collected by Earthwatch Teams, 1986-1987, at Explornapo Camp, Explorama Lodge, and Explorama Inn.

SPECIES	CAMP						LODGE						INN					
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
BLATTIDAE																		
undet. B-1							1									1		
undet. B-2													2			1		
undet. B-3	3				5						3					4	2	
undet. B-4	1				2													
undet. B-5					3						1						2	
undet. B-6					1											1	1	
undet. B-7	1										1					1	1	
undet. B-8							1											
undet. B-9																	1	
undet. B-10																1		
undet. B-11																1		
undet. B-12					4													
undet. B-13																1		
undet. B-14					1											1	1	
undet. B-15					1											2	3	
undet. B-16					1											3	3	
undet. B-17																	2	1
undet. B-18	1				1											2	1	
undet. B-19											1							
undet. B-20	1				2													
undet. B-21	2				10						1					8	3	
undet. B-22							1											
undet. B-23										1							1	
undet. B-24											1					1		
undet. B-25				1	1													1
undet. B-26																1		
undet. B-27					1												1	
undet. B-28												1						
undet. B-29											2					2		1
undet. B-30					3						2							
undet. B-31																	2	
undet. B-32					1													
undet. B-33																1		

Table 5. Species of pygmy grasshoppers (Tetrigidae), "airplane" grasshoppers (Eumastacidae), and stick grasshoppers (Proscopidae) collected by Earthwatch Teams, 1986-1987, at Explornapo Camp, Explorama Lodge, and Explorama Inn.

SPECIES	CAMP						LODGE						INN					
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
TETRIGIDAE																		
undet. T-1											1							
undet. T-2											1							
undet. T-3																1		
undet. T-4			1	1									1					
undet. T-5							8								1			
undet. T-6							6		1						1			
undet. T-7																1	2	
undet. T-8			1				2			1	8		4				1	14
EUMASTACIDAE																		
undet. E-1							5						2					
undet. E-2			2	1											2	1		
undet. E-3					1		1			1					2			1
PROSCOPIDAE																		
undet. P-1								1					3			2	2	1
undet. P-2													1		8			
undet. P-3												3						
undet. P-4								1										

Table 6. Species of grasshoppers (Acrididae) collected by Earthwatch Teams, 1986-1987, at Explornapo Camp, Explorama Lodge, and Explorama Inn.

SPECIES	CAMP						LODGE						INN					
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
ACRIDIDAE																		
Copiocera prisina			1												1			
undet. A-1				1														
Tetrataenia surinama											1	1	3	1	2	3	1	
Mastusia quadrimaculata									1				2		1	1		
Xenismacris cyanoptera?													1					
Cornops sp.													2					
Stenopola boliviana							1	1	1							1		
undet. A-2													1					
Ommatolampis perspicillata			1								1		2		1			3
undet. A-3			1		1		1				2							
Hippariacris latona		1					3				2	1						
undet. A-4			1				1											
undet. A-5			1	1	1						1				1		3	2
undet. A-6																2		
undet. A-7		1																
undet. A-8							1				1		3		1	5		2
Osmilia violacea		1		2			4	1			1				4	2		
Xyphophora cyanoptera							1	2										
undet. A-9							1		1						1	1	1	
undet. A-10			1															1
undet. A-11								1										
undet. A-12															1			
undet. A-13			3													1		
undet. A-14			4	2	3		2	3	1		1		1		6	5	2	1
undet. A-15									1									
undet. A-16					1		1											
undet. A-17															1			
undet. A-18											3				1	1	3	
undet. A-19			1					1										
undet. A-20								1										
undet. A-21							1											
undet. A-22															1			
undet. A-23							2				2		1			2	1	
undet. A-24	2		1	2	1		1		1			1	6		5	4	1	
undet. A-25										1	3		2			1	3	
undet. A-26													1					
undet. A-27							1											1
undet. A-28															1	1		
undet. A-29																		
undet. A-30							1								1			
undet. A-31													1					
undet. A-32																		

Table 6, continued.

SPECIES	CAMP						LODGE						INN					
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
ACRIDIDAE, continued																		
undet. A-33							1											
undet. A-34													1					
undet. A-35			1															
undet. A-36										1								
undet. A-37										1								
undet. A-38											1							
undet. A-39											1		1		3		2	
undet. A-40	1						1						1			2		
undet. A-41				1				1	1				1		6	1	1	1
undet. A-42			1						2									1
undet. A-43				2			3						2		5	3	3	
undet. A-44			1		1		1	2	2						3		1	
undet. A-45					1													
undet. A-46									1						1	2		
undet. A-47			1						1									
undet. A-48			1															
undet. A-49								1							7		1	1
undet. A-50									1						1	4		1
undet. A-51																1		
undet. A-52																	1	
undet. A-53					1			1										
undet. A-54							3				3				6	2		

Table 7. Species of mole crickets (Gryllotalpidae) and true crickets (Gryllidae) collected by Earthwatch Teams, 1986-1987, at Explomapo Camp, Explorama Lodge, and Explorama Inn.

