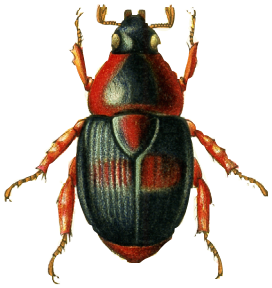

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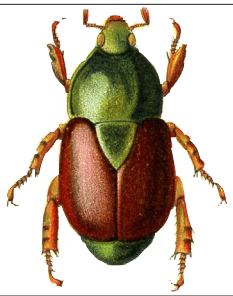

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WITHIN THIS ISSUE

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Facultative Male Trimorphism

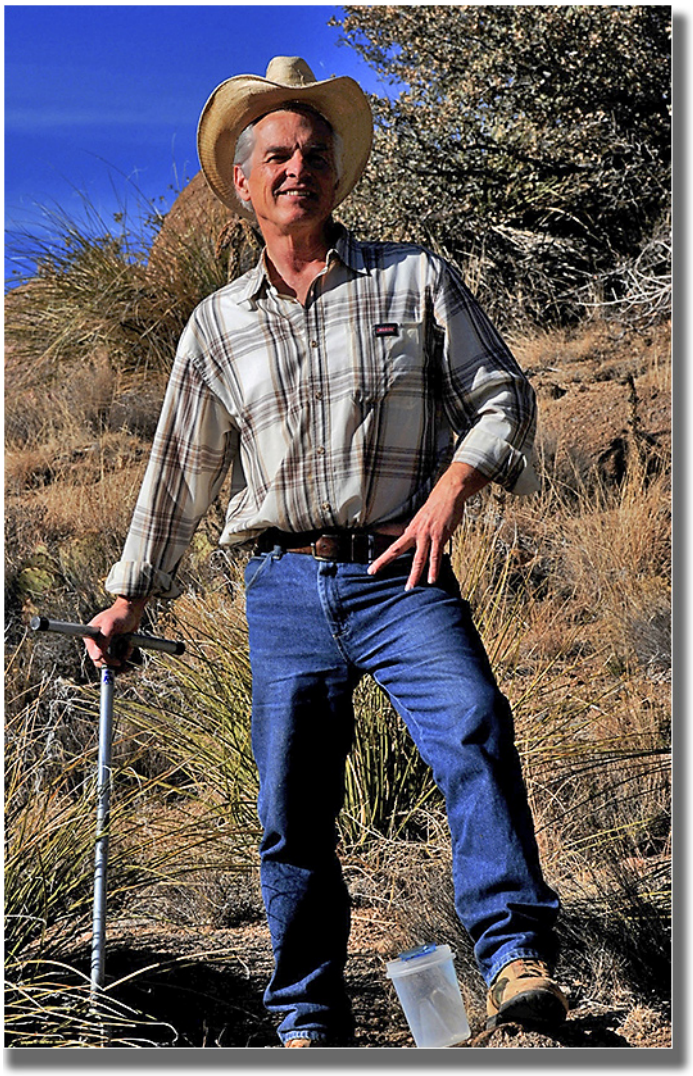
by Barney D. Streit

I received a call the other day that I want to share with newsletter readers because it involves interesting new research on scarab beetles, but also involves increasingly critical issues concerning our own activities as scarab workers. Mark Rowland at the University of New Mexico called because he had heard that I traveled broadly and collected dung beetles intensively.

Mark and Doug Emlen (University of Montana) had just published an article in *Science* magazine revealing the exciting discovery of male trimorphism in several families of beetles including scarabs. The main part of their paper concerned trimorphism in phanaeine dung beetles. We are all familiar with "major" and "minor" males in horned beetles, but their study discovered that in several species of phanaeines the males express three distinctly different male phenotypes: A large-horned "alpha" male, a small-horned "beta" male and a hornless, female-like, "gamma" male. See the photo of *Oxysternon conspicillatum*, another trimorphic species, on the next page.

One of these species is broadly distributed in the United States: *Phanaeus triangularis*. In fact they first discovered trimorphism in samples of this species from Texas.

They are still keen to obtain collections of a few other critical species of phanaeines in order to determine more about the evolutionary behavior of this extraordinary mating system. Highest priority is *Phanaeus adonis*, a close relative of *P. triangularis*. Mark had called specifically to ask if I had any ideas about who might have occasion to work in the part of México in which *P. adonis* is common. They need large (hopefully 40 males or more), unbiased collections in order to determine male morph expression. Representation of all sizes of the males are important - from the very smallest to the very largest (they also look at sex ratio). The full range of sizes of males is necessary to determine the horn allometry – which provides the basis for discriminating the three



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email: rowland@unm.edu
web page: http://biology.unm.edu/Rowland/JMRowlandCV.html

***Oxysternon conspicillatum*. Clockwise from upper right: female; gamma male; beta male, alpha male. Photo courtesy of Mark Rowland and Doug Emlen.**

alternative male phenotypes. Analyses are non-destructive and collections can be returned intact. Alcohol collections are best. If publishable results are obtained from such collections then coauthorship can be arranged. The foregoing speaks to the second reason that I bring this to your attention: Mark and Doug cobbled their important study together from population-based collections borrowed almost entirely from other scarab workers, principally members of ScarabNet (see *Scarabs* #23) - a group known largely by their collective work in compiling an online Scarabaeinae database of taxonomic and bibliographic information (http://216.73.243.70/scarabnet/) as well as numerous collaborative projects on

Frontal view of *Oxysternon conspicillatum* alpha male. Photo courtesy of Mark Rowland and Doug Emlen.

the population ecology and conservation biology of this group.

For further reading, here are papers from Doug and Mark. Check their web pages (listed under their photos) for PDF versions of their papers.

Emlen, D. J. 2008 The evolution of animal weapons. *Annual Review of Ecology, Systematics and Evolution.* 39: 387-413.

Emlen, D. J., Corley Lavine, L., and Ewen-Campen, B. 2007 On the origin and evolutionary diversification of beetle horns. *Proceedings of the National Academy of Sciences* 104 supplement 1: 8661-8668.

