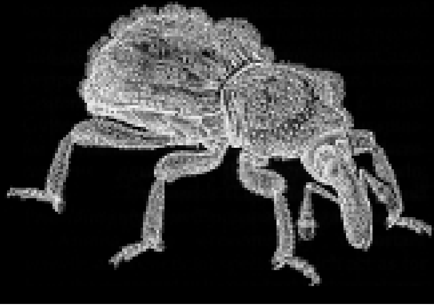

CURCULIO

An International Newsletter for Curculionoidea Research

Volume 45 **September 2002**

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Featured Researcher

Alexander Riedel

University of Nebraska
State Museum, USA

(Alexander Riedel at the UNSM in Nebraska, photo by F. Ocampo)

Academic Background

Diploma in Biology, Ludwig-Maximilians Universität München, Germany - 1995
Doctor *rer. rat.* in Biology, Ludwig-Maximilians Universität München, Germany - 2002
Entomology Collections Manager, Division of Entomology, University of Nebraska State Museum, Lincoln, Nebraska, USA - 2002 to present

Research Interests

Taxonomy, phylogeny, and biology of Curculionoidea; geographical emphasis on the Indo-Australian region.

When I contacted the editor concerning my recent change of address from Munich (Germany) to Lincoln (Nebraska), he asked me to write something about myself in the "featured researcher" column. After some hesitation, I felt that it may not be a bad idea to explain how my fate seems to be influenced by both weevils on one hand, and scarabs on the other. I guess my setting the record straight is preferable to someone screwing up things in my obituary!

In 1985 my parents gave me the chance to accompany them on one of several trips to India. I was already interested in collecting insects in general, and beginning to realize that I would need to specialize on a more limited group if my efforts should lead to more fruitful results. As a matter of fact, I was greatly impressed by the *Heliocopris* that were attracted by the hotel lights at Keoladeo Ghana National Park (Rajasthan). I suppose that I would have become a scarab collector if Charlie O'Brien had not been staying at the same place at the same time. To be precise, it was his wife, Lois, who realized that the soul of a future entomologist could be saved for the weevils. Anyway, Charlie O'Brien convinced me that weevils are a much better group than scarabs. And so I became a weevilist at a time when I still had a few years in high school ahead of me. The discovery of my first new weevil species (*Otiorhynchus riedeli* Braun from East Turkey) came during these years as a student.

In 1989, after I had left high school, I completed my first major collecting trip with my friend Michael Hiermeier, a scarab collector. We chose to go to India. Within ten weeks I had collected several thousand specimens of weevils. However, most of them remained unidentified in my collection even until to to-

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Editorial Comments

Here is the second CURCULIO volume for the year of 2002. We would like to thank everyone who contributed to the last two newsletters with updates on addresses, publications, research interests, or fully featured articles. Please keep it up, it cannot be overstated that the future of our newsletter depends on you. With this volume we have been able to eliminate the backlog of unlisted publications. The feature on weevils on the Internet has been postponed until the next volume since the current list is still fairly short. However, we have several interesting and informative articles, e.g. on weevil DNA studies (by Andrea Sequeira and Brian Farrell, page xx) and on *Ozopemon,* an enigmatic scolytine beetle (by Roger Beaver and Bjarte Jordal, page yy). David Kissinger and Alexander Riedel have provided quality last-minute articles for the featured researcher and book review sections, respectively. We hope that you like what you see and that their efforts inspire you to contribute as well.

NMF

Alexander Riedel (continued)

day. Why? First, because I find it difficult to work with a fauna that was mainly derived from neighbouring continents, and second, because my most exciting collecting trips were yet to come. During my first semester vacations in 1990, I dared to travel alone to a country I had never been before: Malaysia. The collecting was good and I liked the country. Later, two friends (M. Balke and L. Hendrich) convinced me to join them on a collecting trip to the Indonesian half of New Guinea (Irian Jaya or West Papua). We went there during our second semester vacations in 1990. In the course of this journey, I also traveled to other parts of Indonesia, namely Sulawesi and Sumatra. I guess at that time I started falling in love with this country, its people and - of course - its weevils.

From the standpoint of science, I found the weevil fauna of New Guinea to be the most exciting. The diversity there is just amazing. Equally important to me is that the fauna is well isolated, making it convenient to work on. But naturally, all good things come at a cost, and in the case of Papuan weevils it is mainly the problems encountered in the field. I went twice to Papua New Guinea (for a total of ca. four months) and found the weevil fauna possibly even richer than the one of Irian Jaya. Still, I did not like Papua New Guinea as much as Irian Jaya for several reasons. Among these are the exorbitant costs for traveling, a high criminality rate and what I consider bad food. In Irian Jaya other difficulties prevail: extremely difficult transportation, serious problems in communication (unless you are willing to learn some Bahasa), and a culture which requires some adaptation. So I learned some Bahasa, got used to eating sweet potatoes and spicy rice dishes on the road side, and put on my hiking boots. Nobody should trust the public transport system or car rental agencies outside of the few major towns in Irian Jaya. Being on a relatively low budget, one would take a mission flight to some village, ask the natives for help and then start walking (and collecting). On my earlier travels I covered a distance of up to 150 km, mostly along the mountains. It is not unusual to cover only a few kilometers of horizontal distance per day, but you have to climb up and down 1500-2000 m of altitude. To be honest, I have been lazier in recent years, staying along the coast or covering shorter distances. Political instability also played a role. Some of the areas where I have collected in the early 90s are now closed for travelers, mainly because of rebel activities. Even during better times, I could not freely choose where to go. But after a dozen collecting trips to New Guinea, each including new localities, I can probably claim that I have visited enough areas to have a rough idea of the composition of the Papuan weevil fauna.

Alexander Riedel in the field in Papua New Guinea, photo by M. Balke

So, when I had to look for a topic for my Diploma thesis I was in the lucky position to have a collection of several thousand Papuan weevils at my disposal. I decided that I should concentrate on the attelabid genus *Euops.* I continued work on this genus for my dissertation which I completed by the end of 2001. So all in all I have spent almost eight years working on *Euops.* I described 55 new species of this genus and revised the 24 previously known ones from the Papuan region. Still, I have 108 undescribed "morpho-species" on hand. The most important parts of the taxonomic content of my thesis have been published.