SPECIES	CAMP						LODGE						INN					
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
GRYLLOTALPIDAE AND GRYLLIDAE																		
undet. G-1														13		6	4	
undet. G-2																	4	1
undet. G-3			1												1			
undet. G-4															1			
undet. G-5					1													
undet. G-6																1		
undet. G-7							3		3		1					1	6	
undet. G-8				1				2			1							
undet. G-9							1						1					
undet. G-10											2		1			3	1	
undet. G-11					2											1	1	
undet. G-12							1											
undet. G-13								1										
undet. G-14							1											
undet. G-15					2						2				1	5	5	
undet. G-16																	1	
undet. G-17											1							
undet. G-18										1								
undet. G-19																1		
undet. G-20																1		
undet. G-21				1														1
undet. G-22																		
undet. G-23										1								
undet. G-24					1											1		
undet. G-25																		
undet. G-26															1			
undet. G-27																		1
undet. G-28																	1	
undet. G-29																		
undet. G-30			1						1		1	1						
undet. G-31							1											
undet. G-32					1		2		1				2				1	
undet. G-33							1								1			1
undet. G-34											1							

Table 9. Species of coneheaded katydids (Copophorinae) and predatory katydids (Listroscelinae) collected by Earthwatch Teams, 1986-1987, at Explornapo Camp, Explorama Lodge, and Explorama Inn.

SPECIES	CAMP						LODGE						INN					
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
COPIPHORINAE																		
Daedalellus n. sp.			3		5			1	3	1					5	1	3	
Oxyprora sp.n?											1						1	
Ocana robusta (or Nr)															1			
Bucrates sp.1													1	2		1	3	
Bucrates sp.2												1					1	
Bucrates sp.3							1											
Bucrates sp.4 (Parabucrates)												1			1		3	3
Melanophoxus brunneri							1	2					2				2	4
Copiphora sp.1					1			1	4				3		1			
Copiphora sp.2							1											
Copiphora sp.3									2					1				
Acantheremus granulatus																	1	
new genus Y sp									1					1				
new genus Z sp. 1			2										3				3	
new genus Z sp. 2		1										-						
new genus X sp		3	1				1						2		1			
Panacanthus cuspidatus							1											
undet. CO-1							1			1	1		1	1			7	4
undet. CO-2							1		1				3		4		5	1
undet. CO-3										2								
undet. CO-4					1					1							4	
undet. CO-5											1							
undet. CO-6		1	1								1			1	3		5	
undet. CO-7													1					
undet. CO-8								1	1								4	1
undet. CO-9																		1
LISTROSCELINAE																		
Phlugis sp. 1																1		
Phlugis sp. 2									1									
Phlugis sp. 3							1						2		1			
Phlugis sp. 4							1							2		2	1	
Phlugiola sp.1			1				2											
Monoceraphora sp.			1															
n.gen., n.sp							1											
n.gen, n.sp ?			1												1			

Table 10. Species of sylvan and dead leaf mimicking katydids (Pseudophyllinae) collected by Earthwatch Teams, 1986-1987, at Explomapo Camp, Explorama Lodge, and Explorama Inn.

SPECIES	CAMP						LODGE						INN					
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
PSEUDOPHYLLINAE																		
Diacanthodis granosa							2							2				
Acanthodis longicauda							1							1				
Rhinischia? sp							1	1										
undet. X-1									1									
undet. X-2									1									
undet. X-3									1									
undet. X-4																	1	
undet. X-5											1							
Leurophyllum luridum		1							1									1
Leurophyllum consanguineum									1								1	
gen? sp? Pleminiinae							1		1				1					
undet. X-6							2		1				1				1	
undet. X-7															1			
undet. X-8												1			1			
undet. X-9												1					1	
undet. X-10		1					1											
undet. X-11	1		2						2			2						1
undet. X-12	1		2						1			1						1
undet. X-13							1									1		
undet. X-14									1									
undet. X-15																	1	
undet. X-16	1						4	1	1									
undet. X-17								1	1	1					1			
undet. X-18							1											1
undet. X-19									1						1			
undet. X-20			1				2		1						1			
undet. X-21		1	1															
Teleutias viviventer							3		2			6	1	2	1	1		
Teleutias vicinissimus		1																
undet. X-22												1			1			
undet. X-23												1						
undet. X-24																		1
Elapmyraspis nigrita							1											
Jimenezia elegans								1	1				2	1				
Triencentrus sp. 1								1	3						1		1	
Triencentrus sp. 2							1						1		5		6	
Leptotettix pubiventris?								1	1									1
undet. X-25	5																	
Leptotettix voluptarius	1		2				1						6					

Table 10, continued.

SPECIES	CAMP						LODGE						INN					
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
PSEUDOPHYLLINAE continued																		
Macrochiton adjutor									4									
Chondrosternum dohrni			1					1	2				1		1			1
undet. X-26			1												1			
undet. X-27									1									
"Pseudopterophylla n. sp."									1			1						
Diophanes salvifolius									1		1				1			
undet. X-28											1							
undet. X-29									2				1		1			
undet. X-30																		
undet. X-31									5		3		1					
Panoploscelus specularis									2				1					
Choeroparnops alatus		1							3			1						1
Choeroparnops fulvus									1				1					
Eubliastes sp.1									2				1					
Eubliastes sp.2									1			1	1				1	
undet. X-32			1				1		1						3		2	
undet. X-33							1		6									2
undet. X-34			2						1						1			
undet. X-35							2		2									
undet. X-36									1			1			2			
undet. X-37	1							2										
undet. X-38									2									
undet. X-39								2	2			1						1
undet. X-40			2				8								2			
undet. X-41									1				2					

Table 11. Species of bush katydids (Phaneropterinae) collected by Earthwatch Teams, 1986-1987, at Explornapo Camp, Explorama Lodge, and Explorama Inn.