Rowland, J. M. and Emlen, D. J. 2009. Two thresholds, three male forms result in facultative male trimorphism in beetles. *Science* 323:773-776.

Rowland, J. M. 2006a. Continued revision of the systematics of rhinoceros beetles of the genus *Xylotrupes* Scarabaeidae, Coleoptera). Privately published. Albuquerque. 49 p.

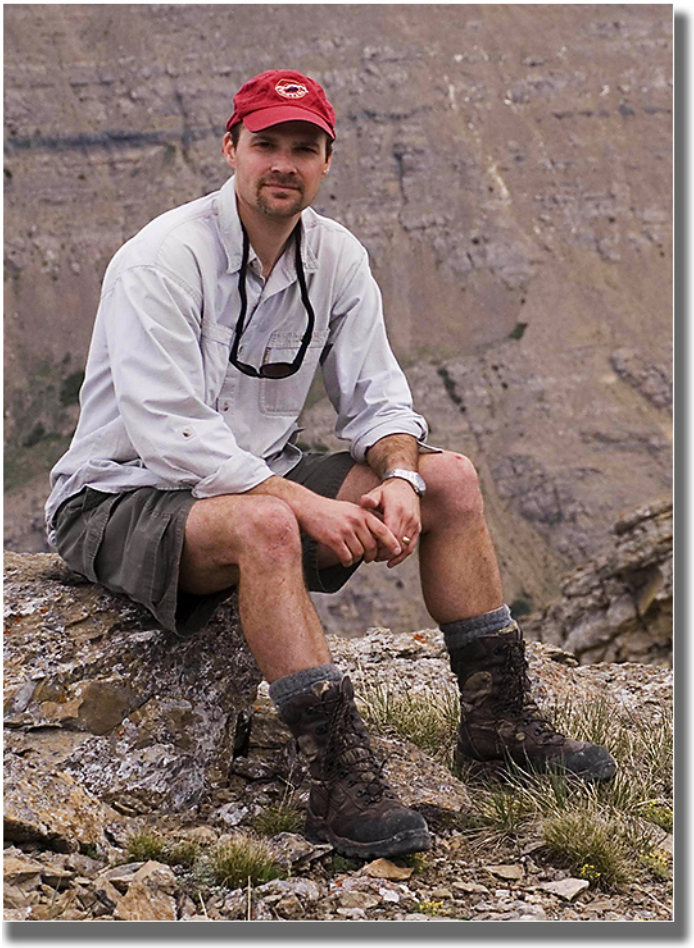
Rowland, J. M. 2006b. Partial revision of the systematics of rhinoceros beetles of the genus *Xylotrupes* (Scarabaeidae, Coleoptera). Privately published. Albuquerque. 41 p.

Rowland, J. M, and Qualls, C. R. 2005. Likelihood models for discriminating alternate phenotypes in morphologically dimorphic species. *Evolutionary Ecology Research* 7:421-434.

Rowland, J. M., Qualls, C. R., Beaudoin-Ollivier, L. 2005. Discrimination of alternative male phenotypes in *Scapanes australis* (Boisduval). *Australian Journal of Entomology* 44:22-28.

Rowland, J. M. 2003. Male horn dimorphism, phylogeny and systematics of rhinoceros beetles of the genus *Xylotrupes* (Scarabaeidae, Coleoptera). *Australian Journal of Zoology* 51:213-258.

Simmons, L. W. and Emlen, D. J. 2008 No fecundity cost of female secondary sexual trait expression in the horned beetle *Onthophagus sagittarius. Journal of Evolutionary Biology* 21: 1227-1235. (with Cover)



Doug Emlen of the University of Montana.
email: doug.emlen@mso.umt.edu
web page: http://dbs.umt.edu/research%5Flabs/emlenlab/

Simmons, L. W., Emlen, D. J., and Tomkins, J. 2007 Sperm competition games between sneaks and guards: A comparative analysis using dimorphic male beetles. *Evolution* 61: 2684-2692. (with Cover).

ScarabNet member Toby Gardner, whom I had the pleasure of meeting at the 2007 ScarabNet meeting in Portal, Arizona, introduced the work of Doug and Mark to the ScarabNet community. Toby's comments are worth repeating.

Kindly turn the page... ☞

A Note to ScarabNet

by Toby Gardner, NERC Fellow

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I wrote an introduction to Mark and Doug's paper to the ScarabNet list which contains a message that we all might consider that concerns the uses that can be made of our ardent and often extraordinary efforts in collecting scarab beetles - and further reinforces that making well-documented, and large collections can provide big payoffs down the road in ways that may not be readily foreseen.

Here is my note to ScarabNet:

I would like to draw your attention to a paper published in today's *Science* by Mark Rowland and Douglas Emlen on facultative male trimorphism in beetles.

I am struck by this paper on two accounts. First, from an intellectual perspective it tells a fascinating story of the evolution and phenotypic manifestation of trimorphism in beetles (and other groups), and the implications of this for our understanding of animal mating systems. The authors make comparisons to other groups and suggest that phenotypic trimorphism translates into distinct male reproductive tactics, including a dominant (fight/guard) tactic, a subordinate (sneak) tactic, and a female-mimicry tactic. The stuff of Darwin indeed!