Well, where do the scarabs fit in now? A few months ago I was offered the position as Entomology Collections Manager at the University of Nebraska State Museum. Right - that is the place where Brett Ratcliffe and the rest of "Team Scarab" are working. I did not have any competing offers from "Team Wee-

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Alexander Riedel (continued)

vil" (will it ever come into existence?), so I decided to move to Lincoln. I have been in the US since August, digesting my culture shock.

Future weevil projects? Yes, if Brett Ratcliffe and the others do not corrupt me with scarabs, I am going to continue with weevils. I have less time to spend on research than before, but I will continue to do some. Maybe I will continue my studies on *Euops,* describing the 108 unnamed species on hand. Research on the fungal partners of *Euops* is also tempting. Perhaps, I will also start some completely new projects. The material I have accumulated should be sufficient for the rest of my career: I estimate that my weevil collection contains about 100,000 specimens. In any case I will try to continue research on the Indo-Australian weevils, although this region is now a bit further away...

Dissertation Abstract - Selected Passages

The attelabid genus *Euops* Schoenherr is demonstrated to constitute a monophyletic group based on the following synapomorphies: 1) mycetangia of the female for storage of fungus spores consisting of three different reservoirs and associated setose structures, 2) a patch of modified setae of the female venter, usually associated with exocrinous glands, 3) enlarged eyes. [...] Selected, monophyletic species groups of *Euops* are treated in a monographic way: the *spinosus*-group (ten species described as new), the *pygmaeus*-group (one species redescribed, 13 species described as new), the *quadrifasciculatus*-group (four species redescribed, six species described as new), the *simulans*-group (three species redescribed, 19 species described as new), and the subgenus *Neosynaptops* (two species redescribed, seven species described as new). [...] The literature published on *Euops* is reviewed and a bibliography is given. At the commencement of this study (1998), 134 species and 10 subspecies of *Euops* were recognized as valid worldwide. A synopsis of Papuan *Euops* is given. Before the commencement of this study 24 valid species of Papuan *Euops*, based on inadequate descriptions, were known to science. These are redescribed to meet the new standards. Where necessary, lectotypes are designated. One species (*E. picipes* Voss) is placed into synonymy. One subspecific name (*Euops femoralis* f. *ruficornis* Voss) is elevated to species level. 52 species are added by formal descriptions. At present (2002), 76 described species are reported for the Papuan region, constituting 40% of the world fauna (189 described species). Another 108 undescribed species from the Papuan region are listed. These could not be described herein but they will be so in later publications. Thus, at present 184 *Euops* species are known from the Papuan region constituting 58% of the world fauna (320 ascertained species). [...] Species of the *pygmaeus*-group are reported to feed exclusively on the fresh leaf flush of *Nothofagus.* Species of its presumed adelphotaxon, the *quadrifasciculatus*-group, are recorded from Myrtaceae. [...] Fungi isolated from the mycetangia of different *Euops* species exhibit different mycological characters (e.g. coloration) and presumably belong to different species. They all belong to the genus *Penicillium.* It was found that spores obtained from the mycetangia can be stored for extended periods in sterilized water. Future studies should make use of this fact to export fungus samples and to cultivate them under more favourable laboratory conditions than usually available in tropical countries. [...] It is estimated that the area studied harbours at least 300 species of *Euops,* making it the most diverse region for this genus in the world.

Professional Experience

1991-1996. Curatorial Assistant, Zoologische Staatssammlung München, Germany.

1996-1999. Research Associate, Zoologische Staatssammlung München, through schoolarship of Ludwig-Maximilians Universität München, Germany.

2000-2001. Scientific Trainee, Staatliches Museum fuer Naturkunde, Stuttgart, Germany.

Publications

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On Weevil DNA Studies

By Andrea Sequeira (USA: asequeira@oeb.harvard. edu) **and Brian Farrell** (USA: bfarell@oeb.harvard.edu)

The superfamily Curculionoidea presents remarkable species diversity and striking morphological and biological variation. As a group, weevils pose an array of intriguing evolutionary questions ranging from the evolution of larval traits and habits (Marvaldi *et al.* 2002), the fidelity of host associations over millions of years (Kuschel 1983, Farrell 1998), to biogeographical patterns on island archipelagos and on the southern landmasses (Lanteri 1994, Emerson *et al.* 2000, Sequeira *et al.* 2000a, Sequeira & Farrell 2001). Many of these research topics have been approached by estimating the phylogenetic relationships among selected sets of taxa or among representatives of the major weevil groups (Marvaldi 1997, Marvaldi & Morrone 2000, for a review see Lanteri 1999). The search for morphological characters and complementary molecular markers that resolve relationships at each taxonomic level and among subgroups that may vary in speciation rate is difficult, because it involves trying to strike a balance between too little and too much variation. Too little variation will provide no signal, no information about the relationships, while too much variation can obscure the actual evolutionary relationships in the form of homoplasy. While decades of morphological studies in insects have explored many different character systems, we are still at the beginning of comparable characterizations of the various genes available across weevil genomes. When the question we want to address involves recovering relationships among congeners or closely related groups of species, sequences from mitochondrial genes such as the two subunits of the cytochrome oxidase gene (COI and COII) are usually suitable and commonly used molecular markers (Langor & Sperling 1995, 1997, Normark 1996, Emerson *et al.* 2000, Sequeira *et al.* 2000a, Jordal *et al.* 2002). Mitochondrial sequences are also useful for population level analysis such as the phylogeographic studies being undertaken to elucidate the geographical origin of infesting populations of the cotton boll weevil *Anthonomus grandis* (Lanteri 2001). Other more slowly evolving nuclear genes such as elongation factor 1-á (EF1-á) and enolase have proved to be suitable for elucidating relationships between weevil genera, either alone or in combination with mitochondrial genes (Normark *et al.* 1999, Sequeira *et al.* 2000b, Farrell *et al.* 2001, Sequeira & Farrell 2001). Subunits of ribosomal genes, either nuclear or mitochondrial, provide a wide array of variation, making them suitable for analysis at different levels: from the rapidly evolving 12s and 16s (Jordal *et al.* 2000, 2002) to the more and even highly conserved 28s and 18s. Moreover, the large ribosomal subunit (28s) presents strikingly different patterns in its expansion segments or regions: the D2 expansion segment is significantly more variable than its contiguous D3 which is extremely conserved. There is a wide array of approaches that a researcher has to consider to deal with the fundamental issue of alignment when analyzing ribosomal sequences (alignment with secondary structure, elision, culling, direct optimization, etc.).