SPECIES	CAMP						LODGE						INN					
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
PHANEROPTERINAE																		
Ceraia cornutoides											3		7	1	3		22	4
Ceraia tibialis									1				4	5	2		4	1
Ceraia sp. 1														1				
Vellea cruenta													1	1			1	
Rossophyllum sp. 1													1					
Rossophyllum sp. 2																	1	
Ischyra sp.														1			1	1
Ischyra sp. (or nr)							1		1				9	1			13	
Microcentrum sp. 1													13	3	1	2	6	1
Microcentrum sp. 2													1				1	1
Microcentrum sp. 3																	2	
Microcentrum sp. 4														2				
Acropsis sp.														1				
Lobophyllum sp. 1													1				3	
Lobophyllum sp. 2									1				2	1			4	
Percyna zebrata													3	1	2		6	
undet. P-1													1				1	
undet. P-2									1									
undet. P-3					1													
Ceraiella trianulata													1					
Steirodon sp.1							1		1				1	2			5	
Steirodon sp.2													3	2				
Steirodon sp.3											1		3	4	1		4	
Steirodon sp.4														1				
Stilpnochlora sp. 1											1			2	1			
Frontinum sp.1													1					
Frontinum sp.2													2					
Euceraia femorata							2	1					7	4			5	2
Euceraia sp. 1							1					1	9	1			9	
Euceraia sp. 2												1						
Euceraia sp. 3													1					
Euceraia sp. 4													1					
Euceraia sp. 5							1						1	1			1	
Euceraia sp. 6													1				2	
Euceraia sp. 7									1					1				
Euceraia sp. 8									1								1	
Euceraia sp. 9					1												1	
Euceraia sp.10			1				1										6	1
Viadana sp. 1			1								1		2		3		3	1

Table 11, continued.

SPECIES	CAMP						LODGE						INN					
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
PHANEROPTERINAE continued																		
Viadana sp. 2								1		2		4		1	1	9		1
Tomeophora sp.1												3						1
Hyperphrona sp. 1							1				1					1		
Hyperphrona sp. 2												1				1		
Hyperphrona sp. 3																4		
Hyperphrona sp. 4														2		3		
Hyperphrona sp. 5			1															
undet. P-4								2										
Ceraiella trianulata							1					1				1		
Montezumina inca									1			1						
Aganacris pseudosphex							2					3		1		1		
unkn.genus, sp.								1				2						
Euthyrhachus sp. 1							1			1				4	4	8		
Euthyrhachus sp. 2										1						1		1
undet. P-5											2							3
Ectemna sp. 1													1					
Parableta sp. 1							1					1				1		
Parascudderia sp. 1																3		
Parascudderia sp. 2												1				1		
Parascudderia sp. 3																1		
undet. P-6										1								
undet. P-7								1										
Dolichopoda sp. 1																2		
Dolichopoda sp. 2			1									1				1		
undet. P-8															1			
undet. P-9															1			
Itarissa sp. 1												1	1		2			
Itarissa sp. 2			1				2					4	2			4		
Itarissa sp. 3				1												4		1
Itarissa sp. 4								2		1			2	4		1		2
Itarissa sp. 5							1					4	1			1		
Itarissa sp. 6								1										
Itarissa sp. 7			1															
Itarissa sp. 8																1		
Itarissa sp. 9												1						
Phyllopteria sp. 1							1				1		2			1		1
Phyllopteria sp. 2							3		1			4	1	3	1	2		

Table 11, continued.

SPECIES	CAMP						LODGE						INN					
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
PHANEROPTERINAE continued																		
Phylloptera sp. 3			1														1	
Phylloptera sp. 4		1																
Phylloptera sp. 5													1					
Phylloptera sp. 6					1		1											
Phylloptera sp. 7							1						3		1	1	4	
Phylloptera sp. 8			1															
Phylloptera sp. 9									1				3		2	1	3	
Phylloptera sp. 10					1				1		3				1	1	1	
Phylloptera sp. 11			1								1							
Phylloptera sp. 12																	4	
Phylloptera sp. 13		1	1		1		1						5	3	7	3	10	2
undet. P-10												2						3
Grammadera sp.1							2	1					1		2			
Grammadera sp.2												1			1			
Grammadera sp.3																	1	
Grammadera sp.4															4	1	4	1
Anaulocomera sp. 1							1						1			3	5	
Anaulocomera sp. 2							1		1				1		2		5	
Anaulocomera sp. 3															1		2	
Anaulocomera sp. 4											1							
Anaulocomera sp. 5																	1	
Anaulocomera sp. 6																	1	
Anaulocomera sp. 7													1					
Anaulocomera sp. 8													1					
Anaulocomera sp. 9																2		
Anaulocomera sp. 10													4			1	10	
Anaulocomera sp. 11															3		4	
Anaulocomera sp. 12															1		1	
Anaulocomera sp. 13																1		

Table 11, continued.