The second reason that this paper struck me is that it is a wonderful example of how we (the scientific community) can derive more value from hard-earned and expensive field collections. Their analyses used specimens provided from various ScarabNet members who have collected throughout the neotropics. I personally feel that this is exactly the kind of interdisciplinary exchange of data and findings that we should be doing everything to encourage. Collecting beetles (or anything else) from remote parts of the world is a time-consuming and costly exercise. However, most of us are only interested in a relatively narrow set of questions (whether ecological, evolutionary or taxonomic in nature) and I think this paper demonstrates very well how we can get more "value for money" from our samples and accelerate our understanding of our study species. Far too much in science we somewhat preciously "hang

on" to our data in the vain and usually naive hope that we will eventually squeeze every last drop and interesting nugget from them. Rarely is this possible – few of us have the necessary time, interest and expertise. However, in addition to these practical limitations I believe that such a laid-back and passive approach to making the most of our specimen data is difficult to justify in a time when so many natural systems are becoming critically threatened in the face of human population and development pressure. In short, our opportunities to learn about the world are becoming increasingly limited and diminishing – we need to make the most of what little is available to us. I believe that achieving this requires a more active approach to communicating research opportunities between interested parties. In today's Internet-dominated world, where it is increasingly simple to contact colleagues who live and work in distant places, it has never been easier to take better stock of new opportunities to enhance coordination and collaboration amongst research projects – and do a more effective job of chipping away at the sometimes bewilderingly complex challenge of understanding nature. I think the synthesis paper by Mark and Douglas is a great example of this. Well done guys!

This is all that is left of the author after six months of field work.

In Past Years - XXV - 1982

by Henry F. Howden

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Before continuing with the second half of my sabbatical, I digress again to mention one incident of my continuing battle with bureaucracy. In 1980-81 I wanted to publish a paper on the dung beetles of Panama and for this I was asked to submit camera-ready copy done on an IBM Executive Typewriter which had proportional spacing. I had grant funds to cover this, so found a second hand machine for sale in Ottawa and put in a purchase order which had to be done through Carleton University. After several weeks, I asked the Purchasing office why I had not received my typewriter. I was told I wasn't authorized to have an "Executive" typewriter, these were limited to just the President's office. I went from the Department Head, to the Dean and finally wound up in the President's office. I explained the situation and asked if he would have the manuscript typed in his office. Finally permission was received to purchase the typewriter, but not without strings. I could have my secretary type the paper on the machine, but only when it was needed for that type of manuscript, I had to keep the typewriter at home. All this caused a delay of at least three months in getting the project finished! Isn't bureaucracy grand?

Photo 1: The Museum in Buenos Aires; closed during January when schools and many other institutions were closed. It seems odd to close when many people were free to visit!

The second half of my sabbatical started with a trip to Argentina, leaving Ottawa on January 9th, 1982. This time, even without Bruce Gill, the travel didn't go smoothly. As usual Anne and I couldn't fly directly to the U.S., but went through Montreal before going to New York. We left our house at 9 AM and arrived in New York eleven hours later. We just caught our plane, stopped briefly in Río de Janeiro at 7 AM, and finally arrived at Buenos Aires about noon on the 10th. At some point between New York and Buenos Aires, Anne's $2,000 worth of travelers checks vanished. On the positive side, we were met by António and Juana Martinez and driven to their home in San Isidro, a suburb of Buenos Aires. They then introduced us to an Argentine meal. A large plate covered with an inch thick steak was brought out. Anne and I thought it was for all four of

us until three more identical plates appeared! We tried to explain that we couldn't eat that much, but it took about a week to convince them that we were not used to eating so much meat. When we did go to a restaurant it was the same way! We never suffered from a lack of protein on that trip.

We spent six days in Buenos Aires, some of the time working at the museum (Photo 1) which housed the Carlos Bruch collection and some of the H. C. Burmeister material; in his later years Burmeister had been the director of the museum. We found January was a poor time to visit, as everyone was on holiday and the museum was closed; if we had not been with António we would not have gotten in! A half day was spent getting our American Express travelers checks replaced; fortunately we had all necessary receipts, so the checks were replaced within three days. At that time inflation was extreme, so dollars were converted into pesos only on the day you were going to buy something. Some time was spent looking at António's extensive collection, which contained not only scarabs, but buprestids, cerambycids and many other beetle families as well as Reduviidae and some Diptera. Several afternoons and evenings were spent collecting near António's house; nothing particularly rare was taken, but it was all new to us, and street lights yielded *Cyclocephala*, *Bothynus*, *Diloboderus* and several aphodiines.

At that time, inflation was horrible, but many people, including António, didn't seem too worried about it. I found out that the way to lessen the impact was to immediately take your paycheck, which was adjusted to the value of the peso the day before, to the bank. At the bank you then were able to convert it to many other currencies - U.S. dollars, British

Photo 2: Downtown Buenos Aires near the Plaza de Mayo.

pounds, or almost any common fund. The banks paid interest on the currency at the rate of the country chosen, less bank charges, of course. When you needed to buy something you withdrew what you guessed you might need in dollars, pounds, etc., that was in your account and then went to an exchange (cambio) store that seemed to be on every third block in Buenos Aires, got the best

Photo 3: Farm road near Suipacha; António liked to walk!

offer for your currency by visiting several stores, converted that into pesos and bought what you needed. It was a crazy system, but seemed to be effective, in general. Buenos Aires (Photo 2) had many well-dressed people and busy stores. It made Ottawa, in comparison, seem like a poor backwater. I still had trouble with my Spanish when told that something cost 140,000 pesos (perhaps $10).

Photo 4: "Farm" house of António's relative; the only thing lacking was an indoor swimming pool.

At the beginning of our second week we left Buenos Aires to visit a well-to-do relative of António who had a country farm near Suipacha about an hour and a half drive from António's home. The drive was through flat, rich looking farm land with very dark soil. To reach the farm we had to turn off the paved road onto a muddy, rutted path, and despite my request to drive, António, who was a poor driver on anything but a straight, paved road, kept driving and promptly got stuck (Photo 3). A tractor later pulled our vehicle, a pick-up-truck, out of the ditch while we walked to the farm "house". The house (Photo 4) was more like a mansion with 12 bedrooms! We were made welcome, shown our very comfortable room, informed of the dinner time and that there would be six other guests. Anne and I then collected for the remainder of the afternoon and into the early evening when it was time to dress for dinner. The dinner table could accommodate about 20 people and there were perhaps 18 of us, some as young as 14. Dinner was great and when we were finishing off desert I asked a question that had bothered me - What is a Peronista?". It turned out that everyone had a different idea, liberal, conservative, socialistic, etc., on the subject and I learned that they were really passionate about their politics; I thought that I had almost started a riot and didn't mention politics for the rest of the trip.