The addition of both 28s regions to a dataset containing EF1-á and 18s helped resolve relationships between bark beetle tribes (Farrell *et al.* 2001, Sequeira *et al.* 2000b). To assess the relative contribution of each of the gene regions to the overall support we can evaluate congruence of independent analyses or calculate partitioned Bremer support. The independent analysis in the case of the combined 28s, 18s and EF1-á dataset showed that the nuclear ribosomal 28s region resolved mainly intergeneric and intertribal relationships but not those at lower levels; protein coding EF1-á provided better resolution mainly at lower levels (within genera); 18s alone did not resolve intertribal relationships but provided support for groupings provided by other genes (see letters for each gene region used in Fig. 1 in Sequeira *et al.* 2000b). Further investigation of the relative utility of each gene partition in a study using three protein coding genes (COI, EF1-á, and enolase) was done by plotting the partitioned Bremer support against the age estimated by an appropriate method for that node (Sequeira & Farrell 2001, Fig. 2D). The results indicated that COI nucleotides (almost entirely 3rd codon positions) provided support close to the tips of the tree but not at higher levels. However, the amino acid sequences for this rapidly evolving mitochondrial gene proved to be useful to resolve the deeper nodes of this phylogeny of basal bark beetles (Sequeira & Farrell 2001, Fig. 2D and Fig. 3). Placing this results in a time scale, and according to our divergence estimations, both nuclear genes, EF1-á, and enolase-ni, provide greater support for Oligocene-Miocene divergences and lose their informativeness approaching the Paleocene, whereas COI amino acids contribute resolution closer to the Cretaceous/Paleocene border and even well within the Late Cretaceous. Given the explanatory power of different gene regions at different taxonomic levels, studies at the suprageneric level can benefit from a combined approach where the simultaneous analysis of combined data can allow emergence of hidden phylogenetic signal (Olmstead & Sweere 1994).

When trying to elucidate the relationships between weevil families a combined morphological and 18s dataset has provided well supported and consistent results (Farrell 1998, Marvaldi *et al.* 2002). However, the authors note there is a striking lack of resolution and/or support at medium level nodes (within Curculionidae) when analyzing 18s alone. The authors suggest that this could perhaps be due to the curculionid clade having undergone an explosive radiation, that further resolution of their phylogenetic relationships will require a much more extensive sampling of characters (more genes and new

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On Weevil DNA Studies (continued)

morphological data) and taxa (Marvaldi *et al.* 2002), and thus remains a challenge to weevil researchers.

Only one of the mentioned gene regions has been exclusively developed for weevil studies (enolase developed by Farrell *et al.* 2001; this gene has not yet been used in other insect groups) - most of them are widely used and considered standard markers for insects (Caterino *et al.* 2000). For example, given the increasing availability of 18s sequences and the satisfactory results in the estimation of higher level phylogenies in several insect groups, Caterino *et al.* (2000) encourage concentrating efforts on these gene regions. Following their advice for ribosomal and other of the "standard" regions could prove useful by enabling future cooperative efforts in compiling large datasets.

Whichever gene regions we choose to use in our phylogenetic study, the limiting factor remains the availability of specimens preserved in ways suitable for DNA extraction and amplification. In the best cases, DNA extraction can be nondestructive for specimens when using available protocols that involve just soaking the specimen in an extraction buffer leaving it intact for future morphological studies. For freshly collected specimens preserved in ethanol, the usual extraction protocol used in our lab is an adapted version of the "salting out" protocol of Sunnucks & Hales (1996), originally designed and modified (Normark 1999) for aphids. However, for more problematic extractions (e.g. older samples, preserved in 70% ethanol or dried) we have tried (with mixed results) a Geneclean Ancient DNA extraction kit (Bio 101). Amplification requires the target DNA region to be intact, not degraded, and this can be more easily achieved in smaller dried specimens or in specimens of any size that have been frozen or preserved in 95-100% ethanol. Even though DNA has been successfully amplified from dried museum specimens, this usually involves amplifying several shorter fragments (Ducket & Swigonova 2000). The most practical and efficient preservation method for straightforward DNA amplification of larger fragments is in 95-100% ethanol. When preparing large series of specimens (from your latest collecting expedition to inhospitable areas of the planet) it would be of great use for ongoing and future weevil molecular systematics projects to keep some of the material in ethanol!

Amplification is not only dependent on the quality of the template DNA but also on the design of suitable primers (there are plenty of available primers for weevils, published or available from authors), and on the nature of the target gene. Ribosomal (18s, 28s) or mitochondrial (COI and II, CytB, 12s, 16s) genes are present in multiple copies which makes successful amplification easier, but amplification of single copy nuclear genes such as EF1-á can be somewhat more difficult and more dependent on the freshness of the material. For single copy genes, our lab has found that a successful strategy is using "touchdown" PCR programs and increasing the amount of template (see Normark *et al.* 1999 and Sequeira *et al.* 2000 for details).

The clarification of weevil subfamilial relationships is still ahead and our most efficient tool to successfully tackle this challenge will be the combination of exhaustive morphological and molecular data. The results discussed in this note are the product of fruitful collaborations with A. E. Marvaldi (Cricyt, Mendoza, Argentina) and B. B. Normark (University of Massachussetts, Amherst).

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On Weevil DNA Studies (end)

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Research Activities and Requests for Specimens

Fatih Bulut (Turkey: biofatih@hotmail.com). Currently a masters student at the Biology Department of the Gazi University in Turkey. Interested in the systematics and distribution of Curculionidae (and Anthribidae) of the Palearctic region.