SPECIES	CAMP						LODGE						INN					
	I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
PHANEROPTERINAE continued																		
Anaulocomera sp. 14														1	2			
Anaulocomera sp. 15													1					
Anaulocomera sp. 16							1						1					
Anaulocomera sp. 17		1													1	1		
Anaulocomera sp., misc.					1		2						3		1			5

PROLOGUE

by
Rob Pudim, Team III

"It's spooky. You don't know spooky till you've been there. Everything's all wet and swirly and tangled up and you can't see jack, you can't find your own pecker to piss with. Like you don't even have a body. Serious spooky. And the sounds, man. The sounds carry forever. You hear shit nobody should ever hear."

Tim O'Brien, How to Tell a True War Story

Until the Amazon Katydid Expedition I had not been walking in the jungle at night since Vietnam. Bushwhacking (or, as the Army called it, reconnaissance) was done without lights and all I remember of those forays was being scared the entire time I was out beyond our perimeter. A dark-adapted eye was useless once under the canopy and I was glad I couldn't see what I was grabbing and touching. There were seriously dangerous things in those rainforests--guys carrying AK-47's, pungi sticks and trip wires. Touch, smell and hearing were all I had, and Victor Charlie was better at it than I was.

The rainforest sounded the same. Peru or Vietnam, it's the same. Strange sounds, Tim O'Brien says, which seemed far away, sort of, but right up close. Weird echoes of things which deceive the ears. One night our team was walking along a trail outside the Camp when we all heard a party going on with people laughing and talking, glasses clinking and a sort of wacked-out music and drumbeat, fading in and out. Auditory illusions of parties happened in Nam, too.

Waiting on a trail one night with Jackie, we shut our lights off to save the batteries while we waited for others. When the lights went out, the blackness was sudden and complete. There's no faint whitish oval across from you which indicates Jackie's face. There's nothing, nada, zilch, just black. Suddenly the noise hits you. The night-time rainforest is far noisier than the day-time jungle. Frogs burble and chirp from above and below. One frog sounded exactly like (and as loud as) a Great Dane barking a basso "WOOF, WOOF." There are crickets which sound like someone tapping an empty glass with a spoon: "TINK, TINK." Then there are the mating calls of a thousand crickets, grasshoppers and katydids--a racket of dry clicks, whirrs, buzzings, raspings, ratchetings, high-pitched trills and keenings. The humid blackness is filled with noise and, paradoxically, the thin whine of a mosquito or midge nearing your ear.

The air is thick and motionless. No stray breezes here, not even a faint movement of air to stir the hairs on your arm. It's like no other forest on earth. An adrenalin surge like you feel in a dark musty cellar when a cobweb touches your face is triggered by the whispery, tickly brush of wings on your face. Probably a moth. Or a bat. Probably.

And lastly, the smell of the rainforest hits. Green-rotting and moisture are mixed with the odor of dead flesh. A movement of the head changes everything. Now the thick layers of air contain the exquisite fragrance of an expensive woman's perfume released by a flower right beside your nose or, maybe, five hundred yards away. There is no way to know. Smells carry a long way in the still, humid air. In Vietnam you could smell the sweaty, ripe odor of the Cong long before you heard them. They smelled us, too, with our sour meat-eaters' stench. I've often thought that jungles must be a hound dog's redolent dream of paradise.

Then, seemingly far away, we heard the others coming. Next we saw the firefly lights twinkling among the trees. When they were upon us, we flipped on our lights and round spots of daylight rainforest appeared. Familiar and comfortable heliconia leaves, elephant-ears, coleus and all the other potted plants of our living-room gardens revealed themselves. It wasn't a big revelation, just a little one, but I finally saw the serious spooky of two decades ago with new eyes for the first time.

Images and Reflections:

One Volunteer's Impressions

by

Mary D'Imperio

AT HOME IN THE FOREST

I imagine that, for some people, going out on the trails at night in the "jungle" may have had negative possibilities. I can well understand that someone who had endured Vietnam might have some very bad memories of jungle smells, tactile sensations, and real terrors behind every tree. My memories of the woods and wilderness have been entirely happy, enriching, and positive, however, and I associate deep forest with some of the best moments of my life. I have always enjoyed drifting silently along in the woods, with or without a pack, walking as quietly as I could, making of myself a floating eye, ear, and mind taking in and relishing everything going on around me in the natural surroundings. In fact, the chance to collect on the trails at night was one of my major motivations for coming on this trip.

I had had one previous experience in tropical rainforest, strictly during daylight hours, but nonetheless exciting and, for me, addictive. I spent two weeks in February 1987 at a large private forest reserve on the Southern Pacific coast of Costa Rica. During this time, I roamed alone in the forest over extensive trails, watching army ant swarms and their attendant birds, looking at the plants, insects and herps, birding, and savoring the richness of life and beauty everywhere in the place. Early in my stay at this reserve, the resident naturalist took me on a long, impromptu "bushwhack" off the trails into the forest, along dry and semi-dry stream beds, crawling through lianas and over huge tree buttresses, and spending frequent intervals just sitting quietly listening and waiting for birds and other creatures to appear. This wonderful experience erased any lingering fears I might have had of "the jungle"; yes, there were real dangers, but the same care I was used to exercising at home, looking where I put my hands and feet, was adequate to cope with them. This trip resulted in my being permanently hooked on humid lowland tropical rainforest. I couldn't ever get enough! It was soon afterward that I signed up for our expedition to Peru.