The next morning we left at 6:30 AM and drove steadily, stopping only for gas and meals, until we reached António's relative's lodge

18 km south of the small town of Arizona at the northern edge of the pampas. The lodge (Photo 5) was definitely more primitive than the farm "house", adequate, but lacking electricity. Water was supplied by a windmill that pumped water to a tank on the roof. The second day I forgot to turn off the connection to the tank and had water all over the roof and around the house - almost like Australia except that it was cold water. Cooking was on a wood stove; we did as little as possible since it was hot enough without the stove. Collecting was great. The habitat (Photo 6) was long grass with bare areas and scattered acacias or some similar thorny tree. Dung traps yielded about eight genera of dung beetles, including the odd *Anomiopsoides* Blackwelder.

We ran our black light off of the car battery at the side of the house, the side having a smooth white wall, no windows and a small overhang. The first night we collected four genera of dynastines including several species of *Cyclocephala*, a number of cerambycids and other beetles. The next night we were rained out, but the following night, which was hot and humid, we were so swamped with insects that by 10 PM we gave up, sprayed the sheet and adjacent wall with Raid, folded the sheet, which had a covering of insects several inches deep, and went to bed. The following day was spent with both of us going through the mass, picking out the beetles: *Ochodaeus*, *Glaresis*, *Cyclocephala*, *Bothynus*, *Archophileurus*, *Leucothyreus*, *Onthophagus*, and five or six other genera of scarabs as well as a great number of weevils and other beetles. If all of the insects had been mounted, they would have kept a team of entomologists busy for a long time. It was painful to throw out the residue! We spent a week there, but never had another night to equal that one.

Photo 5: António's relative's lodge south of the small town of Arizona at the edge of the pampas.

Photo 6: Habitat near the lodge; a great place to collect.

Photo 7: A tame local parrot - the species responsible for the large communal nests that caused many problems when built on phone poles.

Not only was there a great diversity of insects, the birds were also numerous and diverse, many with crests. Many small birds took advantage of the insects left over from the previous night's black light and sat around the next day too full to do much else. There were also parrots (Photo 7) that built a large communal nest consisting of thorny twigs, old bones and anything else they could handle. I often wondered if the nests (Photo 8) were as thorny inside as out. Apparently the telephones were often affected by the large nests on phone poles causing shorts when it rained. We had few problems with ticks or similar pests, but did worry about the numerous reduviids, many including the nymphs, which according to António, carry Chagas disease. The adults were often fairly numerous at our lights. Before we left the local care-taker and António decided that we should have a party including some of the locals. A goat was killed, skinned and after dark a fire was started in an open area. About 11 PM some of the outer cooked parts were passed around and chewed at some length before swallowing. We were told that the good parts would come later, but around midnight Anne and I gave up and went to bed. We didn't get much sleep as the party lasted for at least three more hours. The next day we picked up traps and packed. Two days were spent traveling northward, one night being spent in Cordova. Frequent showers prevented serious collecting, but António was also eager to reach Salta.

Photo 8: One of the large nests of the local parrot housing three families.

The third day on our way to Salta we drove over a rather narrow secondary road. When we started over a small mountain ridge it became obvious that António was not used to winding mountain roads. He drove at about ten miles per hour hugging the inside of the road regardless of the lane. I first tried to tell him to stay in our lane,

but when he seemed unable to do so I asked for Anne and me to be let out. He finally allowed me to drive, but sat with his eyes closed for most of the time and later told me that I went too fast. By the time we were over the ridge, it was time to stop for the night. The only lodging was at a place called La Viña; it had separate small cement buildings (Photo 9) in very poor shape. It was the first and only time we saw António concerned about a place to stay. He had us spray our room with insecticide and told us not to drink the water (in most places we stayed in Argentina the water was safe to drink). The evening was hot and humid, a few insects came to our black light, but hordes of toads took care of most of them. The next day we drove on to Salta and to our destination - Rosario de Lerma.

At Rosario, António and four other entomologists had established a new Institute, INESALT (Instituto de Investigaciones Entomologicas Salta), funded by a one-time grant that allowed them to buy an empty hostel and renovate it (Photo 10). António and several other entomologists either had or were in the process of buying houses near the institute. António had Juana come to Rosario while we were there to approve of the house he had selected. He said it was far less expensive to live there and he would be much closer to both his job (investigation into Chagas disease) and good collecting. Anne and I were housed in the Institute which shared a wall with

Photo 9: Our lodging at La Viña; inside they looked as if they hadn't been cleaned for a year.

a music hall that was very noisy on weekends. We then found out, the pick-up that we had been driving was owned in the name of the Institute and was needed to transport building material and visit the city of Salta for various reasons. All five of the entomologists involved planned to donate their collections to the Institute and had a collection started by giving some specimens that they considered surplus. Anne and I had been told that our

Photo 10: The newly renovated building housing INESALT at Rosario de Lerma.

Photo 11: Area just outside of town near INESALT; the snow on a nearby range was an indication that it occasionally was cool while we were there.

collecting time might be limited at Rosario, but we had not realized that it meant that the truck was only available when no one else wanted it! Meal hours also were a problem, dinner started at 9 PM and, since we were not allowed to drive the truck by ourselves, we initially did not get out of the city to black light. We gradually worked things out.

Fortunately the Institute was at the edge of town, so on many days

Photo 12: Forest near Rosario were we had one of our "picnics" in the evening.

Anne and I simply walked out, collecting on the rows of bushes and trees that marked the farmers' fields (Photo 11). There was also a small river with a fairly wide, bushy flood plain that turned out to be very productive. While our Spanish was never grammatical nor very good, we gradually picked up a fair understanding and realized that we were often the subjects of arguments - what to do with us! On several occasions, expeditions were organized to take us black lighting, but this was never simple, since it included the dinner time. Some good forest scrub land was only a few miles away and Anne and I thought that we might be taken out for several hours, returning for a late dinner. Not so. Chairs, a table, cooking equipment, food and the inevitable wine were all loaded on the truck and we, along with a following car with all of the other entomologists, headed for the woods (Photo 12). By the time we were "set up" it was dark. We did collect some different scarabs, but most of the time was spent eating and shortly thereafter taking down the dining equipment. Everyone was then ready to go, so we were "encouraged" to leave, which we did shortly after 10 PM.