Roberto Caldara (Italy: r.caldara@tin.it). Continuing to study Mecinini: the revision of *Rhinumiarus* has already been published and that of the Afrotropical species of *Gymnetron* is in press. Planning to revise *Cionus* in collaboration with Friedhelm Bahr and to the study the DNA in Mecinini in collaboration with an English geneticist.

Steven Chown (South Africa: slchown@sun.ac.za). Continuing to work on the weevils and other arthropods of the Southern Ocean islands. In the process of writing up the field expedition to Heard Island in the 2000/01 Austral summer with the Australian Antarctic Division. Confirmed the presence of four species previously recorded by Kuschel, and found another - *Palirhoeus eatoni* - expanding its range to include all the Kerguelen Province Islands. Showed that altitudinal variation in size differs between species on Heard and Marion Islands, and confirmed the dietary and habitat preferences of the species found on Heard Island. Also showed distinct variation in thermal tolerances of species from the two islands. Some of this work has been published, and the remainder is in press or has been submitted. For more information visit www.sun.ac.za/zoology/space.

Anthony Cognato (USA: a-cognato@tamu.edu). As a new assistant professor at Texas A&M University, developing a research program in bark beetle systematics and evolution. The current focus is a phylogenetic revision of the Ipini genera and the molecular systematics of *Conophthorus*. More information about research philosophy and student interests can be found at http://hisl.tamu.edu. **Interested in obtaining live Ipini (*Ips, Ortho-tomicus, Pityogenes, Pityokteines*) from Europe and Asia. Will provide US import permits and pay shipping costs. In return, will provide similar or dead bark beetle specimens from the US.**

Hiroaki Kojima (Japan: kojima@museum.kyushu-u.ac.jp). Heavily involved in administrative work such as assisting the planning of a future move of Kyushu University to a new campus. Making an effort to have research time. Interested in the evolution of the rostrum in weevils in collaborative research with Dr. Morimoto. A molecular approach to illuminate the phylogeny of weevils will be started and initially based on Japanese materials. Taxonomic studies now conducted include the Oriental eugnomine *Adorytomus* species associated with plant family Ericaceae in Japan, and the Tychiini and Cyphicerini of Japan.

Vladimir Karasjov (Belarus: karasjov@mail.bn.by). Working on the taxonomy of Palearctic Tychiinae (*Sibinia, Tychius*) and Smicronychini of the Old World (Palearctic, Afrotropical, Oriental regions, and Australia). Participating in the Fauna Europea Project (Catalogue of the Smicronychini) and the Palaearctic

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Research Activities (continued)

Catalogue of Coleoptera (Smicronychini). **Interested in receiving any Smicronychini material from the Old World (especially from China, the Oriental region, Africa, and Australia) for loan, determination, and exchange. Is able to offer any Curculionidae material from former USSR (Caucasus, Central Asian and European parts, Crimea, Siberia, and Russian Far East). Looking for a position as an entomologist in any country of Western Europe, the US, Canada, or Australia.**

Lawrence Kirkendall (Norway: lawrence.kirkendall@zoo.uib.no). Current research groups consists of LK, one postdoc (David Rees: DR), one doctoral fellow (Paul Berg: PB), and three masters students. Research can be divided into two broad categories: biodiversity (including taxonomy and systematics) of scolytines and platypodines, and phylogeography of selected scolytines. In the past few years incorporated a variety of molecular techniques in this research: DNA sequencing (COI, EF-1á), RFLP, ALFP, and microsatellites. Associated with the ALAS tropical arthropod biodiversity inventory in Costa Rica, and recently presented the first analyses of data for bark beetles and timber borers (ca. 250 spp.) at the Association for Tropical Biology meetings in Panama (August 2002). Also in Costa Rica, begun research on the population genetics and phylogeography of two different clades of sib-mating inbreeders, *Coccotrypes* (LK, PB) and *Araptus* (LK, DR), and continued work with the community of specialist and generalist scolytines in the woody fallen leafstalks of *Cecropia*, *Pourouma*, *Cespedesia*, and *Ochroma*. The other geographical focus is Macaronesia, especially the Canary Islands and Madeira, working on the behavior, ecology and evolution of both inbreeding (PB, *Coccotrypes*) and outbreeding (LK, *Dactylotrypes*) scolytines breeding in palm seeds. Finally, this year begun working with the taxonomy of the southern pine beetle complex in Mesoamerica. Sequencing mtDNA has revealed that the population killing pine trees in Belize is probably an undescribed species related most closely to *Dendroctonus frontalis*. Preliminary biological studies by Karl Thunes and morphological analyses both point to the same conclusion. Seeking financial support to follow up on this work. **Always interested in receiving *Coccotrypes* from new locations, especially the species in palm seeds.** Specimens currently assigned to the small species known as *Coccotrypes carpophagus* probably comprise a complex of species. **Also keen to see specimens of *Araptus*.** The inbreeding *Araptus* are tiny (1.2 - 1.6 mm), slender, shiny (almost glabrous), brown to black scolytines (i.e. cylindrical beetles with elbowed, clubbed antennae) breeding primarily in fallen leafstalks, pods, and possibly seeds, and can be relatively common in Winkler and Berlese samples. The overall distributions for Central and South America of these species are very poorly known. Well preserved specimens of other species of *Araptus* can be used for phylogenetic analysis of this genus. **Also interested in receiving bark beetles collected from *Cecropia* or other woody leafstalks, as part of ongoing ecological and phylogenetic/biogeographic research. Finally, needing recently collected small pine *Dendroctonus* (southern pine beetle complex) from Arizona and Central America. Please contact LK for potential exchange of samples of any of these species.**

Analia Lanteri (Argentina: alanteri@museo.fcnym.unlp.edu.ar). Working on the phylogeography of *Galapaganus* (Entiminae, Naupactini) and of populations of *Anthonomus grandis* (Curculioninae, Anthonomini) in South America. Revising the genera *Briarius* and *Teratopactus* (Entiminae, Naupactini).