The first night we went out collecting, I was mainly worried about my ability to see and catch fast-moving insects. I was afraid I would be a klutz, unable to spot the glistening legs and antennae, and too slow and clumsy to nab the critters before they got away. I had brought a headlamp, but hadn't figured out exactly how it worked in time to use it the first night. So I had to cope with a flapping raincoat, plastic bags, a flashlight held in one hand, and a plastic cup and lid I had brought with the idea that I might be able to catch more bugs by clapping the lid over them and imprisoning them in the cup. Needless to say, I didn't catch many. But the experience of being on the trails at night was all I had hoped and more. The most wonderful thing of all was all the sounds! The lovely fluting of tinamous; the pheasant cuckoo with two strange minor piping notes followed by a quaver; all the owls (the spectacled owl's throaty purring, the tropical screech owl's wild war-whoops); the soft flittering of bats; the "whooping frogs" with their tremendous voices; all the "tings" and "teet-tas" and chatterings of frogs and insects; the "pu-pu-whirro" of the paurague. I began keeping a record on my field notebook of all the dawn and dusk sounds, to see how many creatures I could learn to recognize. I loved the feeling of being surrounded by life I could not see but much of which I could hear, and some of which I could touch.

I particularly enjoyed being in the forest at the most interesting periods out of the 24 hours. Since most of our collecting or observing was done at times

including dawn or dusk, I had many opportunities to listen as the forest woke up or went to sleep, and night life exchanged places with daytime life. I remember one amusing incident when, as I was shining my light around looking for katydids or walking sticks or roaches, I disturbed a tiny bird that had chosen a plant near the trail as a place to roost. The poor little fellow was evidently deeply asleep, since he blundered clumsily away with several indignant peeps, crashing into leaves and stems in his confusion. The only dangerous sight we saw was a small fer-de-lance someone discovered toward the end of one collecting trip. It was neatly coiled at a height conveniently at chest level right beside the trail where we all had been busily snatching at the leaves earlier that evening. I guess we were just lucky that nobody encountered it.

I have been back to rainforest several times since our trip--in Costa Rica and on Trinidad--but have had only one additional chance to get out at night with a light. On Trinidad, the naturalist took me out at my request for a brief walk along the dirt road near the Asa Wright Nature Centre, and we saw a great many frogs, insects, crabs, and other lovely things, including two birds--male Great Antshrikes sleeping in a bush. They looked like soft, fluffy balls with their heads tucked under their wings. But in most places, the powers that be frown on night expeditions, and the native guides are terrified of snakes and refuse to go out after dark. Our experience in Peru was a rare opportunity to enjoy the forest at night, and one I may not soon have again.

Mary D'Imperio, Team V

THINGS THAT GO BUMP IN THE NIGHT

EXPLORAMA LODGE, Sunday, 26 July 1987

When the time comes to go out and observe our katydid this evening, to see if it would come out of the same leaf it hid in this morning, it turns out that our katydid has flown the coop, so I come back and thankfully go to bed "early" at about 11:00 PM. After several hours of heavy sleep, and at some wee hour of the morning, I am awakened by loud thumps, voices, and the stumbling of many feet somewhere nearby. I can hear the guides' Spanish voices as well. I rouse up in bed, groggy and stupid, with the idea that our group may have decided to go collecting after all. As the noise continues and increases, I call out, "Hey, what's happening? Where's everybody going?" Jackie, next door, says it's just the new group of tourists arriving at last from their day in the toils of AeroPeru. I'm sure some of them must be lost, since I can clearly hear them trampling past our doors on our walkway! A lot of them are laughing and yelling and making a terrible racket, with no regard for the rest of us who might be trying to sleep. Their "Yanomono Specials" have probably gone straight to their heads after a long, hard day. One woman in particular, that I will call "the Screechy-Parrot Woman," has a grating, loud voice which she keeps raised above all the rest. I will hear it frequently around the Lodge in the next day or so, alas.

At breakfast, I discover to my amazement and embarrassment that nobody else was awakened by the noise. What woke them up was my plaintive query about what was afoot. How could they possibly sleep through all that commotion? Wish I could sleep like that! My waking everybody up is celebrated for posterity in the "award" I got at our farewell part for my all-hearing ears. Oh, well, if I didn't have those sensitive ears, I couldn't hear and enjoy the dawn and dusk chorus of birds, frogs and insects in the forest. It's worth it, all things considered.

-Mary D'Imperio, Team V

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-Mary D'Imperio, Team V

THE LAST BOAT RIDE

EXPLORAMA LODGE, Tuesday, 28 July 1987

Alas, it's time to leave for Iquitos. The trip has gone by much too fast! We've had our last lunch--a very good one, I thought: chicken cooked with pickled olives, rice, beans, and the usual nice salad. I ate more than I usually do at lunch, since heaven knows when I'll get another meal until I reach home. I expect it may be just as hard to get OUT of Iquitos as it was to get in! I can see our luggage being piled into a dugout canoe at the dock on our little creek (too low now for the big boats to come up from the river). They mound it up, with a huge katydid cage on top, then two boys paddle it slowly and soggily away. The boat is so low in the water it looks as if it will swamp at any moment. We trudge down to the big dock in a long, straggling line, carrying all our funny gear--blowguns, dirty packs and duffels, boots, cameras and binoculars--past the kids playing ball in the field, past the sugar mill and the rum distillery, to the house with the pet monkey. No boat is to be seen! It is supposed to come at 1:00, and that time is long past, with no boat in sight, even way in the distance. We settle down to wait in the hot sun, with chickens and dogs bustling around our feet, the monkey scrambling over and around us, and a crowd of local folks milling nearby getting full entertainment value from the gringos. The mother dog lies in the dust with her puppy suckling, surrounded by flies.