The weekends were better. The truck was not needed then, so on Saturday we went first to the river near Rosario and in the afternoon and early evening António took us to a dam site called Cabra Corral. There we collected, mainly on *Acacia*, until dark and then ran our black light until 9:30

when we left to have a late (for us) dinner. Sunday another expedition was planned, this time to a small patch of wet forest (Yungas?) in a mountain range north of Salta city. Before everything was organized it was noon and we got to our collecting site, El Ucumar, about 3 PM. It was in a steep valley, so most of our collecting was along or near the road.

Anne noticed a strange flower up on the forested hillside, so with some effort she climbed up, only to find that the "flower" was artificial. We decided that the flower marked the site of an accident, but being so far from the road was puzzling, had someone come to grief on the hillside? We had our usual elaborate "lunch", table cloth, cooler, wine, etc. (Photo 13), and shortly thereafter it was dark. Before dark we set out several dung and carrion traps and at dusk our black light, We did not get many insects at light, but those we took were interesting, *Neoathyreus*, *Astaena*, and *Leucothyreus* to name some. We left about 9:30 for the two-hour drive back to the Institute. The river near Rosario was called the Río de Lerma and we collected there on several occasions, the site yielding at least six genera of dung beetles along with numerous weevils, buprestids and cerambycids.

On a trip into Salta we noticed an agricultural institute (I.N.T.A.) and investigated. The grounds were only partly in crops, a large part was still in thorn scrub and there were no objections to our collecting there. So dung traps and a flight interception trap were set. On another trip to Salta we found a large hill called Cerro San Bernardo that had natural vegetation from the base to the top. A road ran up to the top with an overlook that was very popular with the locals. We found scarabs plentiful as there was "bait" left in the bushes and Anne collected many weevils on the various shrubs. We stopped on the Cerro whenever the truck had to go to Salta. On other days we found that one of the

Photo 13: Members of the excursion to El Ucumar; more time was spent eating than collecting.

entomologists, Padre Williner, was willing to go collecting with us and drive the truck. Often he took us out to a nearby locality about 4 PM; we would light trap until about 9 PM, then return to the Institute for dinner. One trip was noteworthy. On February 12 the Padre drove us on an all day trip to an area that had good rains about 15 km south of Cabra Corral, locally called Arroyo Viñaco. We first collected along the side of the paved road where it bordered the thorn scrub. There were many pigs in the area and their droppings attracted a

Photo 14: Tropical forest at Yuto, Prov. of Jujuy; good collecting, but hot!

number of dung beetles, including our first *Deltochilum*. Toward evening we explored several dirt roads setting up our light at the open gate in a heavily vegetated area. Good beetles were coming in, including *Neoathyreus*, when suddenly a group of men appeared carrying a number of various weapons including machetes, an old shotgun and even two men armed with bows and arrows. Fortunately the Padre convinced them that we were harmless but they still wanted us to move, so we picked up our light and headed back to the Institute. On a number of other nights it rained in the evening, ending the collecting.

Photo 15: António picking up his trap during the morning rain just before leaving Yuto; there was no roof over his trap!

The weekend before we were due to leave, António arranged for us to visit a patch of rain forest (Photo 14) on the grounds of an experiment station in the province of Jujuy near Yuto. The one small house was vacant on the weekend and we had the use of its facilities. We arrived in the early afternoon and I can only say that it was as hot as we had been on the entire trip. I set out a carrion and several dung traps and found it so hot that I came inside. Just before dark, I checked traps and found a large snail at the carrion trap. This snail was placed on the covered porch of our lodging and when it started to crawl several small beetles were found clinging to its foot! These turned out to be *Zonocopris* which are known to occur only on these snails. We collected 10 of these and divided them up, five going to António. That night António selected the inside room, which had a small air-conditioner. At first we were jealous of the air conditioned room, but that night there was a terrific thunder and lightning storm and the power went off. Fortunately, our room had two windows, so it wasn't too hot but poor António cooked. The

next day we picked up our traps (Photo 15) and headed back to Rosario. On the way we stopped at El Ucumar to empty our traps. Unfortunately we were not able to do much collecting as we got rained out.

The night after our return from Yuto, we all went out for dinner and during the meal there was another argument, this time about the funding for the Institute. Again they did not seem to realize that we understood more Spanish than we spoke. It turned out that there was no regular source of income and it left us wondering how long the Institute would last (it hasn't). The day before we were due to start back to Buenos Aires there was a hard rain; Padre Williner told us he had lots of papered duplicate Coleoptera, so we spent the day "indoor collecting". We actually did better than if we had spent the day collecting locally!

When we left Rosario we drove to Tucuman where we stopped at the university to see their collection and visit with Dr. Willink. Only an hour or so was spent as Jan Krikken had most of their material that I was interested in on loan. We left Tucuman about 11:30 and drove steadily to Termas de Río Honda (Photo 16). We collected near the town from four to 10 PM. The area was dry but very productive, yielding at least 10 genera of scarabs including one new *Neoathyreus* (Photo 17). The next day we drove with numerous short stops in scrub (Photo 18) and sandy country to Capilla Del

Photo 16: Río Dulce near town of Río Honda, Prov. Santiago del Estero, area nearby moderately dry.

Photo 17: *Neoathyreus lepidus* Howden collected near Río Honda at light.