Andrei Legalov (Russia: legalov@ngs.ru). Continuing studies on the leaf-rolling weevils (Rhynchitidae, Attelabidae) of the world fauna. Interested in the phylogeny, systematics, and taxonomy of Curculionoidea (particularly Rhynchitidae and Attelabidae). In the process of proposing a superspecific system for Rhynchitidae and Attelabidae, now based on about 100 new species of leaf-rolling weevils mainly from Southeast Asia. Updating the classification of families Curculionoidea, and interested in cooperating with other experts. **Requesting material of Rhynchitidae and Attelabidae for study, and able to assist with the determination of the leaf-rolling weevils world fauna.**

Antonio Machado (Spain: antonio.machado@telefonica.net). Revising the genus *Laparocerus* (Curculionidae, Entiminae, Laparocerini) which is restricted to the Canary Islands, Madeira, the Azores and Morocco. **Requesting material of this genus (*Laparocerus*).**

Massimo Meregalli (Italy: meregalli@dba.unito.it). Revised the Arabian species of genus *Ocladius*. Presently working on some genera of Cleonini and revising the genus *Niphadonyx*. Plans for the near future include a complete revision of genus *Ocladius*. Interested in Himalayan Molytinae.

José Ricardo Mermudes (Brazil: mermudes@bio.ufpr.br). **Requesting specimens of the genera *Hypselotropis* and *Tribotropis* (Coleoptera: Anthribidae, Anthribinae, Ptychoderini).**

Serban Proches (South Africa: btbmsp@upe.ac.za). Interested in weevil diversity of four vegetation types in the winter rainfall region of southern Africa (fynbos, subtropical thicket, karoo, and grassland), and in niche separation, species diversity and host specificity in weevils in general.

Germano Rosado-Neto (Brazil: ghrosado@bio.ufpr.br). Interested in the taxonomy, biology and distribution of the Neotropical weevils, especially of the tribe Sternechini (Molytinae). A revision of this tribe is almost ready for submission for publication. Currently compiling the description of two new species of *Oxycorynus* (Oxycoryninae), and supervising a graduate student on the subject of the biology, life-cycle, host plant associations, and ecological aspects of *Anthonomus partiarius* (Anthonominae). Planning to continue to revise all genera of Sterne-

(continued page 8)

Research Activities (end)

chini.

Andrea Sequeira (Harvard University: asequeira@oeb.harvard.edu). Currently looking at the evolution of host associations and biogeographical patterns of Cossoninae, using molecular characters for estimating their phylogeny. Continuing interest in other *Araucaria* feeding weevils and now starting a project in collaboration with Adriana Marvaldi and Brian Farrell, using a combined morphological and molecular approach to look at host associations in Nemonychidae.

Gregory Setliff (Papua New Guinea: gregsetliff@yahoo.com). Working with Steven Lingafelter (NMNH, USA) for almost a year focusing on the Curculionidae collection. Has been offered a 12 month position as project manager of Scott Miller's (*et al.*) beta diversity project in Papua New Guinea. Also associated with the University of Minnesota to study weevils in Papua New Guinea for thesis work, with a number of possible projects now in rough outline.

Fabio Talamelli (Italy: talamellif@libero.it). Interested in Palearctic Curculionoidea, and the Lixinae of the world.

Hiraku Yoshitake (Japan: hiraku@agr.kyushu-u.ac.jp). Currently a graduate student in the second grade of the masters course in the Entomological Laboratory, Faculty of Agriculture, Kyushu University, Japan. In addition studying the taxonomic, faunistic and biological studies of Oriental Ceutorhynchinae (Curculionidae), greatly interested in the morphological and molecular phylogeny of the subfamily.

This is a Weevil!

By Roger Beaver (Thailand: robeaver@loxinfo.co.th) **and Bjarte Jordal** (United Kingdom: b.jordal@uea.ac.uk)

In 1956, Howard Hinton described to a meeting of the Royal Entomological Society in London, a single specimen, found in a paddy field in Borneo, of an "unknown group" of insects. In general habitus, it resembled a beetle larva of staphylinoid type, with large falciform mandibles and flattened body, a larviform abdomen, but with a well-developed aedeagus, hence undoubtedly an adult. He suggested that it might represent "a new order" between the Megaloptera and Neuroptera. In the discussion that followed, it was suggested that it might be a slow-moving carnivore, perhaps living in termite nests, or even a parasite living "at least partly beneath the scales of reptiles"! However, no conclusion was reached as to its relationships.

In 1959, Frank Browne, then Conservator of Forests in Sarawak, described and figured the male of a species of bark beetle, *Ozopemon brownei* Schedl, terming it "the most remarkable scolytid beetle known to me. Although sexually mature, it has not only the general form of a larva, but of one that is possibly lower in the evolutionary scale than the typical Curculionoid larva from which it has developed". Browne had been working on the taxonomy, biology and control of scolytines in Malaya and Borneo since the 1930s, and was both an expert on the group as well as an experienced field worker. The species of *Ozopemon* are rather large bark beetles (3-6 mm long), confined to the Oriental region, which make extensive gallery systems below the bark of dead or dying trees. Browne described the gallery system, and noted that he had found both sexes together. The larvae were all of curculionid type, but the male and female pupae differed considerably. Only one male (or rarely two) was found in a gallery system, and the males developed faster than the females.

In 1960, Browne sent specimens of the male to Roy Crowson, a world authority on Coleoptera. Crowson also reexamined the

Figure 1. *Ozopemon uniseriatus,* dorsal view of adult male (thorax and head).

specimen described by Hinton, and realized that it was "very similar to, if not identical to" Browne's specimens. In 1974, he redescribed the male, considered that it must be a beetle, but assigned it provisionally to the Histeridae, although with aberrant features. Certain genera of Histeridae are well-known predators of bark beetles, and Crowson presumed that some normal Histerid female would eventually be associated with the strange, wingless males. *Ozopemon* was presumed to be thelytokous. Authority had spoken, and there the matter rested for a number of years. Few doubted Crowson's assignment, and no further specimens were discovered.