There is a man close by with a thin, long face and bristly coarse hair; he is walking in an odd way, and acting peculiar in general. He talks in a distorted voice, with only a few garbled words. The Explorama boys are calling to him, "Alejo, Alejo!" and good-naturedly teasing him. He is obviously retarded. The kids buzz around me, caressing my bird book softly with their little hands and saying "pajaritos!" We go through our little game again, as I turn each page and they devour the bright pictures with their eyes, crooning in admiration, gasping at the tanagers and trogons, "que bonito!" At each page, they touch each bird, make its sound, and say its local name. Now I can join in too, since I've learned a lot of the songs and local names: Paracuco, the trogon--"Cyoo,cyoo,cyoo..."; Chicua, the squirrel cuckoo, who says his name; Pewicho, the parrakeet; and on and on and on. They never tire of this game, and I never tire of their delight in and knowledge of their world. The little monkey is drinking Coke from a bottle Jackie holds for him, while he sits in her lap.

Norma, Roni, Karl and Cynnie have conceived a project to while away their time on the long boat ride; they plan to make baskets from some lianas they have gathered. Karl has a big messy tangle of lianas in his hand. An attractive, motherly lady comes over to us and talks in Spanish. She is wearing a very nice dress and has a good figure; her round, pleasant face is framed with white hair in an elegant hairdo. She looks like a well-to-do matron from a good family in Lima. She talks softly to Karl and Norma and points to the lianas. I can understand most of what she is saying, I think--she is trying to tell them that the lianas should be wound up in little coils neatly so they can be carried in a plastic bag or container and will keep properly. She politely takes one piece and skilfully winds and twines it in her little short hands to form a small wreath. There is something so gentle, soft and lovely about this lady, and she so obviously is trying to help us clumsy, unknowing but well-meaning gringos to do things right! We have the sense to value the lianas and want to do something useful, but we are

woefully lacking in practical knowledge of how to take care of our materials. She hands the nice little wreath to Karl and tries again to explain. Suddenly we spot an Explorama boat heading for the dock, and everybody gets up and hurries down the steps.

The boat is about an hour late, and I wonder what could have gone wrong. Explorama has been pretty well-organized and prompt in meeting their schedules so far during my two weeks. We pile aboard and load on the luggage, and I watch the basketmakers starting their project in the bow of the boat. Roni is showing the others how to make the small disc that will form the base of a basket. It is beginning to rain, first just a little, but getting harder and harder. We make an unfortunate discovery: the thatched roof of the boat is leaking very badly in many places!

The rain becomes torrential, and we all move away from one side of the boat where the water is coming in most copiously. The boat tilts and goes through the water canted at an angle. It must look very comical from the outside! Marilyn has opened a red umbrella and is standing on the wettest side of the boat, trying to balance the load, with her umbrella jammed up against the thatch. The basket weavers are pursuing their work up in the bow, ignoring the rain; two baskets are in various stages of completion. I move my luggage to a relatively dry spot, wrap my bird book and binocs in a plastic bag, and put on my poncho. Others are standing in small dry spots waiting it out. Somebody breaks out the beers and soft drinks, and we are all relatively cheerful in spite of the wet scene. It rains off and on (mostly on) all the way to the Lodge, where the PI's all leave us. They will wait there for the next, and last, team of volunteers. We have a very affectionate leave-taking, with hugs and kisses all around.

Then on we go, down the great River, its greasy brown waters opaque with the impact of many raindrops. We see people paddling their boats with passengers holding umbrellas; people washing in their canoes; people walking in the rain and mud; all the River life going on in the wet weather just as in the dry. Kids are swimming and playing in the water. Our boat is still limping along canted over on one side. Everybody we pass is waving at us, and probably laughing at how funny we must look. The baskets are finished and passed around for all to admire; they have lovely soft colors and a pleasant fresh fragrance. At last we sight the dock in Iquitos, and the boat boys start to maneuver to come in toward shore. All at once, the motor dies and we are drifting helplessly in the current. They can't get it started again! Another Explorama boat sees our plight and comes out to us; we all hang on to its superstructure while it slowly tows our boat to shore. We are more than an hour late in reaching Iquitos, but Roldan and other Explorama people more than make up for it by their courteous and attentive care to see that we all get our planes and are watched over until we leave. I give Roldan my bird book, since he has borrowed it so often to study and refer to, and I know it will mean a lot to him. I hate to see our group break up--wish we could turn around and do it all over again!

-Mary D'Imperio, Team V

Scenes of the Jungle,

An animated perspective

by

Rob Pudim


SOMEONE COULDN'T PAY ME TO DO THIS. SO WHAT DID I DO?
I PAID THEM TO DO IT.


THANK GOD MARGE IS USING HER SMALL CAMERA. WITH HER REGULAR ONE SHE KEEPS FALLING DOWN AND I'M GETTING TIRED OF CALLING EVERYONE TO GET HER ON HER FEET AGAIN.


I SWEAR EITHER GREG'S SHRINKING OR THESE BOOTS ARE GROWING.