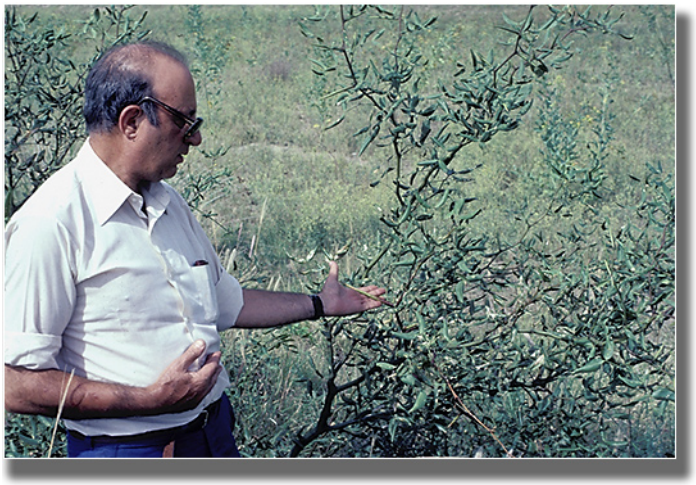

Photo 18: António looking at six inch *Prosopis* thorn near Loreto; the thorns cause problems for tires!

Photo 19: The Plaza de Mayo in front of the presidential palace; dynastids in the lawn were a surprise.

Photo 20: Male *Diloboderus abderus* collected at the Plaza in downtown Buenos Aires; the species was there in moderate numbers.

Monte. We spent the next day in the area staying with a friend of António. The evening was cool and mostly cerambycids came to our light. The insects that came most commonly to light were reduviids, which were worrisome because most could carry Chagas, and we were told that perhaps 70% of the locals had the disease. Later that night there was some rain. The following night we set up our black light in a thorn scrub area near Cruz del Eje. The rains had vastly improved the collecting and we took a number of dynastids including a few *Megasoma joergenseni* Bruch. Even António got excited about some of the beetles that we collected that night. We stayed in the area one more night, then drove to Córdoba and the following day arrived in Buenos Aires. We spent three days in Buenos Aires mostly doing errands in El Centro (Photo 19). The main item of note was finding the dynastine *Diloboderus abderus* (Photo 20) in numbers on the grass of the Plaza de Mayo in front of the presidential palace. Since there seemed to be no other food, I again assumed that the larvae fed on the grass clippings provided by the adults. There were no other entomological surprises, so we flew back to Ottawa on February 26, arriving the next day in Ottawa at 3 PM. It was a great trip.

A Very Simple and Effective Trap for Necrophagous Scarabaeinae

by Conrad P.D.T. Gillett* and Michael P.T. Gillett

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Almost certainly every collector of necrophagous scarab beetles has at one time or another had major difficulties with baited pitfall traps of the standard plastic cup/tub variety. Setting a perfectly placed series of such traps in the most promising and unspoiled localities often involves spending considerable time, effort and resources. All too often, on returning to the traps after long treks in inhospitably hot and humid forest, it is found that far from containing that long sought after *Coprophanaeus*, they are in fact bereft of beetles and indeed bereft of bait! Barney Streit discussed this exasperating issue back in *Scarabs* 17 when he also illustrated and explained the use of a wire mesh cover held down with metal stakes, as used by Patrick Arnaud, who we suspect knows a thing or two about collecting these creatures! It is recommended that even these traps be further protected using large rocks or pieces of wood.

As described by Barney previously, the great nemesis of the *Coprophanaeus* (we do sometimes wish that Olsoufieff had coined the seemingly more logical name *Necrophanaeus* back in '24!) collector is the local carnivorous vertebrate fauna ranging from rats to armadillos, to dogs and free range hogs, not to mention black and turkey vultures and even large cats! We do not joke, as recently in the Pichincha province of Ecuador, one of us (CG) laid out his extensive cordon bleu series of pungent, rotting, prawn-baited traps (complete with wire-mesh-staked covers) intent on capturing *Coprophanaeus edmondsi* Arnaud, only to find the following morning, the traps ripped from the earth and strewn along the muddy

Figure 1: A muddy path bearing the paw-print of either a jaguar (*Panthera onca*) or most likely a puma (*Puma concolor*), the guilty party in denying CG the capture of *Coprophanaeus edmondsi* Arnaud. Tropical Andes, July 2008.

Figure 2. Above: the preferred rectangular, flattened 500 ml bottle of cachaça used as a potent trap for necrophagous scarab beetles. Below: schematic cross-section diagram showing the deployment of the bottle along a small incline on the ground and the hapless beetles attracted to its pungent lure.

trail - surrounded by many puma or jaguar tracks which were not present the previous evening (Figure 1)! What possible hope does the humble collector of these filthy yet delightful beetles have against such fierce native competition? It is no exaggeration to say that CG only barely kept his sanity after this utter disappointment, knowing that he had only that single night to seize the longed-for beetle!

This experience, and similar ones elsewhere in South America, where semi-wild pigs can be the greatest nuisance (not even the heaviest stone placed over a trap being the slightest obstacle for the gluttonous beasts in the experience of MG), led to the research and development of a novel solution to the perennial bait-theft problem. Literally many minutes were spent conjuring the contraption and here we present the resultant alternative simple trap design which may be useful in many situations, and whilst not perfect, has been field-tested and proven in the Neotropics.

The trap represents a compromise: it is less likely to be completely destroyed by animals but equally, it is less likely to yield a large number of specimens (although in our experience it can be extremely successful). In fact the trap is nothing other than a plastic drinks bottle, into which is pushed the putrid bait directly through the mouth. An easily available and very effective bait is chicken. Any part of the chicken can be cut up

***Coprophanaeus cyanescens* (Olsoufieff) male (top) and female (bottom) from an Atlantic forest remnant.**

into small pieces and left to decay for a day or so - it is only important that the pieces are small enough to be pushed easily into the bottle. Alternative baits can also be used of course (fish, prawns, liver, red meat etc) - the only prerequisite being that it reeks of putrefaction!

The bottle and its contents is then either buried into the ground so the rim of the opening is flush with the soil, or it can be simply placed on a slope, ensuring again that the rim of the bottle is in contact with the ground (Figure 2). Stones, pieces of wood or other debris can be placed over the bottle to make it more secure against disturbance, but in our experience this is not absolutely vital. Because the opening into the bottle is rather narrow (though usually large enough for anything but *Megaphanaeus*), the beetles can get in, but cannot get out. Even if the bottle is attacked by an animal during the night, and may be moved from its initial position, the contents of the bottle are rarely disturbed (evidently most animals give up after the frustration of not being able to gain immediate access to the vulgar mass of festering contents). We have found bottles that have been moved many metres from the original location, and which have been inverted, to still contain many necrophagous scarabs.

