THE NEWSLETTER OF THE ORTHOPTERISTS' SOCIETY

Metaleptea

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Society News

Upcoming conference!

Dear Colleagues, Dear Orthopterists

We wish to remind you that the 10th International Congress of Orthopterology will be held soon (June 21-June 25, 2009) in Antalya, Turkey.

A very exciting scientific programme has been planned, attractive to young research scientists, as well as to more established research orthopterists.

A wide range of subjects will be covered with plenary lectures and symposia/workshops aimed at giving overviews and updates on cutting-edge subjects, as well as special sessions of regularly submitted presentations by collaborating research groups.

Please visit the Website of the Congress for more information: www.ico2009.org

Looking forward to welcome you in Antalya,

Battal Ciplak
Antalya, Turkey

Michel Lecoq
Montpellier, France

Please visit the web site of the congress for more information:

www.ico2009.org

Of interest to Society members

The International Symposium on Biomathematics and Ecology: Research and Education will be held on June 13-17, 2009 at the Izmir University of Economics, in Izmir, Turkey.

For more nformation Readers are urged to consult the conference website.

Http://www.biomath.ilstu.edu.bere

Dr. Olcay Akman is organizing this conference. He specifically chose the date to coincide with the ICO Conference. The idea is to make it easy for scientists to attend both meetings.

Below some shots of Izmir, the site for this conference.

New Editor for Metaleptea

I am delighted to accept the new incoming editor position for Metaleptea. First and foremost, I would like to sincerely thank Marianne Niedzlek-Feaver for her excellent service as an editor for many years. She worked on every issue tirelessly and meticulously to make sure that it would contain wealth of good news and information for orthopterists around the world. I am sure I will continue to ask her for her expertise.

I am also excited to introduce a new associate editor of the newsletter, Sam Heads. He is a young and energetic palaeoentomologist who has recently published a number of important papers on fossil Orthoptera. Sam will play a crucial role in ensuring the quality of the newsletter.

As a new editor, I would like to strive for publishing Metaleptea regularly. This means more news, articles, stories and poems from you the members of the Orthopterists' Society. You can surely expect my emails asking for articles and I hope that together we can make Metaleptea more exciting and informative!

Finally, here are some guidelines for sending me articles. Text files should be in MS word doc, Wordperfect wpd, rtf, or regular txt format. Images should be in high resolution JPEG or TIFF format. You can email the files to me with a [Metaleptea] in the subject line at entomos@gmail.com. I hope to hear from all of you soon.

Sincerely,
Hojun Song

Orthopteroid Internet Resources

Ed Baker

Over the last few years there have been a number of new, high-quality, internet resources for those interested in orthopteroid insects. So far, comprehensive taxonomic databases have been created for the orders Orthoptera, Phasmida, Mantodea and Blattodea. These use the Species File Software (http://software.speciesfile.org) and contain complete lists of taxa, valid and invalid names, type data and references. Although primarily of use to those interested in the taxonomy of the relevant order it has a number of more general uses, including generating a list of species known to occur in a particular geographic region, and finding the current binomial combination of species (many species of phasmid, for example, are seen for sale using outdated names).

Three orthopteroid groups have enthusiasts' groups; blattodea (Blattodea Culture Group), phasmida (Phasmid Study Group) and mantodea (Mantis Study Group). Although the Mantis Study Group is not active there is work underway to re-create the group online. All three groups have websites making use of the European Distributed Institute of Taxonomy's Scratchpad system (http://www.scratchpads.eu). This system allows for the creation of professional quality websites that can store and make easily accessible a vast quantity of data.

There is a large number of sites relating to these orders, in particular Blattodea and Phasmida, and the following list is not intended to be comprehensive. As always with internet sites there are a great deal out there which fall short of what one would expect, be it due to poor design, being factually incorrect, or not having been updated for a number of years. All of the sites I have listed below are being actively maintained by communities that have a good knowledge of 'their' order.

Blattodea Species File
(http://blattodea.speciesfile.org)
Taxonomic database of the world's extant species of cockroach, minus the recently included termites (epifamily Termitoidae).

Blattodea Culture Group (http://www.blattodea-culture-group.org)
The Blattodea Culture Group is a society dedicated to the culture of cockroaches in captivity. The website contains back issues of newsletters which are free to download, an image gallery, answers to frequently asked questions, and more. Members receive access to a number of extra features.

The Cockroach Forum (http://www.blattodea.net)
Originally an independent forum, now run by the Blattodea Culture Group this is the best place to discuss

(at least in English) anything to do with cockroaches. Topics covered include identification, rearing in captivity, field trips, livestock exchange and more.

Phasmida

Phasmida Species File (http://phasmida.speciesfile.org)
Taxonomic database of the world's phasmids. A large amount of work is currently underway to include type photographs from the Natural History Museum, London. The references include papers relating to the rearing of species in captivity.

Phasmid Study Group (http://www.phasmid-study-group.org)
This is the most developed of all of the Scratchpad based sites, due mainly to contributions from members and the popularity of these insects as pets. There is a section on the UK naturalised phasmids, including a form to submit records electronically. Other content includes the journal *Phasmid Studies*, now available for free online. There is information on the majority of species that have ever been kept in culture, and the amount of content is continually growing; recent additions include a phasmid glossary. Members of the group have access to back issues of the newsletter, and a number of other phasmid-related journals.

The site has a brand new forum (discussion board) where you may ask questions on rearing or identification, and exchange livestock.

Phasmatodea.de (http://www.phasmatodea.de)
Interesting site with lots of useful information, in both English and German.

Orthoptera

Orthoptera Species File (http://orthoptera.speciesfile.org)
Taxonomic database of the world's orthoptera. This is the most developed of the three Species File sites.

Mantodea

Mantodea Species File (http://mantodea.speciesfile.org.)
Taxonomic database of the world's mantids. This site has only recently come online, and is still in the early stages of development.

Mantis Study Group (http://mantodeamyspeciesinfo/)
Has a growing amount of high-quality information on mantids. This is the youngest of the three Scratchpad sites but has a growing volume of content. The image galleries are arranged both taxonomically and geographically. There is a forum (discussion board) and a number of scientific papers are available for download.

Mantophasmatodea

Mantophasmatodea.de (http://www.mantophasmatodea.de/gladiator/)
Gives the systematic arrangement of the order with photographs, distribution, etc.

Dermaptera

Dermaptera Species File (http://dermaptera.speciesfile.org)
Still in the very early stages of development. The overall content will be similar to that of the other Species Files.

In Memoriam

Robert Pfadt:
In Memory and Honor of a Scholar and a Gentleman

Our scientific community has lost one of its most enduring and beloved members. Robert E. "Bob" Pfadt died on January 19, 2009 at the age of 93.

Bob Pfadt was born May 22, 1915, in Erie, Pennsylvania, the son of George and Margaret (Illig) Pfadt. As a boy, Bob attended St. Mary's Catholic School in Erie. His life was not easy, and perhaps struggle contributed to the development of his character. In the midst of the Great Depression, Bob's father died. At the age of 16, Bob helped provide for his mother and sisters by working two jobs in addition to going to school. This sense of responsibility and service to others would be a hallmark of his life.

Bob attended the Ohio University and then moved to Laramie to attend the University of Wyoming in 1935. He graduated in 1938, and then earned a master's degree in zoology in 1940. In that year, Bob was hired by UW to conduct research on

grasshoppers. The severe outbreak of the 1930s had devastated cropland and rangeland throughout the western United States and Canada. He worked on developing control methods while simultaneously pursuing his Ph.D. at the University of Minnesota. His advisor was Alexander C. Hodson (the University of Minnesota's Hodson Hall now houses the Department of Entomology, along with the Department of Fisheries, Wildlife and Conservation Biology), and his dissertation concerned the role of food plants in the ecology of two major pest species, *Melanoplus sanguinipes* and *Aulocara elliotti*. So began a remarkably productive career that integrated a deep understanding of grasshopper biology with innovations in pest management.

Robert Pfadt

Bob joined the UW entomology faculty in 1943. He spent most of his time conducting research on grasshopper life history, feeding behavior, population ecology, and control—both chemical and biological. He also made significant contributions to agriculture through his work on the biology and control of army cutworm, pale western cutworm, cattle grubs, horn fly and sheep ked. Moreover, he maintained the university's insect museum for many years, a task which enticed him into the study of grasshopper taxonomy and systematics. Indeed, his work on nymphal identification of western species was—and still is—of tremendous value to applied acridology. Bob's devotion to service, along with the respect that his colleagues had for him, conspired to draw him into administration. He was the head of the Department of Entomology and Parasitology for many years before returning to his first love—life as a professor. But this was not his last love, for amidst his research and teaching, Bob married Julia Van Deventer in 1948. They had four children, three daughters and a son.

In 1967, Bob's reputation in research and capabilities as a leader led to his being named chief of party for a team of Wyoming scientists working through the US Agency for International Development to improve agricultural practices in Afghanistan. Bob lived abroad for two years, during which time he and his students made an extensive collections of grasshoppers. This work led to his describing five new species from Afghanistan.

In the course of his career, Bob received many well-deserved honors. He received the Gamma Sigma Delta award for scholarship and service to agricultural science, and he was chair of the editorial board of the *Journal of Economic Entomology*. In 1997, Bob was named as an honorary member of The Orthopterists Society. And in recognition of his years of service to his science, university, and state, Bob was awarded the status of professor emeritus upon retirement in 1984.

When I arrived to putatively "replace" Bob in 1986, he welcomed my energetic, but naive, perspectives on grasshopper ecology and management (I say "Bob", but it took me a couple of years before I was no longer calling him "Dr. Pfadt"—not because of any airs on his part but because the man simply evoked a sense of deep respect). I fondly recall his response to one of my early papers, in which I questioned the notion of multiple-year benefits of grasshopper control. I knew that he had previously taken an opposing view, so I was anxious to see how this legendary entomologist would take the contrary notions of a scientific whippersnapper. After reading my article, he responded in his inimitable way: "Well, Jeff, if we both thought the same things, then they'd only need one of us." It is said that you are more likely to be bitten by a little dog than a big dog, because a poodle

is insecure and constantly yaps to prove itself, while a Great Dane is quiet, dignified, and confident in its abilities. Bob was a "big dog".

