



# SCARABAEUS



THE IRREGULAR NEWSLETTER FOR ALL THINGS SCARAB

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## Editorial:

A message to our readers



## Presenting the Editors

*Proctophanes caldwelensis*, NSW (J.F.Maté)



## Beating sheet DIY

Auke shares his experiences designing an economical and sturdy beating sheet for use in the tropics.



## Observations on *Golofa porteri*.

Stéphane and René share their observations on the male combat and mating of this species in Venezuela.



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Mario relates his search for Harold's *Ateuchus* types.

## Editorial: A message to our readers

Dear reader and fellow scarab enthusiast,

Seeing this newsletter, you may wonder who made it and what its purpose is. Those are valid questions and we will try to answer them here. To do this, we will start with a bit of history.

Back in 1980, a newsletter with the name of "Scarabaeus" was started by A. R. Hardy, D. C. Carlson and W. D. Edmonds. This newsletter contained information on collecting methods, addresses, observations, notices on literature, meetings etc., all related to (researchers of) the Scarabaeoidea. Its last and 18<sup>th</sup> issue was published in April 1990.

In December 1990 another newsletter, named "Scarabs," was started by Rich Cunningham and Barney Streit. It was intended as a private project between some scarab-collecting friends and contained some inside humor. At the time it was not known that the "Scarabaeus" newsletter would cease to exist, but in the following years, Scarabs would incorporate several of the features of Scarabaeus while retaining its own sense of humor. After the publication of its 14<sup>th</sup> issue in October 1998, a long pause happened until in November 2004 Scarabs number 15 appeared as a full-color online newsletter, whereas the previous issues were black-and-white and physically mailed to its subscribers. Many more issues followed until the 86<sup>th</sup> issue in February 2018. In July of that year, a controversy arose in which the editors were accused of sexism due to the regular appearance in "Scarabs" of glamour photos of women, a majority of which were wearing tight-fitting T-shirts with the logo of the newsletter. The women in question were friends of the editors, one of which who was next to scarabs also interested in fashion photography. Although these photos may have appealed to a part of the audience, their presence had little relevance to the actual subject of the newsletter and was offensive to others. Because of this, both the Coleopterists Society and the University of Nebraska had to apologize and stop hosting the newsletter on their servers. The editors then also decided to permanently stop with "Scarabs" as they considered its relevance diminished anyway due to the increased use of emails and webpages.

We, the editors of the present newsletter, and at least some other scarab workers, consider it still relevant to have a publication dedicated to the subject. We recognize that the dissemination of information goes much faster now thanks to emails, chats, weblogs and other forms of social media. We nevertheless consider it useful to have a more stable and formal medium for relevant information, such as how to rear specimens, construct collecting equipment and photograph living or pinned specimens. Especially when referring to something in a scientific publication, it is important that the source is unchangeable. An article in a newsletter in pdf-format is therefore, by its nature, preferable over something as ephemeral as a text on a website. As the name of this new newsletter, we have opted to revive the name "Scarabaeus."

Before the inception of the present newsletter, we and two other scarab workers intended to make yet another newsletter. Unfortunately, we had a fall-out during the early stages of its set-up. At its root, that discussion hinged on the sidelining of us by the other co-editors and their one-sided changing of the focus of the newsletter from the original ideas. Because of this disagreement, we had to conclude that if we wanted our vision to come to fruition it was better to part ways. It is our desire that this publication be a fun, informative read of all things scarab. Whoever you are and whatever you do, if you have any news, stories or trivia relating to the superfamily Scarabaeoidea, we want to encourage you to submit them for publication. We want to have a respected but lighthearted newsletter to bring the world's scarab workers together, and we believe that "Scarabaeus" can be that newsletter.

To ensure those objectives, we have created a set of guidelines which we will adhere to. These guiding principles are the following:

- The content of "Scarabaeus" will be everything related to Scarabaeoidea except for nomenclatural and taxonomical acts;
- All issues of "Scarabaeus" are assigned an ISSN number. Copies of them will be printed and sent to the Library of Congress of the U.S.A. to be archived;
- "Scarabaeus" is published as an online and open-access newsletter in pdf-format with a unique serial number for each issue.
- "Scarabaeus" is inclusive to all people interested in Scarabaeoidea and will not contain rude, discriminatory or offensive language.



## Issue 1: July 2020

- “Scarabaeus” articles are written primarily in the English language. Articles in other languages are acceptable when accompanied by a full English translation.

- “Scarabaeus” will be well-edited and full color.

- “Scarabaeus” will be published irregularly depending on the availability of content, but no more than once a month and no less than once a year.