Other advantages to these traps include the fact that it is easy to prepare them in large numbers at home before a collecting trip and to carry them around in a backpack with tops screwed on ready for deployment, thereby eliminating the putrefying stench. Once in the field the traps are simply removed from the backpack, the tops are unscrewed and they are placed in the desired position in a matter of seconds. This also makes them rather discrete if one is placing traps in an area frequented by non-enlightened passers-by, as long as a little effort is spent in concealing them in the undergrowth or in the soil - for instance we have had good results at busy roadsides. This can be important in some situations on the outskirts of towns where risk of assault/robbery can be high i.e. it is too risky to prepare elaborate traps. Upon returning to check the traps, one can simply screw the caps back on and take them home for examination, again somewhat protected from the malodorous whiff. The traps are most effectively emptied (outdoors in the garden / yard) by a quick flick of the wrist, which usually expels both malignant bait and beetles. Because the beetles are still usually alive, if a

Figure 3. And from rotting flesh are born jewels! *Coprophanaeus cyanescens* (Olsoufieff) (left) and *C. dardanus* (MacLeay) (right) attracted to carrion-baited bottle traps. Atlantic forest, April 2008.

***Coprophanaeus* habitat: caatinga and Atlantic Forest.**

little torpid, they are not damaged by this action. The bottles can then be washed (again outdoors!) to reduce the fetid stink and may be re-used many times over. We have found through experience that the best bottles are the small 500 ml bottles of cachaça (sugar cane rum, Figure 2) which are dorso-ventrally flattened as opposed to being tubular, such that they are even easier to place along a gentle slope, though any plastic bottle will suffice. The original contents of these bottles can be enjoyed the evening prior to trap deployment with fresh lime or passion fruit juice and plenty of ice along with the requisite tales of scarab collecting in distant and exotic lands!

We have been able to collect as many as 9 *Coprophanaeus* in a single bottle trap together with many other species in various genera including *Canthon*, *Pseudocanthon*, *Dichotomius* and especially *Deltochilum*. The traps have been shown to be effective in all manner of habitats ranging from caatinga (*Coprophanaeus pertyi* (Olsoufieff)) to cerrado (*C. acrisius* (MacLeay)), Atlantic forest (*C. cyanescens* (Olsoufieff) and *C. dardanus* (MacLeay)-Figure 3) and Amazonian rainforest (*C. jasius* (Olivier), *C. parvulus* (Olsoufieff) and *C. telamon* (Erichson)). Possibly the biggest drawback to these traps is the aforementioned problem with collecting the fantastically bulky *Megaphanaeus*. If one is anywhere East of the Andes there is often a chance of any one of either *M. lancifer* (Linnaeus), *M. ensifer* (Germar) or *M. bonariensis* (Gory). The simple solution to enable the capture of these fantastic insects is to cut around the neck of the bottle to increase the diameter of the opening accordingly, allowing them access to the grimness within. By doing so you will lose the ability to screw the cap back on, but this is a minor issue when such impressive species are to be had.

***Coprophanaeus dardanus* (MacLeay).**

We hope that readers will try out the traps for themselves and we will be interested to hear of any successes (or failures!). Needless to say positive results in the Neotropics should be reported directly to Dave Edmonds (see *Scarabs* #17, page 6) for his continuing work on *Coprophanaeus*.

We finish with this rather appropriate quotation coined by the famous evolutionary biologist W.D. Hamilton, who obviously also had an appreciation for those great flesh-eating beetles of the tropics.

"I will leave a sum in my last will for my body to be carried to Brazil and to these forests. It will be laid out in a manner secure against the possums and the vultures just as we make our chickens secure; and this great *Coprophanaeus* beetle will bury me. They will enter, will bury, will live on my flesh; and in the shape of their children and mine, I will escape death. No worm for me nor sordid fly, I will buzz in the dusk like a huge bumble bee. I will be many, buzz even as a swarm of motorbikes, be borne, body by flying body out into the Brazilian wilderness beneath the stars, lofted under those beautiful and un-fused elytra which we will all hold over our backs. So finally I too will shine like a violet ground beetle under a stone."
W.D. Hamilton

Above and below: bottle traps in place.

***Coprophanaeus (Megaphanaeus) lancifer* collected in bottle traps, Suriname, June, 2009.**

European Cetonids and Their Diversity of Colours

by Olivier Décobert

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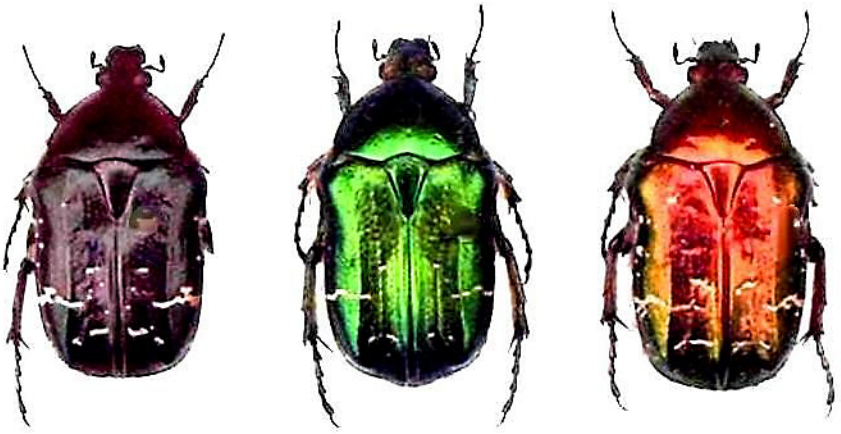
In *Scarabs* #35, I showed the chromatic variability for the genus *Protaetia* in Europa. All the species of cetonids which have a "metallic" aspect have the same potential for color diversity. Nevertheless, there are exceptions like *Protaetia mirifica* (Mulsant) which is always violet (see *Scarabs* #35 and also *Scarabs* #36 for the interesting article by Conrad Gillett about this species and many others in Ardèche, South of France).