When I began my work at the University of Wyoming, Bob was gracious enough to take me to his favorite field sites. His goal was to help me get off on the right foot, but the lesson that I learned was more one of humility than hope—at least initially. Bob could identify grasshoppers at a distance of 10 feet, while I struggled to even find the creatures that he was naming amidst the vegetation. But he was a kind and patient mentor, and I can only believe that he must have been a first-rate teacher. In fact, he was a profoundly influential teacher of my students, even (perhaps particularly) in retirement.

When I asked my former students for their memories of Bob, they replied with fond recollections of a man who modeled the life of a dedicated and passionate scientist. One wrote, "I remember seeing him coming to the lab and 'playing' with grasshoppers on weekdays and weekends." And "play" is the right word, for Bob never lost his childlike sense of joy and wonder with the natural world. He did not see science as work but as a kind of serious play that could produce both enchanting discoveries and valuable contributions to the human condition. A favorite game of students was to guess Bob's age, as he seemed eternally youthful in his approach to research yet wizened with regard to chronological age. Another student said, "I was always impressed by Dr. P constantly inquisitive nature and his trademark, whirlwind road trips by himself as an older man to collect specimens in some distant corner of the West. We should all be so fortunate to be as physically active and productive, with as positive, friendly, and helpful a personality, as Bob was at an age in which many people have retired to the couch." Fortunate yes, but there was also a deep commitment to his studies and a cultivated approach to life that made Bob what he was. Perhaps this comment from a student says it all in terms of what Bob taught those who were half-a-century younger that he: "His dedication to science taught me to love what I do and do what I love."

I too learned a very great deal from Bob. His genuine devotion to understanding the natural world is what made him, in my mind, one of the few, authentic naturalists that it has been my privilege to know. In his work, Bob exemplified a virtue that seems to be in continual decline—the valuing of depth and completeness over ease and speed. His research was remarkably thorough because he steadfastly refused to trade quality for quantity. Having served as the Founding Father of entomology in Wyoming, I think that his approach became a cornerstone of our program. At least I like to believe that Bob's values infused the culture of entomology at the University of Wyoming, where the contributions to science and society continue to be disproportionate to the modest number of faculty, staff, and students in our discipline.

After Bob retired, he continued his studies of grasshoppers for more than 20 years. Although he'd published four textbooks on applied entomology, two children's books, six monographs, and more than 40 refereed articles along with dozens of extension publications, arguably his greatest work was still to come. A decade after Bob "retired," he produced his magnum opus, a project requiring countless days of detailed observations, unimaginable reams of careful measurements, and endless hours of patient photography. *The Field Guide to Common Western Grasshoppers* is a tour de force of natural history and set a standard for all of the life sciences. If there is a more accessible, rich, thorough, detailed, useful, and exquisitely illustrated guide to a group of organisms on Earth, I've not yet seen it.

There may be a work nearly as comprehensive and compelling as Bob's Field Guide, and that would be the rather spectacular Guide to Australian Grasshoppers and Locusts by David Rentz et al. What's of particular note is that this monumental book was dedicated to a giant of Australian acridology, Ken Key (1911-2002) and Bob Pfadt. Although Bob had never been to Australia, his scientific reputation was global. The dedication includes a lovely portrait and states: "We dedicate this book to two acridologists working at disparate points across the globe on different faunas but with similar goals. Both have spent their lifetime in an effort to understand their respective grasshopper biotas, systematics and biology."

In 2003, when his health demanded that he move to a lower elevation, Bob headed to Powell, Wyoming, to live with his daughter, Kathy, and her family. On the outskirts of town, he set up shop in

the university's Research & Extension Center and continued his labors of love. Bob had to give up his trademark road trips, but his meticulous curation of specimens that we shipped to him continued to build and strengthen the grasshopper collection. And he enjoyed being a grandfather, making sure that each of his grandchildren had an opportunity to catch grasshoppers. Bob had always enjoyed kids, having been a 4-H leader for many years in Laramie. And in a sense, he had been something of a grandfather to a whole cadre of students and junior faculty at the university, where he provided a soothing and wise presence.

In December 2004, the University of Wyoming dedicated a room to the "Robert E. Pfadt Grasshopper Collection." Bob had amassed a beautifully curated collection of 11,500 specimens, representing 221 species. The collection included material that he brought back from locales ranging from Arizona to Afghanistan. We commissioned with a plaque for the hallway outside the room with the simple inscription: "In honor of a career of exemplary service to science and society." I was asked to provide a few thoughts at the dedication of the collection, and the words with which I ended that ceremony sum up, to the extent that such is possible, what Bob meant to us:

I*n closing, Dr. Pfadt is our friend, colleague, and mentor. The Robert Pfadt Grasshopper Collection is a fitting tribute to one of the University's finest faculty members. His scientific legacy is one of having established the University of Wyoming as a preeminent American institution in the field of acridology. But perhaps, at least for me, Dr. Pfadt's greatest contribution may be his having personified two of the most old-fashioned qualities of academic life that are desperately needed in the modern university. Dr. Pfadt was and is a scholar and a gentleman.*

Bob's legacy includes not only his contributions to the science of acridology but something that he valued even more. He is survived by his daughters, ten grandchildren and five great-grandchildren—along with innumerable colleagues and students who were touched by his gentle ways and made better for his example of humanity.

Jeffrey A. Lockwood

University of Wyoming

SCATTERED RECOLLECTIONS

Stan Gangwere
Professor Emeritus,
Wayne State University
Detroit, MI 48202, USA–

I've been interested in the orthopteroid insects for six decades, during the course of which I've come to know many prominent New World specialists of this fascinating taxon as well as a good number of their Old World counterparts. I've come to regard some of those among them who have passed on to be so interesting that they deserve not to be forgotten in today's rush toward advancement in our science. I might add that I've reached a stage of life where I no longer have a research laboratory or research associates with whom to collaborate, but memories of these deceased colleagues continue to flood my mind, and I can still write. It has occurred to me that some of my recollections may be worth recalling for this audience. Toward this end I offer a few candid commentaries on selected orthopterists of the past, some of whom were well known in their day, others not so well known but all deserving of recognition. Some of these accounts will be brief, almost cursory, representing only my personal reaction to the individuals in question, but others are more detailed being based not only on recollections but on letters and other documents from my extensive files. All are offered in hopes of elucidating something of the life, personality, and accomplishments of these persons. Needless to say, my remarks do not purport to be true biographies, being nothing more than incomplete, subjective reflections for which I apologize. The individuals treated herein deserve better.

Cantrall, Irving J.

Irving Cantrall was born in Springfield, Illinois, in 1909. He took his bachelor's, master's, and doctoral degrees from the University of Michigan before assuming his first position with the Tennessee Valley Authority. This TVA assignment was followed by three years as a 1st Lieutenant in the U. S. Army Air Corps during Word War II. After leaving the Air Corps, he was appointed Assistant Professor of Biology at the University of Florida. Then, in 1949, he rejoined his alma mater, the University of Michigan, as an Assistant Professor, serving as

Curator of the E. S. George Reserve field station. Upon promotion, he continued serving at the George Reserve until 1956 when he became Curator of Insects in Michigan's Museum of Zoology. He retired from the university in 1978 and died in the city of Ann Arbor in 1997.

During Irving's long professional life, he carried out research, wrote journal articles, and served for many years as Editor of the Great Lakes Entomologist. He was among those who gathered at San Martin, Argentina, for the formative meeting of the precursor organization of today's Orthopterists' Society, and he became the new organization's first secretary. Irving was a devoted teacher who enjoyed working with students of all levels from large classes of non-science majors to individual graduate students, and it was an especial treat to accompany him into the field to observe his truly exceptional knowledge of nature. He devoted hours of public service to the university museum, answered innumerable inquiries about insects for the general public, and also carried out volunteer work as an insect specialist, all at the same time as he supervised an active program of expansion and improvement in the museum's orthopteran collection, helping make it one of the finest in the world.

Irving was not my mentor at the University of Michigan, but he played a role at least equal to that of my advisor in my professional development. He was not the most prolific of investigators in terms of numbers of research publications, but he certainly deserves recognition as having been an *orthopterist par excellence*, for he was one of our discipline's most gifted observers, experimenters, and collectors. I first came to appreciate his expertise during an early excursion to the southeastern United States to collect acridid topotypes. This expertise was gained the hard way through years of onerous work in laboratory and field, yet he unselfishly shared it with anyone asking help. I worked closely with him when he was Curator at the George Reserve, where, for a time, I served as his assistant. He discussed with me, for example, the change of habitat occupancy upon maturity of the walking stick *Diapheromera femorata* and the katydid *Atlanticus testaceus*, which altered my conclusion's of those insects' food selection. He showed me innovative collecting devices such as his *Cycloptilium* trap and the use of new collecting techniques such as oatmeal baiting for studying the periodic behavior of nocturnal insects. He invited my wife and me to his home where we dined with him and his family. Once we were invited to his home in mid winter, but our car couldn't negotiate the Reserve's treacherous ice- and snow-covered roads. Though he was doing something else at the time, he cheerfully dropped it to rescue us in his jeep. We benefitted from his friendship then and, upon graduation, even after I left the university for another academic position. And I remember Irving especially for his gentle unassuming, no-nonsense manner expressed through a pronounced mid western U. S. twang.

Figure 1. Irving J. Cantrall on the reader's left and Theodore H. Hubbell on the reader's right.