It was not until 1992 that more males were found, this time in Brunei by RAB. Several males corresponding to Browne's description were found in gallery systems of *O. brownei*, and

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This is a Weevil! (end)

similar, but distinct, males in galleries of *O. obanus*. However, there was still no conclusive evidence linking males and females. Dissection of the normal-looking beetles, taken both from beneath the bark, and from pitfall traps during dispersal, showed that all were female, and that the spermathecae contained sperm. The sperm had surely come from the strange associated males. Parthenogenesis was virtually ruled out. However, only molecular biological studies could finally resolve the matter. For various reasons, these were delayed, and by the time that they were carried out in 1999 in Brian Farrell's laboratory at Harvard University, DNA could only be extracted from specimens of *O. brownei* (one male and one female from different gallery systems). However, it was sufficient to show that the female and supposed male were conspecific.

In 2000, BHJ, collecting in Papua New Guinea, was able to find both sexes of a further species, *O. uniseriatus*. DNA extracted from specimens from one gallery system provided the final proof. A series of genitalia dissections of several species also revealed an aedeagus typical for males in species closely related to *Ozopemon*. Indeed, Browne had been correct - though, unfortunately, he did not live to see his work vindicated. With hindsight, more careful examination of characters of *Ozopemon* and related genera could have been sufficient to link males and females, but as film director Billy Wilder is reported to have said: 'Hindsight is always twenty-twenty'!

Figure 2. *Ozopemon uniseriatus,* adult siblings.

What is the phylogenetic relationship of *Ozopemon* to other scolytines? Recent molecular work at Harvard University has shown unambiguously that it is the sister-group to all the other haplodiploid, inbreeding scolytines currently included in the tribes Dryocoetini and Xyleborini (over 1400 species). In these scolytines, the male is nearly always smaller than the female, weakly sclerotized, with reduced eyes, and lacking hind wings. Only one male (or a very few) is produced in each brood. The male emerges earlier than his sisters, and mates with them, rarely leaving the gallery in which they developed. There appears to have been only a single origin of sib-mating in the lineage. It is likely that size reduction and wing reduction occurred close to the origin of sib-mating. However, in *Ozopemon,* evolution then took a different path. A larval 10-segmented abdomen was retained - the only known instance of neoteny in the Coleoptera. Eyes were lost completely, as were tarsi and claws. The head evolved large, falcate mandibles quite different from those of other scolytines, and the head and pronotum became enlarged, flattened and strongly sclerotized.

But why should the males of *Ozopemon* be so different from the females, and from the males of other sib-mating species? One of the few who had doubted Crowson's story was W. D. Hamilton. In a wide-ranging discussion of wingless and fighting males published in 1979, he noted that the *Ozopemon* male "looked like a fighter", and that the gallery system could provide "a seraglio situation that would make precocity, winglessness, and fighting advantageous in a male". He also pointed out a parallel with certain fig wasps, in which the male may be adapted for fighting and differ greatly in habitus from the female. We believe that Hamilton was correct, although fighting between males has not yet been observed. But for such enlargement of the head, and change in mandibular shape to evolve, there must have been some positive selective pressure. This might have been the frequent occurrence of encounters by the single male of a brood with other broods. The mature gallery systems of *Ozopemon* are large, and often close together, and the bark around them becomes increasingly loose as the brood matures. Unlike the more cylindrical females, the strongly flattened males must find it relatively easy to move between gallery systems. It is also possible that, if more than one male is produced in a gallery system, fraternal fights will ensue as each male tries to ensure that its sperm are passed on to the next generation. Whether *Ozopemon* males are fighting with unrelated or close kin, are aggressive against insect enemies, or owe their strangeness to some other cause remains to be discovered. As usual much more field work in the tropical rain forests is required - before the forests and their inhabitants are lost for good.

For further details on this research see: Jordal, B.H., *et al.* 2002. Extraordinary sex ratios and the evolution of male neoteny in sib-mating *Ozopemon* beetles. Biological Journal of the Linnean Society 75: 353-360.

Book Review - Australo-Pacific Apionidae

Marec Wanat

By David Kissinger (USA: davidgkissinger@aol.com)

Marek Wanat. 2001. Genera of Australo-Pacific Rhadinocybinae and Myrmacicelinae with Biogeography of the Apionidae (Coleoptera: Curculionoidea) and Phylogeny of the Brentidae (*s. lato*). 432 pp. ISBN 83-914336-1-7, from Mantis, ul. Niepodleglosci 53/55, 10-044 Olsztyn, Poland, Email: mantis@mgt.pl, website: www.mantis.mgt.pl, Cost: $ 65.00 US.

This, the first in a series of publications planned to treat the apionid fauna of the Australo-Pacific region, is an important foundational study with full descriptions of 42 genera or subgenera of Apionidae (32 newly described) representing some 360 mostly undescribed species; 50 species are described as new or redescribed; the systematic review occupies 240 pages. Characters used in keys, descriptions, and in the phylogenetic analyses are explained in a 42 page section and are well illustrated, along with species characteristics, by 844 (mostly) line drawings and scanning electron micrographs. Keys to subfamilies, tribes and genera are provided.

The biogeographic and phylogenetic analyses are supported by a valuable synopsis (20 pages) of the geologic history, physiographic details, floral characteristics, and major climate changes of the study area extending back spatially to Gondwana before its division and temporally to the Cretaceous. The "Biogeography of the Apionidae" is a 25 page section treating the "Origin, early evolution and dispersal of the Apionidae" and the "Biogeography of the Australo-Pacific Apionidae".