As you can understand, a newsletter needs content. With a worldwide community of presumably several hundred (more or less active) scarab workers, we are sure that there are many stories, techniques and notes to be shared between us. Please don't be shy, and send your stories for inclusion in future issues of this newsletter to [editors@scarabaeusnewsletter.org](mailto:editors@scarabaeusnewsletter.org) or to the private email address of one of the editors. Possible subjects include:

- Field adventures
- Book reviews
- Interesting websites
- Stories on visited collections (private as well as institutional)
- Stories / reports on meetings, seminars, ...
- Designs for collecting and curating equipment
- Techniques for collecting and curating
- Stories about / biographies of past collectors
- In Memoriams
- Notes on ecology, behavior, distribution, etc.
- Scarab jokes and cartoons (please mind copyright on the latter)
- Photography techniques
- Various announcements
- Miscellaneous (coins and stamps with scarabs, use of scarabs as food / toys / jewelry / religious objects,...)

All submissions will be judged solely on their merit, quality and general interest, and not on who submits them. Nevertheless, we would especially like to encourage colleagues from demographic groups which are traditionally underrepresented in entomology to submit relevant content. If you feel uncertain about the quality of your English, please

remember that we are willing to help you with that. If you want to do more than submit content, please let us know!

As an addition to this new “Scarabaeus” newsletter, which can also be downloaded from <http://scarabaeusnewsletter.org>, we have created a moderated Facebook group: <https://www.facebook.com/scarabaeus.newsletter/>. We intend to use this group to share forthcoming newsletter editions as well as a place for readers to ask questions, start discussions regarding published articles, fielding specimen requests for research etc.

We feel the present times call for some additional lines from us. By now, most of you will, to some degree, have been affected by the COVID-19 pandemic. We cannot help but to think that much of the spread of this disease could have been prevented if the warnings of scientists would have been taken more seriously. The devastating results of the disregard of science have been swift this time and are still spinning further out of control. In other branches of science, including scarabaeoideology, we have also seen stark and ominous signs of the effects of mankind on nature and our environment. Even though in our branch the results of people's (in)actions may not play out as direct as with COVID-19, they may prove to be even more consequential in the long run. It is therefore our sincere hope that if anything good comes from the present pandemic, it will be a greater respect of policy makers and the wider public for the findings and recommendations of the actual experts and scientists. Science and research should not be the victims of political games, but instead they should be treated for what they are: the tools we need to discover and comprehend our surroundings, improve our lives and to reverse or at least mitigate the severe damage we have already caused to this planet and its biosphere.

Having said this, we still hope you will be able to enjoy this newsletter. It may even help a little to temporarily divert your mind from the sobering things playing out around us.

We thus wish you happy reading!

The editors

## Introducing the editors

Dear readers, we would like to take the opportunity to introduce ourselves as the initial editorial team of the “Scarabaeus” newsletter. At the moment, your newsletter has three editors which are introduced here (in alphabetical order):

### Steven Barney

I am a lifelong beetle enthusiast; my primary focus has always been species within the Scarabaeoidea superfamily. I am the proprietor of The Beetle Experience where I organize events and give presentations featuring live invertebrates. This project began in 2003 as an informative website about the beetle hobby and slowly evolved to where it is today. I have recently been able to add giant, exotic beetles to the list of available insects. I am also the owner of Beetle Source which sells beetle jelly and rearing supplies, mainly to zoos and institutions in the U.S.A. In 2014 I conceptualized and curated the Crawl Space Entomology Exhibit at the Lafayette Science Museum. It was started with local beetles, other insects, myriapods and arachnids and now houses tarantulas, giant centipedes and exotic roaches. In 2012 I coauthored the book, *The Complete Guide to Rearing the Rainbow Scarab and Other Dung Beetles* with my friend Orin McMonigle.

I am the creator and organizer of the recurring events Bugstock and Insect Day. Bugstock is mainly a private event that has taken place since 2007 on 130 acres near central Louisiana. It was featured in the Animal Planet show Bug Eating Man with David Gracer in 2008. Insect Day is a public event that brings together entomologists and insect enthusiasts from around Louisiana and neighboring states. Last year saw our 9<sup>th</sup> event and we drew over 1,000 visitors.

### Auke Hielkema

Growing up as the son of an avid Dutch scarab collector, I learned to collect beetles from an early age. Several years after graduating as an engineer in tropical forestry, I ended up in Suriname (northern South America) where I have been living for 15 years now.

As a general naturalist, I am now mainly focusing on photographing and studying all the macroscopic biodiversity of Suriname. When not in the field looking for insects to catch or to photograph, I try to earn a living by working as a tour guide, nature consultant, biodiversity researcher, author and text editor.

Although I have no private collection, I still collect insects for my father and some other researchers. Over the years I have developed some of my own collecting equipment, and I recently published the solutions to a variety of nomenclatural problems regarding Neotropical Scarabaeoidea. Together with my father I also just published a checklist of the Scarabaeoidea of the Guianas. As a contributor to this newsletter I am looking forward to sharing some of my experiences with you, and as an editor I hope you will be sharing some of your stories too.