Grant, Harold J., Jr.[1]

I first came to know Harry Grant through correspondence in 1958 when he was at the Academy of Natural Sciences of Philadelphia serving essentially as J. A. G. Rehn's research assistant. He left Philadelphia shortly afterward to complete his doctoral degree under Professor Gordon Alexander at the University of Colorado in Boulder. He enjoyed Colorado and was held in high regard there. With some regret, therefore, Harry returned to Philadelphia in the early 60's to continue work on the academy's well-known North American grasshopper project. In that capacity he served as co-author, with the inimitable Mr. Rehn, of some 16 research papers and the first volume of a large monograph. Upon Rehn's death, Harry succeeded him as Curator of Insects and immediately undertook important initiatives toward improving the academy's antiquated entomological and orthopteran programs, particularly with respect to

loans, publications, general institutional cooperation, and funding. He was frequently in touch with me and, on one occasion, in November, 1962, was my personal guest. On another occasion, he wrote to me from Madrid reciting some of the exciting events of his Spanish trip, telling me how much he was enjoying interacting with the vivacious Eugenio Morales Agacino, and enclosing a menu from my favorite Madrilenian restaurant, La Casa Botin, a 17th Century establishment located in the old section of the city.

Harry's new professional responsibilities at the academy were just well underway, as was his ambitious personal research program of studies on South and Central American katydids, when he traveled to Trinidad. On that occasion, in Feb., 1966, several other entomologists and he were collecting alongside an inviting-looking beach. It was hot, tiring work, so they took time off for a brief swim. They were standing on a slope in deep water without realizing how dangerous that location was before their footing gave way subjecting them to a strong oceanic undertow. The waders who escaped were badly bruised in their desperate scramble to safety, but Harry was not among them. His body reappeared some hours afterward. It's ironic that he endured his long, difficult association with the irascible Mr. Rehn only to drown just 13 months after succeeding to the chairmanship that he so cherished. He was then in his early 40's and just reaching his prime. Today, one still remembers Harry for his *joie de vivre*, geniality, enthusiasm, and other favorable attributes that made him universally liked and appreciated by friends and associates.

[1]Parts of this account are based on a March 5, 1962, letter from Ashley Gurney.

Gurney, Ashley B.[2]

Ashley Gurney was one of this country's foremost orthopteran systematists when I first began my studies. Though we had yet to meet personally, I wrote to him asking for suggestions on field crickets which he generously provided, going out of his way to provide information. It was not until much later that I met him in person at his USDA laboratory in the U. S. National Museum Building in Washington. I was struck by his cordiality and kindness to me, a young investigator in the early stages of career development. Ashley was a most engaging individual with a pronounced New England accent. He loved to chat and exchange stories which he did endlessly. His death in 1986 stilled one of our fraternity's most significant voices.

Figure 2. Ashley B. Gurney receiving his society honorary membership from then-President Ricardo Ronderos.

Ashley grew up in a Berkshire Hills farming community near the University of Massachusetts where he first attended college. This brought him into contact with the world-famous crane fly specialist C. P. Alexander under whose tutelage he began work, not on Diptera, but on Orthoptera where there were afforded, he felt, more research opportunities than provided by most other insect groups. He turned to A. P. Morse's "Orthoptera of New England" as his research guide and subsequently was in touch with that eminent specialist who also encouraged him in his efforts, as did W. A. Riley later at the University of Minnesota.

Gurney visited the Solomon and Philippine Islands and Japan while serving in a U. S. Army Malaria Survey Unit during World War II during which he necessarily emphasized mosquito collection but also took Orthoptera. Ashley was widely traveled both in the United States and in Europe, and he worked in the West Indies, Puerto Rico, Egypt, and Ethiopia. He was among those who traveled to San Martin, Argentina, at the inaugural event of our society. He collaborated with innumerable orthopterists on a variety of projects too wide to mention here while serving at his USDA Systematic Entomology Laboratory post. He preferred research and writing to curating and collection building, as he

freely admitted to those who asked. Not surprisingly, on his retirement, he left a jumbled confusion of unincorporated specimens in Schmidt boxes, cigar boxes, and assorted other containers in his neglected insect cabinets, for which presumed failure he more than compensated by his outstanding publication record and professional outreach.

[2]Parts of this account are based on a series of written interviews sent me by Jose Liebermann.

Hubbell, Theodore H.[2] **(Fig 1.)**

A native of Detroit, Michigan, Theodore Hubbell took the baccalaureate from the University of Michigan in 1920 and began service as an instructor at the University of Florida in 1923. Then, in 1934, he returned to Michigan to take the doctorate. He was to stay there for the rest of his life becoming Professor and Curator of Insects and later Director of the Museum of Zoology.

Hubbell's love for nature began early, at about 8 years of age when he collected butterflies first in the Detroit area and later in the Philippine Islands where his father, an engineer, served as the islands' Director of Public Works. Here he grew up and, with a young friend, continued collecting adjacent to his home in Manila and on foot and horseback at the family's summer home in Baguio, northern Luzon. The boys had only two insect books, neither of which dealt with the Philippine fauna. Fortunately, they met a kindly young German entomologist, W. Schultze, Department of Entomology, Bureau of Science, Manila, who taught them how to collect and record data, how to mount specimens, and how to use entomological keys to make specific determinations. This relationship ended in 1913, when Hubbell's family returned to the United States. He completed school in Benzonia Academy, northern Michigan, all the while collecting Lepidoptera. During the summers of 1914 and 1915, he worked as an assistant to the Coleopterist S. A. Rower at the U. S. Forest Insect Experiment Station in Virginia. His education was interrupted by a stint as a trainee in aerial gunnery with the U. S. Army Signal Corps. Aerial gunnery WWI style was primitive, he recalled, involving nothing more than use of a shotgun out of an open cockpit. One day, flying over mountainous terrain, he neglected to attach his safety belt and almost regretted it; thereafter he was more careful (or else I wouldn't be writing this account!). After the war, he returned to the Michigan Museum of Zoology where he was introduced to orthopteran study by Curator F. M. Gaige who asked him to determine and put into order the Museum's overflowing collection of Schmidt boxes based on various expeditions throughout the world. He tried to use Blatchley's "Orthoptera of Northeastern America" as a guide but quickly realized that text, however useful it was locally, failed to address global needs. The more he worked with Orthoptera, the more interesting they became to him, to the extent they became his life's work.

The Museum sent Hubbell on three early field expeditions (northern Michigan, southwestern Michigan, and North Dakota) on the Orthoptera of each of which he published a report. His doctoral dissertation consisted of a revision of the large, poorly known, especially difficult rhaphidophorid genus *Ceuthophilus*. He was fond of telling how, during the economically stressful period when he pursued his education, he had a bed secretly hidden in the upper floor of the old museum building, and several other students and he cooked their meals nearby, on one occasion buying cartons of canned food that had survived a fire *sans labels*. Their evening meal was always a surprise! Then Hubbell's education carried him to Harvard University where he worked with the myrmecologist W. M. Wheeler before leaving for a year's collection in Honduras. Upon return to the United States, he served as an instructor at the University of Florida where he was to stay for 23 years, advancing through the ranks until 1947 when he left Gainesville to become Professor of Zoology and Curator of Insects at Michigan and, about a decade later, Director of the entire Museum of Natural History. His research took him to every U. S. state and to many foreign countries including much of Europe and South and Central America. He was a font of knowledge in overall natural history and truly one of the greats of modern orthopterology. His approach was a systematic one involving intensive field study and collection of large series of specimens for optimal description of specific variation, never one of so-called "cabinet drawer taxonomy," which he strongly decried.

Even when older, Hubbell never ceased being drawn to the field. I remember that, one day in autumn,

1954, I proudly deposited on his desk what I thought t be an excellent, complete manuscript of my doctoral dissertation. Little did I know! He hadn't seen any of the text previously, so he carefully turned the pages as I watched, perusing the text as he went, and some hours later solemnly pronounced it an adequate first draft in need of careful editing to be done on his return from the following week's excursion to the Guatemalan rain forest. I hadn't known that trip was scheduled, and I didn't know it would last for an entire year! Inasmuch as it took priority, I was obliged to await his return until 1955. Then he and I began revision after revision of my precious manuscript completing the job in 1956, two years later and very different from my original draft. Though he retired in 1969, this undeniably brilliant but driven man visited the Museums Building in Ann Arbor almost daily continuing his research and writing up until his death in 1989 at the age of 92.

Fig 3. Eugenio Morales

[2]Parts of this account are based on a series of written interviews sent me by Jose Liebermann.

Morales Agacino, Eugenio (Fig. 3)

It's difficult to assess the life and work of Eugenio Morales because he did so much, traveled so many places, wrote so many reports on Spanish and North African Orthoptera, on Saharan and Central American locust plagues, and on Iberian and Moroccan mammals, as well as a massive three-volume autobiography entitled "Memorias de un Español de a Pie." He also gained numerous international scientific honors and awards, and, upon his death in 2002, had many obituaries written about him (including a *Metaleptea* 2003 article by Carlos Carbonell) to the point that one doesn't know where to start. Allow me to begin from the point-of-view of someone who was a close friend, who worked in his laboratory, who studied with him in the field, who corresponded with him over the years, and who was an over-night guest in his home at 30 Calle Sagasta, Madrid (an especial distinction for a foreigner to be thus admitted into a traditional Spanish home).

Eugenio was born in Barcelona, Spain, in March, 1914, but spent his youth in various Spanish cities including Barcelona, Las Palmas (Gran Canaria), Cartagena, Vigo, and Madrid owing to the periodic reassignment of his father, who was a naval physician. The Morales family eventually moved to Madrid in 1931 where he was introduced to, and cordially received by, the distinguished orthopterist Ignacio Bolivar y Urrutia who was then Director of the Museo Nacional de Ciencias Naturales. Bolivar immediately sensed something of Eugenio's enormous enthusiasm, talent, and interest in living things and offered him an assistantship. Eugenio's father wanted his son to become a physician, like himself, but relented when the internationally known Bolivar interceded, telling him of Eugenio's exceptional promise as a scientist. So, in 1932, Eugenio began his studies at the Universidad Complutense de Madrid at the same time as he happily worked at the side of the renowned Bolivar who stimulated his interest in Orthoptera. He also spent many days in the museum's Vertebrate Section with the result that he soon became an expert mammalogist as well as an orthopterist.