Preceding each of the two phylogenetic analyses is an extensive treatment and discussion of the data matrix characters and their polarity. The analyses used Hennig86. The phylogeny of the Brentidae, following Kuschel (1995), was investigated using a matrix of 22 taxa and 70 characters. Using Kuschel's data matrix (with 138 characters), characters irrelevant to the brentid lineage were discarded and those relevant to apionid genera and higher categories were added. The taxa (ranking largely from Alonso-Zarazaga & Lyal 1999) included Caridae (outgroup), Curculionidae (outgroup), *Myrmacicelus* Chevrolat, *Neocyba* Kissinger, Notapionini, Rhadinocybini, *Chilapion* Kissinger, *Rhinorhynchidius* Voss, *Podapion* Riley, *Apiomorphus* Wagner, *Mecolenus* Schoenherr, *Lispotherium* Faust, Cybebini, *Tanaos* Schoenherr, Antlirhininae, Apionitae, Aspidapiitae, Eurhynchidae, Nanophyidae, Brentinae, and Cyladinae. In Kuschel's scheme Brentidae included all of these, except Curculionidae. The tentative result, which differs from any previous classification, is the division of the brentid lineage into four families: Brentidae with Brentinae and Cyladinae; Eurhynchidae; Nanophyidae; and Apionidae with Antliarhininae, Tanainae (stat. nov.) for *Tanaos*, Mecoleninae (nov.) for *Mecolenus* and *Apiomorphus*, Cybebinae (stat. nov.) for *Cybebus* Schoenherr, Myrmacicelinae with Myrmacicelini for *Myrmacicelus* and Lispotheriini (trib. nov.) for *Lispotherium;* Rhadinocybinae (stat. nov.); and Apioninae with supertribes Apionitae, Aspidapiitae, Rhinorhynchidiitae (stat. nov.) for *Rhinorhynchidius*, Chilapiitae (nov.) for *Chilapion*, and Podapiitae (nov.) for *Podapion.* Further, concerning Apionidae as here constituted, "The monophyly of this family has been definitely confirmed". The phylogeny of the Rhadinocybinae was investigated using a character matrix of 43 taxa and 65 characters. The taxa included all the genera of Rhadinocybinae treated here plus the New Zealand Neocyba and *"Apion" terricola* Broun. The analysis supports the division of the subfamily into two tribes, Rhadinocybini Alonso-Zarazaga and Notapionini Zimmerman. Unfortunately, "Obtaining an unambiguous picture of [the] evolution of the Rhadinocybinae using unweighted characters turned out to be unrealistic, and the selection of [the] preferred cladogram must involve a further subjective character evaluation".

One important feature of this book is the focus on the Apionidae while interpreting the complexity of the Brentidae-Apionidae lineages in contrast to most recent phylogenetic studies of Curculionoidea where the highest level apionids are included incidentally. The diversity of opinion regarding the rank of the numerous distinctive entities in the Brentidae-Apionidae lineages is not due solely to the recalcitrance of the various authorities. There is a severe problem in determining the taxonomic rank of numerous morphologically disjunct entities, especially since the rank may (and has) range(d) from subtribe to family. If these lineages indeed date from the Cretaceous and have experienced the rifting and drifting of Gondwana and the resulting potential for serious climate change and adaptive radiation and species bloom and mass extinction, then it is not surprising to find isolated forms with no clear antecedents. The phylogenetic arrangement may be more like a net than a tree particularly if many intermediate steps are missing. At the least these lineages challenge the utility of current phylogenetic procedures, which are not designed to deal with missing data.

This contribution from Dr. Wanat is certainly an important step in the task of describing the large fauna of Australo-Pacific Apionidae and places the taxonomy of the family on a firmer foundation.

Literature Cited: Alonso-Zarazaga, M. A., and C. H. C. Lyal. 1999. A world catalogue of families and genera of Curculionoidea (Insecta: Coleoptera) (Excepting Scolytidae and Platypodidae). Entomopraxis, Barcelona. 315 pp.

The Bulletin Board

News About Weevils

Sharon Collman (USA: collmans@wsu.edu) announces the New Root Weevils List. To everyone with one (or more) of the pieces to the root weevil puzzle (taxonomy, field studies, behavior, genetics, management, control, pesticides, species specific, personal observations, etc.). For some time it has been our intention to try to connect researchers, educators and pest managers working on some aspect of root weevils. This listserver has been set up at Washington State University with the kind help of Tony Wright, list co-owner. Root weevils generally encompass the following genera: *Diaprepes, Dyslobus (Lepesoma), Hylobius, Nemocestes (Geoderces), Otiorhynchus, Panscopus, Sciopithes,* and *Trachyploeus.* However, there are likely genera that we have left out and there may be other interpretations of the category root weevils. Much that needs to be known by many of us involved in research, education or field management of these weevils is known by "someone", and will not likely ever be published in today's journals. A medium that allows us to query and share information (such as new host records, new weevil pests, basic observations) is proposed: the **Root Weevils List.** Being new to the area of research, it seems that it may be likely that some of you will not want to share some of your research directions or information until publication. However, we believe that there is still much information that could be freely shared without compromising "proprietary information". Please feel free to share your comments, thoughts and interests on this concept, and contact Sharon J. Collman at collmans@wsu.edu for details on how to subscribe to the list.

Malcolm Furniss (USA: malfurniss@turbonet.com) informs about the publication of a **Field Guide to the Bark Beetles of Idaho and Adjacent Regions,** by Malcolm M. Furniss and James B. Johnson. 2002. This guide includes 102 species of bark beetles and 12 relatives of different habit, referred to collectively as "scolytids". The information presented here will be of use especially to owners and managers of trees that grow in the forest, around homes or in orchards in Idaho and surrounding areas. Indeed, three quarters or more of these beetle species also occur in Oregon, Washington and Montana. And, all but ten species occur in neighboring British Columbia, Canada.

Included are introductory sections on collecting and rearing bark beetles and the distinguishing features of their biology and natural history. A section on biology covers life history, how beetles communicate and the kinds of galleries that they make in the bark while colonizing trees. A section on their ecology explains their use of attractant pheromones to aggregate on and overcome live host trees and the uses that they make of fungi that they carry into trees in special receptacles on their bodies. The paramount importance of host tree condition and the supportive role of predators and parasites in regulating beetle numbers are also discussed.

To facilitate field identification of these small beetles, this guide utilizes the high degree to which a bark beetle species is restricted as to the species of tree or shrub that it can infest (host specificity), the location in the host (branch, stem, roots), differing gallery patterns (biramous, radiate, etc.) and differences in their biology and behavior. Thus, the small (1-9 mm) beetles themselves may not be needed to determine the species involved. This is especially helpful if the broods are immature or have emerged.