Cetonia aurata (Linné) (below) is certainly one of the most common Cetoniidae in France and elsewhere in many parts of Europa. Habitually, this scarab is green (below, middle). Red forms are sometimes observed (right). Melanistic forms (left) are rather rare. I found this specimen in the region of Corrèze (South-West of France). The two others are from the North of France.



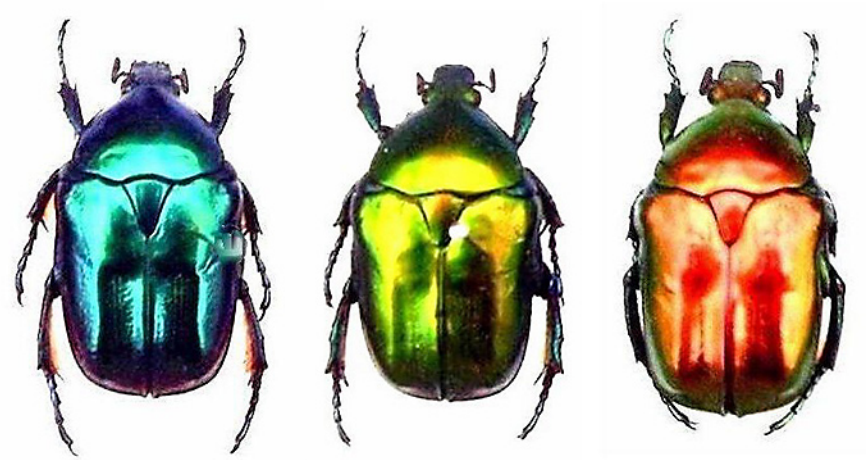
***Cetonia aurata* (Linné)**

Larva of *Cetonia aurata* (Linné)

I recently (April 2009) found a larva at Wallers, in the North of France, not far from my home, in a decaying willow. It was not the first time I had collected larvae of this species, but this time I took advantage of this opportunity to record some images using the technique I described in *Scarabs* #38. I reared this larva in the same rotten wood, and obtained the pupal shell in June.

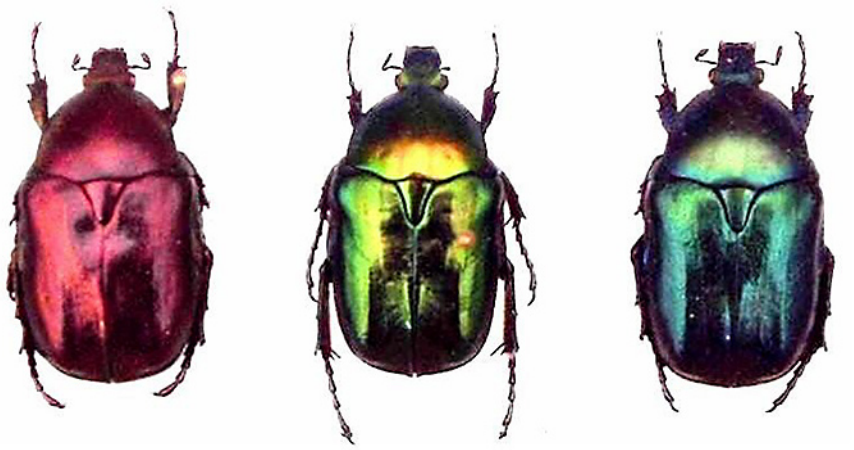
Pupal shell and pupa of *Cetonia aurata* (Linné)

Protaetia affinis (Andersch) is a closely-related species to *Protaetia aeruginosa* (see *Scarabs* #35 and #36), but smaller. It is a common scarab in the South of France and Europa. The colour is often green (below, middle – region of Ardèche) and rarely red (below, right – Velebit Mountains of Croatia). This last specimen was obtained by exchanging beetles with an Italian entomologist who breeds this species.



***Protaetia affinis* (Andersch)**

The blue *Protaetia affinis* (above, left) was found in Corsica which is an island part of France, in the South. In this region, it is the subspecies *tyrrenica* (Miksic), which is often so colored.



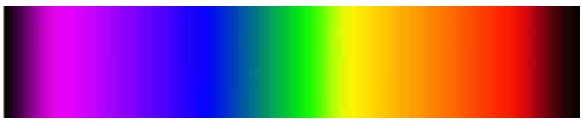
***Protaetia angustata* (Germar)**

Protaetia angustata (Germar) is figured above. This scarab is also variable in chromatism. It lives in Oriental Europa. I never found that species and obtained these insects from the same Italian colleague. I once thought that *Protaetia angustata* was always green but I now know that it presents the same variability of other "metallic" colored cetonids.

The global explanation for chromatic diversity of these scarabs is the same for other beetles which have a structural color. The structure of the exocuticle contains layers of chitin (it is called a multilayer) which physically provokes light interferences, selecting the radiation going out of the cuticle and associated with a color (see *Scarabs* #35).

A slight increase in the thickness of layer causes a shift in the reflected light towards the red end of the white light spectrum. Thinner layers would result in a shift towards blue (see *Scarabs* #26 with the interesting article by David Hawks about *Chrysina*). I have read (see bibliography) that only five layers within cuticle are sufficient to work as an interference reflector.

"Metallic" scarabs are a pleasure for our eyes, and are also an invitation to try to understand how these incredible and various colors can exist.



White light spectrum (all the colored radiations) – ultraviolet on the left and infrared on the right are invisible radiations. If the thickness of layers is sufficiently low or high to cause a shift to ultraviolet or infrared, the cuticle appears black (melanism) as in the first image of *C. aurata*.

Bibliography: HARIYAMA T. *et al.* - The origin of the iridescent colors in coleopteran elytron (2002) – *Forma* 17: 123-132