The Spanish Civil War interrupted Morales' studies until 1947 when finally he was able to return to Madrid to complete his university studies. Most of his professors and companions had been forced into exile by the phalangists who took over the country during the aftermath of the war, leaving Morales in a difficult position. He too quit Madrid, moving to Almeria, in the far south of the country, where he secured a position in the Phytopathology Station of INIA (Instituto Nacional de Investigaciones Agrarias). This period corresponded with his greatest scientific productivity. He traversed over 5,000 km on camel

back throughout the desert regions of Morocco, Mauritania, and Algeria, and he undertook studies on *Schistocerca gregaria* and the depredations that locust caused in Ifni and Rio de Oro. (Incidentally, Eugenio discovered a colony of the rare, endangered monk seal during his work in Cabo Blanco, Mauritania, which was widely reported by the world press, and the grotto frequented by these animals was henceforth renamed "Cueva Morales"). Then, in 1951, the FAO (United Nations) tapped his antiacridian expertise engaging him to study the locust plagues of Mexico and Central America. This assignment was followed by his selection, in 1956, as Technical Assessor for the World Conference on the desert locust.

Eugenio returned to Madrid in 1958 in the capacity of Secretary (= Executive Director) of the Museo Nacional de Ciencias Naturales where he was essentially in charge of the day-to-day operation of the entire entomological program and edited and produced its two scientific journals, *Eos* and *Graellsia*. He proved to be a superb administrator and editor whose activities were a credit to Bolivar, his mentor, whose laboratory he proudly occupied and collection he faithfully curated. Then, in 1967, when the elderly Director of the Instituto, Gonzalo Ceballos, died, it was assumed that Eugenio would succeed him, but this was not to be. Spain's then Minister of Science, a devotee of *Opus Dei*, mandated that all senior appointments be filled by followers of that religious movement, of which Eugenio was not one. Offended, he left, never to return. He would not long remain unoccupied, however, because, the very same year, 1967, the FAO named him Special Assistant to the Government of Iran in its fight against agricultural pests. He enjoyed the Iranian assignment but, at this stage of life, wasn't content to be away from his beloved wife and family. It was not long before he was offered the position of head of the Departamento de Protección Vegetal del INIA. His responsibility in this new position was to develop and coordinate Spain's role in the Man and Biosphere program of UNESCO. The following year, 1980, he was asked to head Spain's antiacridian and phytopathology programs, a prestigious position that he held until his retirement in 1983.

Eugenio authored or coauthored numerous publications of which 39 were on mammals, 72 on insects (mostly Orthoptera), and others ranging from prehistoric rock paintings to taxidermy. He held many responsible scientific positions in Spanish and world government and was active in many scientific societies including our own. It was in his laboratory at the Instituto during "coffee time," as he happily proclaimed it, that Eugenio, Ricardo Ronderos, and I planned the international conference that was eventually formalized in a December, 1976, meeting at San Martin de los Andes, Argentina, under auspices of the United States / Argentina Cooperative Science Program. This meeting resulted in formation of the Pan American Acridological Society which was the precursor of subsequent meetings held in various venues throughout the world as the organization metamorphosed into today's Orthopterists' Society. Eugenio himself hosted one of our meetings, the memorable 5th International Meeting held at Valsain, Spain, in 1989. He was actively involved with Vern Vickery and me in making arrangements for that superbly run conference, and he secured for us access to the governmental facilities that served as venue. Moreover, as a person of wealth, he paid for the society's banquet and field trip, though he refused to have his generosity made known to the membership.

Eugenio was a born collector of, among other things, pipes, toy trains, stamps, and, above all, scientific books, of the latter of which he had many rarities including a treasured original of Linnaeus' "Systema Naturae." His holdings of books and manuscripts were so extensive that, upon his retirement, he established a formal library to house it in the upstairs of one of his commercial properties on the busy Calle Atocha in downtown Madrid.

Eugenio was the proud recipient of numerous prizes and awards for his international scientific achievements including gold and silver medals and honorary memberships from various foreign governments, universities, and societies (including the Orthopterists' Society), and, in June, 1998, he was tendered an Honorary Doctorate by the Universidad Autonoma de Madrid. On investiture of the latter, he delivered an address entitled "Recuerdos de un Naturalista en el Desierto" in which he discussed the continuing need of field work for entomologists and illustrated his talk with examples from his own life.

These facts assure placement of Eugenio Morales in the company of other contomporary European greats

such as the orthopterists Lucien Chopard of France, Max Beier of Austria, B. P. Uvarov of England, and G. J. Bei Bienko of Russia. I might add that Ignacio Bolivar and he
were indisputably the premier Iberian orthopterists of the 20th century. But these facts say little of the proud man behind them. Eugenio was also a brilliant, highly enthusiastic, energetic extrovert with a marvelous sense of humor, for which reason he was universally liked. I know of many, many people who, like myself, regarded him as among their best friends. He spoke a charmingly accented English that was little better than my own flawed Spanish, yet he proudly insisted that all conversation between us be in English. On one occasion, for example, my wife and I had traveled to Granada where she became afflicted with a digestive ailment. When he asked about the trip, I recounted the fact that she had been treated by an excellent English-speaking physician sent by our posh hotel, the Alhambra Palace, located on Alhambra hill. When asked how much all of that cost, I told him the total (about 5,000 ptas., as I remember) to which he responded, "hombre, is better die, no?, particularmente when no is you!" This example provides insight into his delicious sense of humor and his proficiency (or lack of it) in English.

Much of his wealth was inherited through his beloved wife, Amalia de Oñate y Fernandez de Gamboa, or "Lala," as he called her. She belonged to a noble family and contented herself with maintaining a household of high standard and refinement. Eugenio and Lala had three sons as well as a child who died in infancy. Lala maintained household and servants and devoted her life to assuring that Eugenio, whom she adored, was always comfortable and happy. She died in 1998, from which he never quite recovered, though he lived on until 2002.

One of my most cherished memories of the Morales family stems from 1997 when Eugenio and Lala invited my wife, my daughter, and myself to celebrate Christmas with them and their immediate family including his elderly mother, their brothers, sisters, and children. The highlight of the evening after a sumptuous multi-course dinner for about fifteen of us was a theatrical presentation produced and acted by the children who kindly included my own young daughter, Leslie, in their cast. Lala had a professional artist from the civic opera decorate the apartment with a large creche in the family room, a tree in the dining room, and the salon was converted into a stage. At about 10:00 pm, the rest of the extended family (about a hundred people in all) had arrived, and the two-act play began. Afterward, Saint Nicholas appeared with gifts for the children, and a luncheon followed. We left, exhausted, well after midnight as the festivities continued unabated. I don't know when it all ended.

Rehn, James A. G.[2]

There were two living workers, J. A. G. Rehn and Sir Boris Uvarov, whose names stood out above all others when I first began studying Orthoptera. The former was prodigiously active in research and publication on New World acridid taxonomy and the latter in the study of Old World acridids. Rehn grew up in Philadelphia where he became acquainted with the curator of its museum, C. W. Johnson, who encouraged a small group of local boys and him to become naturalists. Little attention was being devoted to Orthoptera in proportion to the other insect groups at the time, so Rehn began his life studies on the group. He was widely traveled in the United States and South and Central America and also did some work in Africa. He single-authored numerous papers and also published extensively in collaboration with Morgan Hebard, with his son J. W. H. Rehn, and with Harry Grant. He proudly noted of having spent 42 seasons in the field, hence his objection to colleagues who (to use his words from a letter in my file) were "unduly influenced by erroneous preconceptions of relationship and centers of origin" based on lack of adequate field work.

My first interaction with Mr. Rehn was in 1961 upon completion of my monograph on feeding which was accepted by the publications committee of the Transactions of the American Entomological Society and its editor but, at the last minute, returned "for modifications" demanded by Rehn. The editor apologized profusely but said he could do nothing. It was up to me to settle the controversy. Rehn felt that I had paid insufficient attention to "his innumerable contributions" to the feeding behavior of Orthoptera. (It was obvious that I was ignorant of them, and, to this day, I remain so). And it seems that my frequent reference to useful compilations such as those of W. D. Blatchley, L. Chopard, M. Beier, and E. D. Ball

et al. were galling to him because, as he noted, their information was based entirely on "his earlier work" for which he had received no credit. As he put it, "many of them were closet students who knew almost nothing of the living entities they discussed." As I pointed out to him when I journeyed to Philadelphia to discuss the manuscript, many of his so-called "feeding records" were mere perching records and not *prima facie* evidence of preference, but he was adamant. It was an unfair fight that was necessarily resolved in his favor. The inevitable result was that I included many of his so-called "classical feeding studies" in my manuscript which he then pronounced to be "satisfactory." That was the only time I met him. He retired and died shortly afterward, but I'll never forget his haughtiness as I talked to him. That notwithstanding, Rehn admittedly dominated New World acridid systematics for decades and deserves recognition as one of the greats of our field, but, on a personal basis, I found him to be no gentleman.

[2]Parts of this account are based on a series of written interviews sent me by Jose Liebermann.

REPORTS

Teacher vs. taught: does experience matter when counting grasshoppers?

Tim Gardiner

I was asked to do an all-day lecture on the MSc in Conservation Management at Writtle College, Essex, UK, in June 2007. The module was Biological Surveying and the tutors wanted a guest lecturer to introduce the students to the perils of insect surveys in the field. I decided to do a more formal lecture in the morning which introduced the principles of ecological surveys, followed up by a practical exercise in the afternoon to show how variable the results can be from applied research. Naturally, I wanted to do something on grasshoppers, so I thought I should get the students out in the field doing a real life hopper count. This should be relatively interesting for them, and it would be fun to compare the results from each student. Given that they had no prior knowledge or experience of grasshopper counts, I introduced them to transect sampling methodology in the lecture room, before showing them how to undertake the method in the field. Each student was given a trial run, where they had to walk at a slow strolling pace (roughly 2 km/h) whilst counting all of the grasshopper and bush-cricket nymphs (it was early June so we had no adults) in a 0.5 m band in front of them. This is a published technique and a fairly simple one to grasp.