Beetles and galleries appear in 236 photographs and drawings. Each of the 29 genera is characterized in an introduction followed by a simplified key to species of that genus (utilizing host species, gallery pattern and when necessary, distinguishing anatomical features). Following each key is information on each species including distribution, hosts, adult features, gallery, biology and references. A glossary of terms and a host diagnostic index are appended.

The book is available from Ag Communications, University of Idaho, P.O. Box 442240, Moscow, ID 83844-2240. Fax (208) 885-4648, call (208) 885-7982 , e-mail agpubs@uidaho.edu. Cost: $ 19.95 plus $ 3.00 for shipping and handling.

Rolf Oberprieler (Australia: rolf.oberprieler@csiro.au) reports from the **6th International Conference on Cycad Biology.** This latest of the triennial international cycad conferences was held at the Nong Nooch Tropical Garden in Thailand from 27 July to 3 August 2002. It was attended by 78 participants from 14 countries, spanning the whole gamut of cycad enthusiasts from systematic botanists via pollination ecologists and conservationist to horticulturalists. The scientific program comprised 22 papers in 6 sessions (Systematics and Phylogeny; Physiology, Biochemistry and Toxicology; Biogeography and Ecology; Pollination Biology; Conservation; Horticulture). From a weevil point of view, the most interesting and relevant was that on pollination biology, featuring a paper by John Donaldson (Kirstenbosch Botanical Gardens, Cape Town, South Africa) about differential survival of specialist pollinators (weevils) and generalist ones (languriid and boganiid beetles) among species of *Encephalartos*, and about the decrease of weevil diversity on these plants from southern to north-eastern Africa; and a paper by Irene Terry (University of Utah, USA) about differentiation in thermogenesis and volatile compounds in male *Macrozamia* cones in correlation with different pollinators (weevils versus thrips).

In this session RO also contributed a paper, entitled "Evil weevils - the key to cycad survival and diversification?", and exploring the role weevils may have played in the evolution of the extant flora of cycads. From a study of the taxonomic relationships of the seven groups of weevils associated with cycads, and against the framework of overall weevil evolutionary history (their phylogeny and fossil record), RO

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concluded that probably all cycad associations in weevils have evolved as shifts from angiosperms (most often from monocots), that these shifts occurred only during the Tertiary (possibly late Cretaceous in the Antliarhinini), and that particularly the pollinators among these weevils have significantly diversified along with their hosts. Furthermore, from the fossil record of the cycads in the Tertiary it appears that these colonizations by weevils may have coincided with lineage turnover events in the plants in the early and again in the late Tertiary, suggesting that generally only those cycad genera that evolved associations with weevils (pollination in particular) survived to the present.

The Conference also included a meeting of the IUCN Specialist Group on Cycads, a body engaged in drafting a comprehensive action plan for the in situ conservation of cycads, and an informal Cycad Pollination Workshop, which resolved to identify, and promote study of, the major issues hampering our understanding of the pollination systems of these plants. There was also ample opportunity to visit to various parts of the magnificent Nong Nooch Tropical Garden and enjoy the mind-boggling collection of cycads (especially in the cycad nursery), palms, heliconias, orchids and bromeliads. A visit to a wild population of Cycas (which yielded several weevils and other beetles) preceded the actual congress, and a more extensive tour to Vietnam and several poorly known cycad populations followed it.

Proceedings of the full papers of the conference will be published in due course, and the next conference, in 2005, will be held in Mexico. For those interested in the evolutionary aspects of cycads and their insects, an overview was recently published: Schneider, D., M. Wink, F. Sporer, and P. Lounibos. 2002. Cycads: their evolution, toxins, herbivores and insect pollinators. Naturwissenschaften 89: 281-294.

Peter Sprick (Germany: psprickcol@t-online.de) informs that the **8th contribution of the Weewil News** has now been posted on the Internet. It includes a compilation of information on the dispersal of *Rhopalapion longirostre* in Central Europe (WWW URL: http://www.curci.de/inhalt.html). This conspicuous species can be recorded easily in the field by its habitus and host-plant relationship. We propose to cooperate with us to document its further spreading.

Recent Publications on Curculionoidea

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Alonso-Zarazaga, M. A. 1998. The genus *Podapion* Riley, 1883 in the Old World: a new species and biogeographical implications (Coleoptera, Apionidae, Apioninae). Museo Regionale di Scienze Naturali, Torino: 133-143.

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Anderson, R. S. 1998. Nomenclatural changes in New World Curculionidae (Curculioninae [Cryptorhynchini, Molytini], Cossoninae). Coleopterists Bulletin 52: 285-290.

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Anderson, R. S., and J. S. Ashe. 2000. Leaf litter inhabiting beetles as surrogates for establishing priorities for conservation in selected tropical montane cloud forests in Honduras, Central America (Coleoptera; Staphylinidae, Curculionidae). Biodiversity and Conservation 9: 617-653.

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Anstett M. C. 1999. An experimental study of the interaction between the dwarf palm (*Chamaerops humilis*) and its floral visitor *Derelomus chamaeropsis* throughout the life cycle of the weevil. Acta Oecologica 20: 551-558.

Barratt, B. I. P., A. A. Evans, C. M. Ferguson, M. R. McNeill, M.R., and P. Addison. 2000. Phenology of native weevils (Coleoptera: Curculionidae) in New Zealand pastures and parasitism by the introduced braconid, *Microctonus*

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Recent Publications (continued)

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This Just In

4th International Workshop on Otiorhynchinae and Related Root Weevils

The 4th International Workshop on Otiorhynchinae and Related Root Weevils will be held in **Wageningen, The Netherlands, on May 11-14, 2003** on behalf of the Applied Plant Research (PPO) and the Plant Research International (PRI). The Workshop is a continuation of the 3rd Vine Weevil Workshop (which focused on *Otiorhynchus sulcatus*, see photo to the right), held in France in 1999. The language is English, and the topics include: pest management, biological/chemical control, IPM, natural products, registration issues, semiochemicals; genetics and behavioral ecology; bionomics and taxonomy; and modelling and forecasting. Oral presentations and poster presentation will be scheduled. For further details and registration forms see the following website: www.ppo.dlo.nl/weevil.