OH, DAMN, GINGER'S SINGING HER FROG SONG AGAIN.


NO, I WILL NOT TRADE MY M&M's AND PEANUT BUTTER FOR YOUR SISTER AND A TOWNHOUSE IN VAIL.


ZEKE, I DON'T THINK THE WORD FOR A VIRGIN KATYDID IS "KATYDIDN'T."
SCRABBLE


ANNE'S REALLY LOOSENED UP A BIT, HASN'T SHE?


SHUT UP AND STOP COMPLAINING. YOU GET THE CUTTER'S THIS TIME. I GET THE MUSCOL ONE.


I CAME ALL THE WAY TO THE AMAZON TO COLLECT KATYDIDS AND ALL WE DO IS TALK ABOUT JUNK FOOD AND SEX.
WHAT DO YOU EXPECT US TO TALK ABOUT... KATYDIDS?


YOU MIGHT SAY THAT. BARKING SPIDERS DO TEND TO BE MALE. THE FEMALE BARKING SPIDERS TEND TO BE QUIETER AND SNEAKIER. AND NO, IT'S NOT A MATING CALL.


HEY, DAVE, WOULD YOU COME HERE A MINUTE. THIS ISN'T ONE OF YOUR RUN-OF-THE-MILL BIG PREDATORY KATYDIDS.


DAVE? DID YOU SAY KATYDID'S EYES GLOW IN THE DARK OR SPIDER'S?

NOTES ON *Scapteriscus oxydactylus* IN PERU

by
James L. Castner and David A. Nickle

Three species of mole crickets (Orthoptera: Gryllotalpidae) in the genus *Scapteriscus* are pests of turf and pastures in the southeastern United States. All three species are of South American origin and have become extablished in the United States through accidental introductions. There are approximately 45 species in the genus Scapteriscus, any of which could potentially become a pest through similar unintentional introductions.

Scapteriscus oxydactylus is the largest species of the genus. Adults range from 45 mm to 50 mm in length. Little is known of their habits, as the majority of specimens in collections have been taken at lights. On 17 July 1987, approximately 40 specimens were collected from an alluvial beach exposed by the lowering waters of the Amazon River. This beach was located approximately 40 km downriver from Iquitos (Department of Loreto) in northeastern Peru. The areas where the mole crickets were found were planted with both rice and chiclayo.

Mole crickets were located by searching for entrance holes on the surface of the sand. A machete was then used to excavate the soil and unearth the cricket. Some individual *S. oxydactylus* were as deep as 30 cm and tunnels ranged underground for as far as 90 cm from the entrance hole. Adults of both sexes and ultimate and penultimate nymphs were collected. One pair (male and female) of *S. oxydactylus* were found in the same tunnel, while all others were found singly. No egg clutches were found.

A large species of tiger beetle (23 mm) identified as *Megacephala klugi* was also found while digging for *S. oxydactylus*. All *M. klugi* were buried in the sand when discovered.

The same beach area was visited at night in an attempt to record calling *S. oxydactylus*. No *S. oxydactylus* were heard calling. *M. klugi* and at least two other species of tiger beetles were collected on the soil surface.

5TH INTERNATIONAL MEETING OF THE ORTHOPTERISTS' SOCIETY, VALSAIN (SEGOVIA), SPAIN JULY 17-20, 1989

Final Announcement

The 5th International Meeting of the Orthopterists' Society is scheduled for July 17-20, 1989, at the local headquarters of the Instituto Nacional para la Conservacion de Naturaleza (ICONA), Valsain (Segovia), near Madrid, Spain. This superb new governmental installation, with state-of-the-art facilities and accommodations, appears ideal for the Society's meeting. And, orthopterologically speaking, Spain itself is ideal both because of its large numbers of endemic species and interesting mixture of faunal elements and because it is a kind of "bridge" between Europe and Africa and the New World and the Old. What better location for the Society's first meeting outside of the Americas?

Lodging will be at the ICONA facility, Valsain, or in nearby Segovia or Madrid (10 km and 70 km, respectively, from Valsain). Meals will be served in the ICONA restaurant and may be taken also in the local area. Costs should be modest. Camping will not be possible in the immediate area, but arrangements are underway for minimal-cost facilities in adjacent La Granja.

Weather. The 5th International Meeting is scheduled for summer. Weather in Madrid will be hot (perhaps oppressively so), but it should be sunny, cool, and pleasant in Valsain, in the Central Range of the Guadarrama Mountains. There is little likelihood of rain.

Organizing Committee. The Organizing Committee for the 5th International Meeting of the Orthopterists' Society includes:

Arrangements Chairperson E. Morales Agacino, of Madrid, Spain;

Arrangements Staffpersons D. Cadahia, J. Gosalvez, and V. Llorente, all of Madrid, J. J. Presa, of Murcia, Spain, and others to be appointed;

Organizational Committee Chairperson and Society Executive Secretary S. K. Gangwere, of Detroit, USA; and

Society President V. R. Vickery, of Ste. Anne de Bellevue, Canada.

International Transportation. Madrid, the capital city of Spain, is served by many airlines and an extensive system of railways and highways. Conference delegates arriving at Barajas Airport or Atocha Train Station will receive instructions concerning their travel to Conference Headquarters at Valsain. Those arriving by car should proceed directly to Valsain. Details will be announced later.