After the trial run, each student walked the transect, which had two sections, the first being a grass field margin (200 m long), the second a grassy footpath (100 m long). The students started the transect walks at staggered 10 minute intervals so that the grasshopper assemblages could recover from the disturbance caused by the previous sampler. Once all of the students had finished, I walked the route and noted down what I saw. I have over five years experience of counting Orthoptera in the UK, so it was a straightforward comparison between experienced and inexperienced samplers.

A comparison of the transect results back in the lecture room certainly surprised us all. Even though I had expected the inexperienced students to see less grasshoppers and bush-crickets, I did not expect them to see so few. On average, the students saw only four grasshopper nymphs (only 17% of my count), the most adept student saw 10 nymphs, whilst four students saw two each (Table 1). Many students found it hard to detect the fairly small nymphs (most were in 1st or 2nd instar) when they were flushed out of the grass, even though they were walking at a slow pace during sampling. Several students also found it hard to distinguish between grasshopper nymphs and leafhoppers (such as *Philaneus spumarius*); this kind of quick differentiation comes with experience and confidence.

The time taken to undertake the transect counts reveals that most of the inexperienced samplers walked too slowly (two students took 20 mins = 0.9 km/h). Only one student walked the transect route in 10 minutes (roughly 2 km/h pace). However, although the students' counts were low in comparison to mine,

most results showed that the field margin had higher numbers of grasshoppers than the footpath (Table 1). Interestingly, two students saw a grasshopper nymph on the footpath section, which I did not see, this shows that even experienced samplers can miss individuals in a sward. In conclusion, the students felt the exercise showed them just how variable transect counts can be and that interpreting data from applied insect surveys should be done with caution, with the experience of the sampler in mind.

Table 1: Number of grasshopper nymphs counted along two sections of a transect by seven students (inexperienced samplers) and a lecturer (TG: experienced sampler)

Student	Time taken (mins)	Section 1 (field margin)	Sec. 2 (foot path)	Total count	No. less than lecturer
A	20	2	0	2	21
B	14	1	1	2	21
C	20	4	0	4	19
D	12	9	1	10	13
E	10	2	0	2	21
F	14	2	0	2	21
G	15	9	0	9	14
Lecturer	10	23	0	23	-

Orthopterists' Society Small Grant Report

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Sexual selection can cause speciation (reviewed in Coyne and Orr 2004). To maximize their reproductive success, males are predicted to evolve mating traits that satisfy female preferences. Divergent female preferences in isolated populations of a single species may cause male mating traits to evolve along different trajectories. If incompatible mating systems result, new species are formed. This process can be studied across populations where male mating traits are shown to differ (e.g. Ritchie 1996).

Figure 1. Map of field sites.

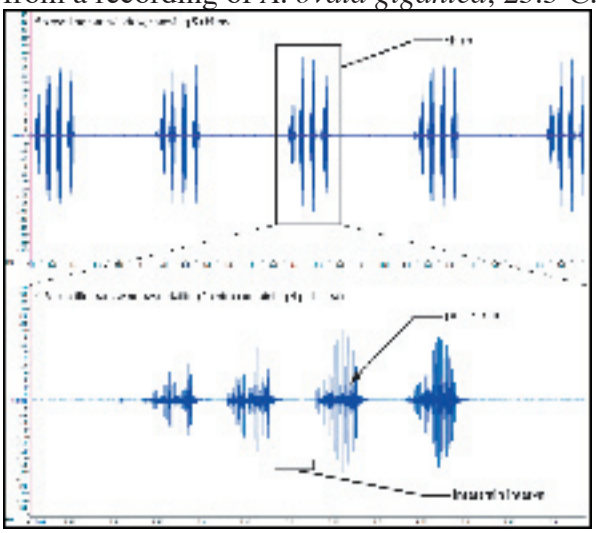
My study organisms are shield-back katydids in the genus *Aglaothorax*. The Transverse Ranges of southern California are a center of diversity for this group (Rentz and Weissman 1981). For the last two years I have been studying the female preference of *Aglaothorax morsei* and *A. longipennis*, both occurring in isolated populations throughout the Santa Monica Mountains. In 2007, I studied populations of *A. morsei* at four localities: Point Mugu State Park (Sycamore Canyon), Leo Carrillo State Park (Nicholas Flat), Arroyo Seco, and Millard Canyon (Fig. 1). Male calling song is a sexually selected trait in these insects. I previously found significant differences in two song features: the number of pulse trains (pt) per chirp ($p<0.0001$), and the intertrain interval (iti) ($p<0.001$; Fig. 2). These features differ both at the species and population (subspecies) levels.

Female preferences may be of the stabilizing or threshold types (Rodriguez et al. 2006). Stabilizing preferences select for a particular trait value, with preference declining on either side of this value. Threshold preferences select above or below a certain value. Under a coevolutionary hypothesis of sexual selection, with male song evolution driven by divergent female preference, I expected to find stabilizing preferences selecting for the pt/chirp means in the various populations.

I set two objectives for my 2007 fieldwork:

1. Measure female preference for the pt/chirp song feature in the Point Mugu population. I added Arroyo Seco and Millard Canyon to extend geographic and taxonomic coverage.
2. Measure female preference for iti in all focal populations.

Figure 2: *Aglaothorax* song structure, illustrated from a recording of *A. ovata gigantea*, 25.5ºC.



Methods

Collection and rearing of females

I collected immature females in the field and raised them to maturity in the laboratory to control for mating history, which alters preference. Most females were found feeding on flowers at night, especially *Sambucus mexicanus* and *Mimulus aurantiacus*. Live specimens were maintained on a diet of cut cabbage, fish flakes, bee pollen and oatmeal. Adult females were aged 10 d post eclosion to ensure sexual receptivity.

Stimulus construction

For the pt/chirp tests, I digitally added and removed pt from population-specific recordings of "average" male chirps. CoolEdit (Syntrillium, Inc.) was used for all digital sound manipulation. I constructed a set of 10 stimuli spanning 1 – 28 pt in 3 pt increments, encompassing four standard deviations above and below the natural mean. I paired chirps differing by 6 pt to make a set of eight stimulus pairs.

For the iti tests, I manipulated iti in population-specific chirps containing the mean pt/chirp number. I made a set of eight stimuli ranging from 6 msec to 188 msec in 26 msec intervals. I arranged six stereo pairs by combining all stimuli that differ by 52 msec.

Female preference testing

Preferences were estimated with the same choice test protocol used successfully in 2006. Testing took place at 25ºC under red light, one hour after the dark cycle began. A dowel Y-maze simulated branches over which females move toward males in their woody chaparral habitat. Two loudspeakers, one each at two of the ends of the Y-maze, broadcast the stimulus pairs. Females were released onto the third maze arm. In one session, females received two repetitions of each stimulus pair in random order, with playback reversed between the speakers during the second repetition to control for side bias. I retested females on a second night with another two repetitions of the entire stimulus set, allowing within female variation to be assessed. For each stimulus pair, I recorded a 0 for choice of the low stimulus, a 1 for choice of the high stimulus, or a "no response" if the female failed to move 2/3 the distance to a speaker within two minutes. I analyzed the choice data with logistic regression.

Results

Goal 1: Female preference for pt/chirp.

Female pt/chirp preference is a threshold in all populations studied in 2007 (Table 1). Females selected against the lowest numbers of pt/chirp, but made no significant choice when presented with pairs consisting of higher pt numbers. The preference of the Topanga Canyon population, studied in 2006, is also threshold (Table 1). Thresholds ranged from 4 to 10 pt/chirp, depending on the population. The only population that responded according to coevolutionary predictions was Point Dume, studied in 2006. In this population, female preference is stabilizing on the male pt/chirp mean (Table 1).

The threshold preference shapes do not explain the specific male trait means beyond a coarse level. Male-male competition is perhaps responsible for finer scale variation in pt/chirp. Males form synchronous choruses, and may add pt to chirps to obscure the songs of other males or exploit precedence effects in females (Greenfield et al. 2004). Predation or parasitism may account for upper limits on pt number, as occurs in field crickets (*Gryllus*) (Gray and Cade 1999). A parasitoid fly (*Ormia* sp.) emerged from one male collected at Arroyo Seco. These flies parasitize singing male orthopterans by homing in on their songs. Male-male competition and predation will not be studied as part of my dissertation. The stabilizing preference at Point Dume perhaps indicates this population is embarking on its own evolutionary trajectory.

Table 1. *Aglaothorax* populations studied for pt/chirp preference.

Taxon	Population	male pt /chirp (mean ±SD)	female preference (type, pt)
A. morsei costalis	Point Mugu State Park	14±4	threshold, >7
A. morsei	Nicholas Flat (Leo Carillo)	12±2	threshold, >10
A. morsei morsei	Arroyo Seco (Angeles NF)	18±4	threshold, >4
A. morsei morsei	Millard Cyn. (Angeles NF)	10±4	threshold, >4
A. longipennis	Topanga Cyn. State Park	4±2	threshold, >4
A. morsei tectinota	Point Dume State Park	9±2	stabilizing, =10

Goal 2: Preliminary iti preference.
I measured iti preference in four populations (table 2). Sample sizes were too low to assess statistical significance, but trends indicate divergent selection by females. Point Mugu and Nicholas Flat females select for lower iti, accepting the lowest iti of a pair below a threshold of approximately 84 msec. Above 84 msec, female response rates declined by over 20%, indicating these stimuli were ignored. Preference of females from Point Mugu and Nicholas Flat may thus explain the evolution of low iti in male songs, characteristic of Santa Monica Mountains *A. morsei*. In contrast, females from the Arroyo Seco and Millard Canyon populations preferred iti stimuli above a threshold of 84 msec. Female response rates increased steadily with increasing iti at Millard Canyon, perhaps explaining the very long iti in this population. The 2008 field season will concentrate on building detailed preference functions for iti, which I hypothesize is a species recognition feature in these insects.

Conclusions

Female preferences are apparently not important in maintaining the population-specific pt/chirp distributions found in *Aglaothorax morsei* and *A. longipennis*. Preliminary results for iti suggest

Table 2. *Aglaothorax* populations studied for iti preference.