### Jason Maté

I have been an avid amateur entomologist for as long as I can remember and settled into Coleoptera early on. After finishing my PhD degree in 2003 (“Radiation and Diversification of *Aphodius* Dung Beetles”) I went into industry but always kept a toe in entomology, publishing small articles as work and family commitments allowed. Although my main interest is in Aphodiinae, I have an ongoing interest in other groups, including non-scarab taxa like Ptiliidae and Lathridiidae (nobody is perfect).

I am mainly interested in employing new techniques that I have picked up through my job (imaging, automation, remote sensors and dataloggers) towards the phylogenetics and ecology of Aphodiinae of the Old World and Oceania. I am currently working on several revisions, including a revision of the genus *Ataenius* of the Ethiopian region and of the subgenus *Liothorax* in the Palearctic. Although I have never contributed to newsletters before, I strongly believe in the unifying effect a newsletter can have in our community and I would like to encourage everybody to contribute their stories and ideas relating to any topic scarab.

## A design for a cheap and robust beating sheet

by

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Some years ago, after reading several issues of *Scarabs* with stories mentioning the use of beating sheets/trays for collecting scarabs, I was inspired to try this collecting method for myself. The prospect of easily collecting masses of *Ceratocanthinae* and other scarabs which are hard to lure was quite tempting. For financial reasons, I decided to make a beating sheet myself. I still haven't been very lucky using it as an actual beating sheet, but I did find some interesting species using it in another manner (as I will elaborate upon in a future article). As my design has proven to be quite durable under the tropical conditions of Suriname – a beautiful country on the northern coast of South America – I thought it a good idea to share the design here.

You can buy beating sheets in specialized (online) stores or use one of the designs already shared over the internet. However, not everybody can afford spending 30–50 euros or dollars on some collecting equipment, and the DIY models I found on the internet all have the crossbeams of either wood or bamboo. Bamboo and softwood may quickly become moldy or start rotting under the

warm, humid conditions of the tropics. On the other hand, stronger kinds of wood are usually heavier and darker, which means extra weight to carry around and an increased chance to overlook a bullet ant or small scorpion walking over the crossbeams towards your hand.

Because of my reservations regarding the use of wood or bamboo, I instead decided to use yellow PVC pipes of the kind normally used for channeling electricity wires. These are durable, lightweight, light of color and entirely washable, while beasts find it difficult to walk over them for a bite. Also, they are available almost everywhere and are very cheap. Of course, they have to be attached to each other to make a strong and stable cross. Simply drilling a hole and putting a bolt through the pipes could severely weaken them. To counter this, I used two small pieces of strong aluminum pipe, just wide enough to let the PVC pipes pass through. By reinforcing the drilled section of the PVC pipes with the aluminum pipes, the tension is taken away from the hole and toward the place where the PVC pipe exits the aluminum pipe. If there is no aluminum pipe of a suitable diameter available, some iron pipe could also be used, although this is heavier and will rust if not treated with primer first.

Because I considered the usual sheet size of 1 square meter unwieldy in a tropical forest, I instead opted for a square with sides of 80 cm.



Fig. 1. All parts of the disassembled beating sheet, including a machete to beat on the vegetation and a large knife to rummage through whatever falls in the sheet



Also, I figured the PVC pipes would, despite the reduced size of the sheet, be too long to fit in a backpack whilst travelling. Hence, I cut them through the middle, effectively taking out the part through which the bolt had to go. The shortened PVC pipes are secured in the aluminum pipes with additional bolts and wing nuts.

To make this type of beating sheet, you need the following material:

1 - piece of sturdy, but not too thick white cloth of 82 x 82 cm

4 - pieces of the same cloth of about 15x15cm

4 - pieces of the same cloth of about 18x9cm

2.7 - meters of 12 mm (1/2") PVC pipe

20 cm of 15 mm (5/8") aluminum pipe

4 - bolts of 5 mm (1/8") x 20mm with wingnuts

1 - bolt of 5 mm (1/8") x 35mm with wingnut strong sewing thread

some fine sandpaper to smoothen the endings of all the pipes

In addition you will also need (or else the help of someone with):

- a sewing machine

- a drill on a stand to make well centered holes, with appropriate drill bits for drilling PVC and aluminum pipes