Registrational and Other Fees. Conference registration will be by mail, in advance, through the Secretariat in Detroit, or personally upon

arrival at Conference Headquarters at Valsain. A registration fee of $100 (US currency) has been set for Regular Members and one of $25 for Student Members if paid at least three (3) months in advance of the meeting. (These monies are refundable in full upon official withdrawal within six (6) weeks of the meeting.) Registration later than the above or at the meeting itself is possible at a per-person charge of $150 (Regular Members) or $40 (Student Members), on a non-refundable basis. Scholarship (gratis) registration may be arranged for students and others unable to provide the registration fee. Family members of delegates may register gratis.

All additional charges (lodging, meals, Society banquet, local transportation) will be on an at-cost basis, the greater the number of registrants, the lesser the per-person cost. Total meeting costs (excluding page charges, discussed below) should be modest for an international meeting.

Official Letter of Invitation. An official, personal letter of invitation to attend the 5th International Meeting will be sent prospective participants on written request to the Secretariat. This invitation does not obligate the Society in any way to pay for travel, subsistence, or other expenses that participants may incur at the meeting.

Tentative Program. The tentative four-day program of the 5th International Meeting of the Orthopterists' Society will include the following activities:

1) Registration and opening-day reception and mixer;

2) Four sections of submitted papers (control, evolution & systematics, physiology & genetics, ecology & behavior) on locusts, grasshoppers, and their allies;

3) A full-day field trip within the environs of Valsain;

4) Business meeting; and

5) Banquet and closing ceremony.

In addition, planning is underway for an optional 4-day post-conference field trip for those who wish to avail themselves of an exceptional collecting opportunity.

Official Languages. English, Spanish, and French are the official languages of the 5th International Meeting of the Orthopterists' Society. Simultaneous translation services are expected to be available. Papers read in other standard languages must include an abstract/resume in one or more of the official languages and may not be submitted for full publication.

Publication. Publication will be in the 5th Proceedings of the Orthopterists' Society. All contributed papers will be considered for publication in their entirety at the author/authors' expense. All must include an abstract/resume in one or more of the official languages (English, Spanish, or French). Inasmuch as all abstracts are published

(whether or not the full text is published), they must be received at the Secretariat at least six (6) weeks prior to the conference opening. All papers submitted for publication in their entirety must be turned over to the Meeting Organizer (Gangwere) or to the Society Editor (Nickle) on the day they are read. They must comply in format with the Society's editorial standards, as published elsewhere. All are expected to be original contributions (i. e., not previously published elsewhere), and all will be reviewed/refereed by a panel of experts chosen by the Society's Publications Committee.

If abstracts cannot be provided within the prescribed time limits (i. e., 6 weeks prior to the meeting), the research may still be considered for inclusion in the program on a read-in-title basis. Read-in-title contributions may be considered for publication in full if the text is made available to the Organizer or Editor at the time of presentation.

There will be a $10 (US currency) per-page charge for all papers published in their entirety and for each page of abstract. This charge covers the editorial process, administrative handling, printing, and mailing of 100 free reprints. Additional numbers of reprints may be ordered at authors' option and expense. Scholarship (gratis) publication may be possible if the Society receives a governmental subsidy.

Post-Conference Field Trip. J. J. Presa, of the Universidad de Murcia, is organizing a 4-day post-conference field trip through parts of the orthopterologically rich Sierras de Cazorla and Segura of southern Spain. Participants' food, lodging, and transportation will be on an at-cost, relatively inexpensive basis. Inasmuch as accommodations are limited, registration should be made at least six (6) weeks in advance of the conference. A non-refundable payment of $25 (US currency) is required of each participant, to be applied to his/her total field trip cost.

Accompanying Persons' Program. Family members are encouraged to attend the 5th International Meeting of the Orthopterists' Society. An Accompanying Persons' Program is being arranged under the direction of V. Llorente, of the Museo de Ciencias Naturales, Madrid, and her committee. Sight-seeing visits to various historical and other interesting places are being explored. Costs of these half-day or full-day trips are payable at registration on an at-cost basis. Again, as with other costs, they are expected to be modest.

5TH INTERNATIONAL MEETING OF THE ORTHOPTERISTS' SOCIETY AT VALSAIN (SEGOVIA), SPAIN IN JULY, 1989

Registration Form

Name: _____ _____ _____
Surname/name Given name Initial

Sex: _____ _____ Telephone/s: _____
Male Female

Institution (if any): _____

Mailing address: _____

_____

_____

Accompanying family: _____ _____

_____ _____

_____ _____

_____ _____
Name Relationship

Section/s of Interest: _____ _____
Control Evolution & Systematics

_____ _____
Physiology & Genetics Ecology & Behavior

Do you wish to read a paper/s? ____ ____ In which language? _____
Yes No

[If yes, list title/s and provide an abstract/resume in one of the official languages (English, Spanish, French)]

Do you wish this paper/these papers published in abstract form only or in its/their entirety? _____ _____
Abstract only Full text

Do you wish to participate in the following?

_____ _____ _____
Banquet Site-seeing visits Post-conference trip

[Kindly complete the above form and return it to S. K. Gangwere, Executive Secretary, Orthopterists' Society, c/o Department of Biological Sciences, Wayne State University, Detroit, MI 48202, USA, along with the proper registration fee ($100 Active Members or $25 Student Members)]