Taxon	Population	male iti (msec, mean±SD)	female
A. morsei costalis	Point Mugu State Park	27±2	threshold, <84
A. morsei	Nicholas Flat (Leo Carillo)	30±9	threshold, <84
A. morsei morsei	Arroyo Seco (Angeles NF)	100±24	threshold, >84
A. morsei morsei	Millard Cyn. (Angeles NF)	164±18	threshold, >84

divergent preferences may explain the evolution of distinct iti distributions found in different parts of the range. Future studies will produce detailed iti preference functions to address the importance of iti with regard to species recognition and song evolution in *Aglaothorax*.

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Phylogeny and systematics of the Isophya modesta group (Phaneropteridae) based on morphology and bioacoustics

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Introduction

Genus *Isophya* Br.W. is one of the richest in species orthopterous genera in Palaearctic and second after *Poecilimon* in the family Phaneropteridae. It comprises more than 80 species (91 after OSF 2007 but including some previously synonymized and Neotropical forms which apparently should be excluded from this number) (Warchałowska et al. 2008) and more than 45 in Europe (Heller et al. 1998), the majority known only from restricted ranges or single localities.

The genus is one of the most taxonomically complicated bush-cricket genera among which few large groups of sibling taxa could be recognized (e.g. Heller 1988, Sevgili et al. 2006; Warchałowska et al. 2008). Usually, within a group, the species display weak morphologic differentiation but, in sympatric taxa, well outlined differences in the song pattern (Zhantiev 1981). Thus, only after applying the bioacoustical approach (incl. some morphocharacters connected with the sound production) some systematic (Heller 1988, Sevgili et al. 2006) and territorial revisions (Heller et al. 2004) were done. Yet, the phylogenetic relationships neither of the genus nor within it or among the species groups have been investigated.

The present study has aimed to infer about the systematics and phylogeny of the *Isophya modesta* group sensu stricto, as defined in Warchałowska et al. (2008).
The closest relatives of *Isophya modesta* (Frivaldszky, 1867) form one of the large and most complicated generic groups. The latter species is the only Central European representative of the group. Ramme (1951) gave the first records on *Isophya modesta* related species from Bulgaria describing *Isophya longicaudata* Ramme, 1951 (its taxonomic status reconsidered as subspecific by Kis 1960) and *I. rhodopensis* Ramme, 1951. Later on Peshev (1959a, 1959b, 1981, 1985) described another nine species (one of them with 3 subspecies) from Bulgaria, most of them related to *I. modesta*. One subspecies – *I. modesta intermedia* Kis, 1960, was described from Romania. One species – *I. leonorae* Kaltenbach, 1965, is known from Northeastern Greece and one – *I. tosevski* Pavicevic, 1983, from Southeastern Macedonia (F.Y.R.O.M.) and the central part of Northern Greece. Though detailed, most descriptions are uninformative enough to speculate about the systematic relations within the group and even insufficient for taxa recognition.

Material and methods

During the study material from several collections was surveyed – collection of the National Museum of Natural History (at that time incorporating also the former collection of Orthoptera of the Institute of Zoology), Bulgarian Academy of Sciences, Sofia; collection of the Naturkunde Museum, Berlin; collection of the Natural History Department of the Regional History Museum in Blagoevgrad; the author's private collection. For the taxa considered, oscillograms of the male song are presented. General characteristic of the song, typical for each intragrouping of taxa was made. Songs were recorded in captivity with an electret condenser microphone (Knowles BT-1759-000) equipped with a custom-made preamplifier, connected to a PC through an external soundcard (TransitUSB, "M-Audio") (48/96kHz). Field recordings were obtained by ZOOM H2 handy recorder (Zoom Coproration) (96kHz). Figures of oscillograms of the song were prepared using Turbolab 4.0 (Bressner Technology, Germany). Song terminology follows Heller et al. (2004) (Figs.1-3). Some important morphological characters were studied by Scanning Electron Microscope (JSM-5510). Phylogenetic analysis was accomplished using PAUP* 4.0b10 (Swofford 2003).

Results

In order to define the species composition of *Isophya modesta* group and its position within *Isophya* a preliminary phylogenetic analysis of the genus was made (unpublished), which is not a matter of this report. The group and intragroup categories are here morphologically and bioacoustically characterized and some inferences about the taxonomic status of the taxa are proposed.

***Isophya modesta* group**. The group as here considered at present includes 15 taxa (12 species) (for changes in systematics see below), some of them still with doubtful taxonomic status. Main characteristics are: body large for the genus (hind femur usually more than 20 mm long), stout. Fastigium verticis wide, between half to two-thirds of scapus width. Pronotum elongated, not or slightly concave dorsally. Male tegmina elongated, equally or slightly longer than pronotum. Female tegmina about half or less of the pronotal lenght. Male cercus stout, basally wide, its apical one third characteristically angularly curved. Apical cercal spine always one, laterally situated. Ventral keels of hind femora usually bear 1-2 small spines. Ovipositor is long, more than 2.3 times longer than pronotum. The pit of the lower ovipositor valve base (formed between the lamella and gonangulum) is wide, well opened, the lamella is thin, not laterally protruded. Stridulatory file with 55-180 teeth. Melanism is absent.

Basal stock: *Isophya bureschi* (Fig. 4).

This species shows the most primitive morphological characters within the group, similar to that of *I. cania*. These include moderate body size (smallest within the group), body not as stout as in the other species; Cu2 vein in male is short (≤2/3 the width of hind margin of pronotum), moderately widened; male tegmina are not distinctly bulged, their coloration is not modified; male stridulatory file bears low number of sparsely distributed teeth (68-75); male tegmina on the contrary are not primitively long; apical cercal spine is elongated and pointed. The species has never been found in the lowlands as most other representatives of the group. Its range is restricted to the middle belt of few high mountains in Southwestern and Central Bulgaria. The calling song (Fig. 1) consists of short syllable sequences, each syllable including short main part (40-60 ms), followed by an isolated part of few after-clicks after 600-800 ms.

Superspecies *Isophya andreevae*.

Includes *I. andreevae* (Fig. 5) and *I. tosevski*. The first is found in the Southwestern Bulgaria, between 300 and 1800 m alt., the second is known from the lowlands and low mountains of Macedonia and Greece (see Introduction). These two taxa show great similarities with each other, differing slightly in the cercal shape and song (though the oscillogram of *I. tosevski* on Abb. 30-C in Heller 1988 identical with some oscillograms of *I. andreevae*), thus they are here considered together despite their paraphyly within the cladogram.

Both species characterize with large, stout body; Cu2 vein is wide, long (>2/3 to >3/4 of the hind margin of pronotum); disc of male tegmina (at least in lowland populations) yellowish; stridulatory file with 75-110 teeth; apical cercal spine is pointed and long but stout, much wider than in *I. bureschi*. Song (Fig. 1) consists of groups of 3-5 syllables, the syllables include well separated impulses and last 180-450 ms, and sometimes an after-click (up to 8 in *I. tosevski*) follows after ca. 200 ms.

Northern stock: *Isophya modesta* closest relatives.

This is the richest in species intragroup. In Bulgaria it occurs in the northern part of the country with some penetration in South via the Black Sea coast with the taxa *I. miksici, I. plevnensis, I. pravdini pravdini* (Fig. 6), *I. longicaudata longicaudata* stat.rev., and *I. longicaudata adamovici* comb.nov. (for taxonomic changes see below).

Similarities with *I. modesta modesta* are found in the general body shape, cercus shape and the first part of the song. Common characteristsics are: body large to very large for the genus, stout; Cu2 vein is wide, stout and long and only in some populations of *I. miksici* the vein lenght and width is similar to that of *I. bureschi*; in the other taxa Cu2 lenght is longer than 2/3 the hind pronotal margin, up to >4/5 in *I. longicaudata*; disc of

male tegmina is greenish to yellowish-brown colored (the latter coloration is much more pronounced within the eastern lowland populations). Typical characteristic is „bulging" the disc by straighten vertically the lateral (Costal) parts of tegmen (in *I. plevnensis/pravdini* and partly in *I. miksici*) and/or bulging the whole disc (in *I. longicaudata)*. The stridulatory file bears 70-160 teeth; cercal spine is pointed but wide, short, stout. Song (Fig. 2), similarly to the differences in number ot stridulatory teeth and shape and coloration of tegminal disc, is subjected to more or less smooth changes from West to the East. From consisting of syllable sequnces (>5 syllables) with the syllables general shape, lenght and number of impulses similar to these of *I. andreevae* in *I. miksici*, the songs became consisting of single, strongly continuated (up to >1.5 s) syllables in *I. l. longicaudata* and *I. l. adamovici*, in the same time losing typical after-clicks. In *I. m. modesta* the song is additionally complicated, consisting of single syllables of short main impulse series (120-240 ms), followed with a long delay (4-9 s) of an additional terminal impulse series (200-2500 ms) (Orci & Heller 2004). Based on morphology and songs, a change in the systematics of *I. modesta longicaudata* and *I. pravdini adamovici* is proposed here. In addition, the great similarities between *I. plevnensis* and *I. pravdini pravdini* call for a possible synonymy.

Isophya longicaudata Ramme, 1951, **stat.rev.**
For morphological descriptions see Ramme 1951, Bey-Bienko 1954 (*I. longicaudata*), Kis 1960 (*I. modesta longicaudata*), Peshev 1985 (*I. modesta longicaudata* and *I. pravdini adamovici*).
A supplement to the description, song description and diagnosis. Body large to very large for the genus (hind femora usually longer than 20 mm up to 28 mm), ovipositor very long (longest among the genus; usually >17 up to 24 mm). Tegmina as long as or usually slightly longer than pronotum, the disc is more or less bulged, membranous, yellowish-brown colored with long (>3/4 to >4/5 of hind ponotal margin) and very thick yellowish Cu2 vein. Stridulatory file is long (>3.5 mm) and has 145-160 teeth. Tergal coloration is dark green (to bluish-green) with a typical whitish opalescence laterally. The song (Fig. 2) consists of isolated syllables, repeated slowly at an interval from few seconds to more than a minute. The syllables last (0.4)0.5-1 s at 30°C to more than 1.5 minutes at lower temperatures (<20°C) and includes 55-80 well separated impulses, which form first part with dense impulses (decreasing in amplitude) and a second part of sparse impulses (with first half increasing and second half decreasing impulses). The main frequency spectrum lies between 10 and 25 kHz with main peaks observed at 13-14 and 16-17 kHz.
Differences from *I. modesta* (incl. *I. modesta rossica* but excluding *I. modesta intermedia*, which likely represents a form of *I. longicaudata*) include the above characters. Hind femora of *I. modesta* are 16-19 (up to 24) mm long, ovipositor is shorter (15-18 mm), tegmina are not distinctly bulged, greenish; Cu2 lenght is ca. 3/4 of the hind pronotal margin, moderately thickened and usually greenish colored; stridulatory file bears (95)124-143 teeth; whitish opalescence lacks. The song (see Heller et al. 2004, Orci & Heller 2004) is one of the most striking characters for distinguishing *I. modesta*. Here the first part, being generally similar to that of *I. longicaudata*, is sharply disconnected from the second part of sparse impulses by a gap of 4 to 9 seconds, thus the terminal impulse series obtain similarities with (or even become functionally?) after-clicks.
The range of *I. longicaudata* covers the middle part of the Western Black Sea coast: South Dobrogea (Dobroudzha) in Southeastern Romania and Northeastern Bulgaria with narrow penetration along the coast into Southeastern Bulgaria. Preferable habitats are coastal semidry to moderately humid high grass associations and mesophyte clearings in lowland forests; some bordering populations occur in sunny meadows with lush-vegetation up to 1000 m alt. in the mountains.

The species is here considered with two subspecies.
1. *I. longicaudata longicaudata* Ramme, 1951.
The nominate subspecies expresses strongly the specific characters with longer and strongly bulged tegmina with longer Cu2 and longer ovipositor. The recorded songs (Fig. 3) characterize with syllables lasting 850-1100 ms (field observation show even longer songs) with well differentiated first (dense) and second (sparse impulses) part. When this differentiation was not so clear, the border between the parts was put at the lowest

amplitude before its secondary increase and at an impulse-period of ~10 s. The following measurements of the song was obtained from 19 syllables (8 syllables at 28°C, 11 – at 30°C) of typical specimens. At 28°C the syllables lasted 863-1059 ms (Mean=955±73, n=8) with part I of 127-166 ms (Mean=152±13, n=8) and part II – 697-932 ms (Mean=816±91, n=8); at 30°C the song lasted 645-863 ms (Mean=708±65, n=11) with part I of 130-160 ms (Mean=146±8, n=11) and part II – 498-733 (Mean=562±69, n=11). The number of impulses did not differ within one individual at different temperatures, thus it is evaluated here combined. The syllables consisted of 61 to 76 impulses (Mean=68±5, n=19) distributed as follows: part I – 32-46 (Mean=42±4, n=19), part II – 16-43 (Mean=26±9, n=19). Syllables duration is compared on Table 2.
The subspecies occurs along the Western Black Sea coast from the region of Bourgas (SE Bulgaria) to Southern Dobrogea in Romania with penetration into the lowland forests of NE Bulgaria.

2. *I. longicaudata adamovici* Peshev, 1985, **comb.nov.** = *I. pravdini adamovici* Peshev, 1985.
The subspecies differs from the nominate one in the following characters. Tegmina are less bulged and generally shorter. Cu2 is usually shorter and narrower. Pronotal side margins in metazone are usually sinuate. The ovipositor lenght by Peshev (1985) is 17.8-18 mm. Cerci are usually stouter, with broadly rounded tip. The song (Fig. 3) is shorter (400-850 ms), with less clear differentiation into two parts. First part is prolonged (longer than in the nominate subspecies) sometimes with smooth transition into the sparse second part (shorter than in the nominate subspecies). The latter is sometimes significantly reduced. The measurements obtained from 12 syllables (at 27-28°C), though three males from the same population recorded, show two song types: one with well differentiated second part and longer impulse-period and second with unrecognizable border between parts and shorter impulse periode. The syllables lasted 386-818 ms (Mean=661±137, n=12) with part I of 285-326 ms (Mean=311±16, n=9) and part II – 250-494 ms (Mean=407±71, n=9). The number of impulses in the syllables was 58-75 (Mean=66±7, n=10) (thus not significantly different than *I. l. longicaudata*) distribued as follows (if recognizable): part I – 43-64 (Mean=50±7, n=8), part II – 9-19 (Mean=14±4, n=8). Syllables duration is compared on Table 1.
The subspecies is at present known from East Stara Planina Mts, the central part of E Bulgaria, at altitudes of 900-1000 m.

Table 1. Measurements of the impulse-period of the song of *I. longicaudata longicaudata* and *I. longicaudata adamovici*.

Part of the song	Whole impulse sequence in a syllable		Part I of the syllable			Part II of the syllable		
Taxon/Temp. n	long n=19	adam n=11	long/30° n=11	long/28° n=8	adam/28° n=7	long/30° n=11	long/28° n=8	adam/28° n=7
Min	2	2	2	2	5	7	8	11
Max	217	108	7	10	20	217	64	108
Mean±SD	12±15	11±11	3±1	4±1	7±2	27±25	24±9	30±17
Mode	3	6	3	4	6	19	22	23
Median	5	6	3	4	6	20	22	25

Abbreviations: adam – *I. l.adamovici*, long – *I. l. longicaudata*, Max – maximal value, Min – minimal value, n – excerpt size (number of measured impulse-periods), SD – standard deviation, Temp. – air temperature during measurements.

Superspecies *Isophya rhodopensis*.
Four taxa are described in this group: *I. rhodopensis, I. leonorae, I. kisi* (Fig. 7), and *I. petkovi* (Fig. 8), all from the Rhodope Mountain group in Bulgaria and Greece. Common characteristics of the group are: body large, stout; Cu2 vein wide, very long (>3/4 of the hind margin of pronotum); disc of male tegmina is green in western and mountain populations, yellowish in the eastern lowland populations; stridulatory file always with high number (130-180) of teeth; apical cercal spine long, very stout, sometimes like a crest, shovel formed; cercal hairs quite thick, dense. Song (Fig. 3) consists of groups of 2 to many (>10) syllables of dense impulses with

decreasing amplitude and lasts 50-300 ms, sometimes an after-click (up to few in *I. petkovi*) follows after 100-1000 ms. The great similarities between *I. leonorae* and *I. kisi* support their probable synonymy.

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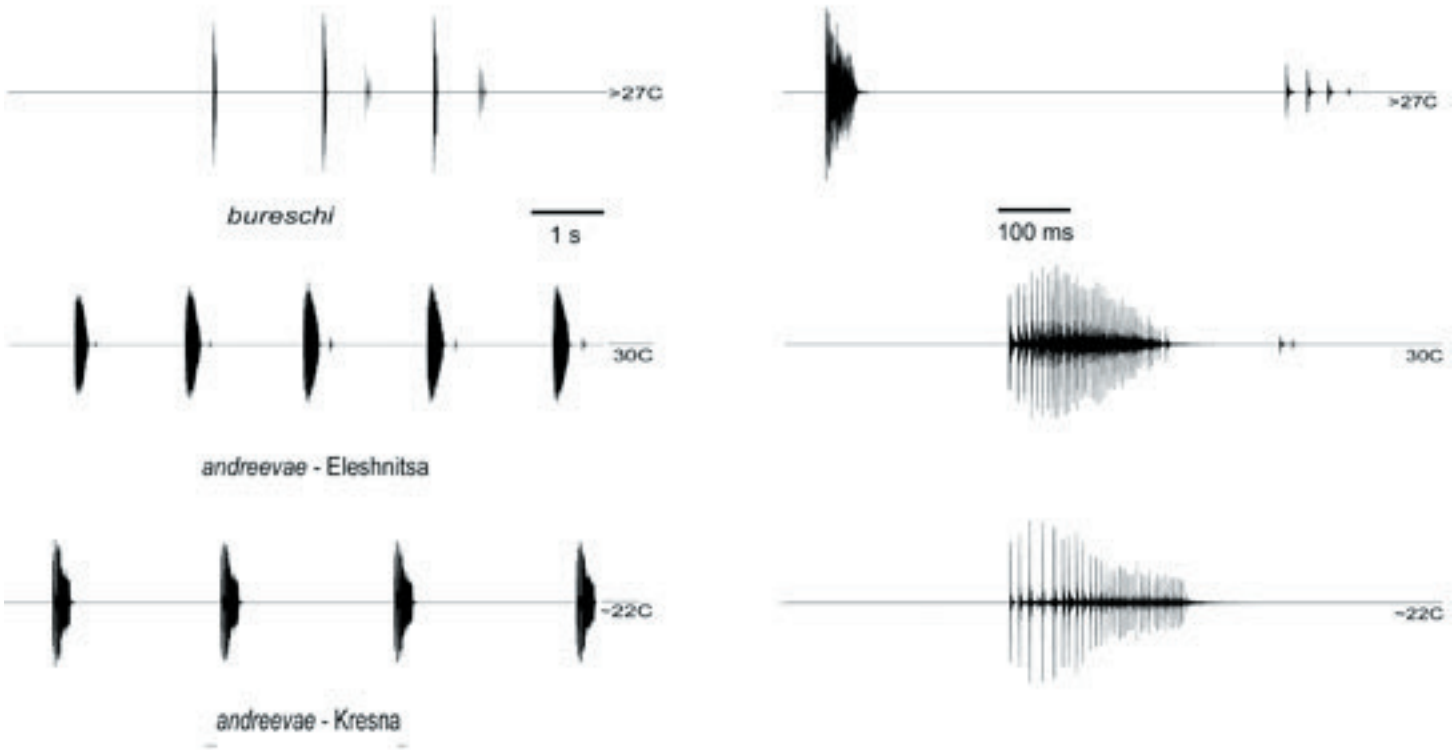

Fig. 1. Oscillograms of the calling song of *Isophya bureschi* (above) and *I. andreevae* (middle – mountain population, below – lowland population) shown in two different speeds (temperature during each recording is shown).

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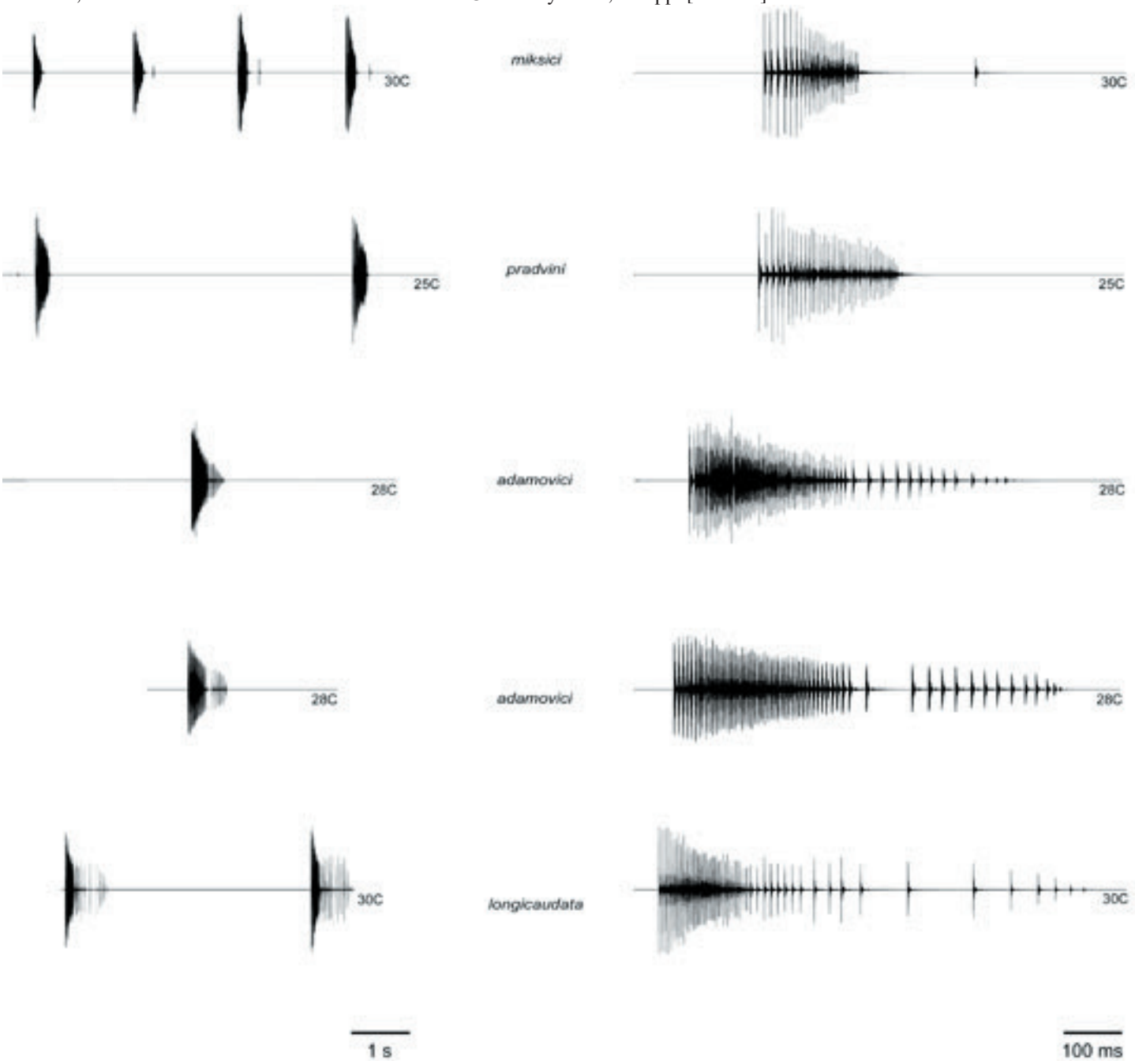

Fig. 2. Oscillograms of the calling song of taxa from the Northern stock of *Isophya modesta* group shown in two different speeds. From the top downwards – *Isophya miksici, I. pravdini pravdini, I. longicaudata adamovici* (songs of 2 males from the same population), *I. l. longicaudata* (temperature during each recording is shown).

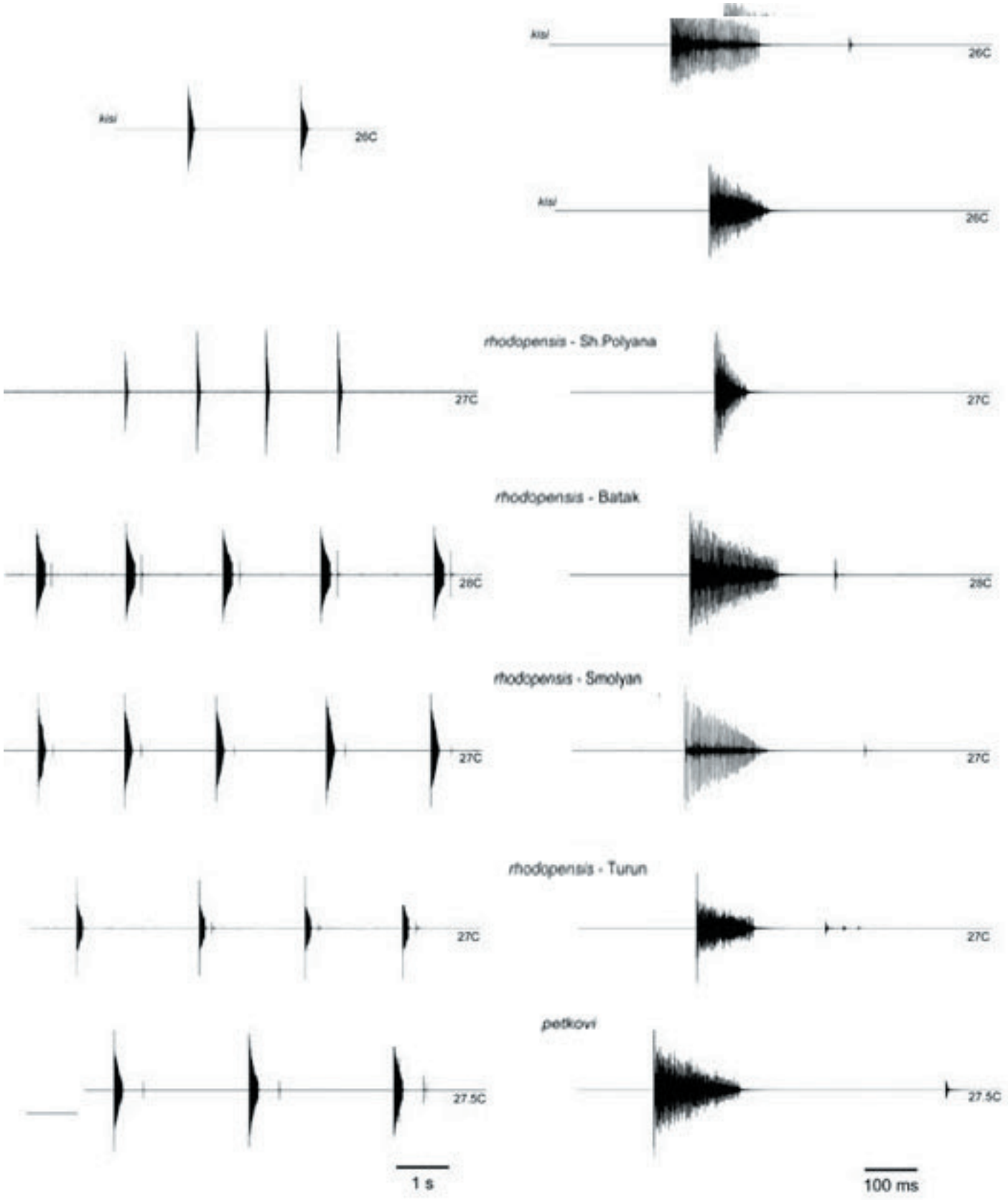

Fig. 3. Oscillograms of the calling song of taxa of *Isophya rhodopensis* superspecies shown in two different speeds. From the top downwards – *Isophya kisi* (songs of 2 males from the same population), *I. rhodopensis* (males from 4 different populations recorded), *I. petkovi* (temperature during each recording is shown).

Fig. 4. *Isophya bureschi* – a male from N Pirin Mts (SW Bulgaria).

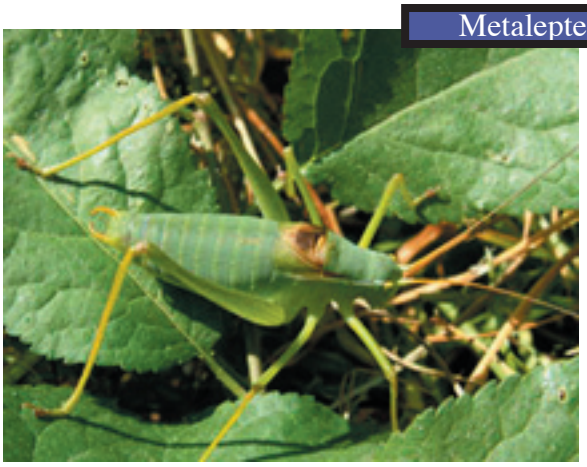

Fig. 5. *Isophya andreevae* – a male from the Strouma Valley (SW Bulgaria).

Fig. 6. *Isophya pravdini pravdini* – a male from Central Stara Planina Mts (N Bulgaria).

Fig. 7. *Isophya kisi* – a male from Alibotoush Mt. (SW Bulgaria).

Fig. 8. *Isophya petkovi* – a male from E Rhodope Mts (SE Bulgaria).

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