- a metal saw for cutting the PVC and aluminum pipes on the appropriate length

Firstly, hem the large square of cloth on all sides. Then fold the eight small squares into triangles and hem these shut. Put one of these triangles in each corner on the underside of the sheet and sew it to it on all sides, enforcing the corner by making the sheet thrice as thick. Sew another triangle on the upper side of each corner, but leave the inner side open. This creates the pockets where the endings of the crossbeams will fit. For extra strength, you may want to use a double zigzag stitch for the sewing. A different option would be to first place the triangles on the square and then do the hemming. Keep in mind that by the final hem, the cloth will be fifteen layers thick. Then, fold the remaining cloth rectangles into squares and hem these on all open sides. Fold these squares into rectangles and sew these shut on the open long side and one open short side. When turning them inside out, this should result in four small 'socks' which can snugly fit over the endings of the PVC pipes. These socks will offer extra protecting for the corners of the sheet, meaning that if they wear through you only have to replace the socks instead of the complete sheet. Alternative protective pipe endings like small rubber stoppers might work too, but as those are usually black, they will make it more difficult to see what might be hiding in the corners of the cloth. If they would drop on the ground, they would be much harder to find back as well.



Fig. 2. The assembled beating sheet, ready for use. The plastic pipes are under tension with the cross about 20 cm above the sheet

Next, cut the PVC pipe into two equal pieces of about 135 cm. Slide a piece of aluminum pipe of about 10 cm to the middle of each PVC pipe, and then drill a hole straight through the center of each of them. Connect the aluminum-reinforced PVC pipes to each other with the long bolt and nut. Now, try to fit them in the sheet to assess the fit. If the tension is too high, equally reduce the length of each of the four PVC pipe endings. Keep doing this until the tension on the cloth is adequate to keep it taut but not so much as to risk tearing the cloth or the stitches or breaking the pipes. In my own beating sheet, the space between the empty sheet and the center of the cross is about 20 cm. Unlike other beating sheets, where the crossbeams are horizontal and the sheet hangs below in a shallow curve, this system thus has the crossbeams arching with the sheet in a single plane. Once the length of the pipes is adequate, sandpaper the endings of all the pipes. If you're happy with using long pipes for the cross, you're done now. Otherwise, drill an extra hole through both the aluminum and plastic of each of the four cross arms at about 2.5 cm from the central bolt. Try to do this exactly the same for each of the arms, so that the PVC pipes will be interchangeable (otherwise, you should mark which PVC pipe fits on which aluminum pipe ending). Then, remove the central bolt and slide the aluminum pipes of the PVC pipes. Narrowly cut the part with the hole for the central bolt out of the PVC pipe. Now you're done, and all that's left is putting everything together with the help of the 4 shorter bolts and nuts once you're in the field.

Because the actual sheet is stretched (in time, the middle will start sagging a bit), it is important to keep the beating sheet horizontal to prevent roundish specimens from rolling off. In my experience, without scarabs but with leg-retracting weevils, this isn't too much of a problem. If you decide to try this system, I'd love to hear about your experiences with it and of any further improvements you think of. Good luck and happy collecting!

## Observation of *Golofa porteri* in Venezuela (Scarabaeidae: Dynastinae)

by

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During a stay in Venezuela in 1990, we were lucky to find and observe *Golofa porteri* (Hope, 1837) in the wild. Readers of *Scarabaeus* will now be able to discover interesting observations and photographs.

*Golofa porteri* is a large Dynastinae of the Dynastini tribe. Among the approximately thirty known species in the genus, this is the largest. Sexual dimorphism is remarkable and strongly accentuated. Males are red-brown in color, almost orange, sometimes with small dark dots. The pronotum and elytra are very bright. The male has two well-developed horns, and major specimens can be imposing. The cephalic horn has small teeth



Fig. 1. Detail of the head and prothorax of *Golofa porteri*.



or denticles. During male combat, these allow a better grip compared to that of a horn that would be totally smooth. The thoracic horn is devoid of denticles, placed vertical, often very large, and with short, red setae. The setae may have a tactile function because male individuals react quickly when the setae are touched (Fig. 1). The size of the males ranges between 40 and 65 mm. The male forelegs are particularly elongated and play an important role in both fighting and mating. The tibiae and tarsi of males are long and robust. The female is devoid of horns and is black and shiny with rough elytra.

In Venezuela, we observed *Golofa porteri* in the region of Aragua, near the town of Tovar (Fig. 2), which is at an elevation of around 1800 m. It was founded in 1843 by a group of German families. At the time of our visit, it had about 15,000 inhabitants. The architecture and color of the houses make it atypical compared to other towns in the country.



Fig. 2. View of the town of Tovar.

### Perches

Finding *Golofa porteri* is relatively simple once a site at elevation (which can be difficult to access) is found with a series of "bamboos," *Chusquea fendleri* Kunth (Fig. 3). The specimens, mainly males, were observed during the day (early morning and until noon) perched on long stalks of *Chusquea fendleri* (Poaceae: Bambusoideae: Bambuseae).

In Venezuela, 20 species of *Chusquea* are known to occur, including *C. angustifolia*,



Fig. 3. *Chusquea fendleri* with almost invisible *Golofa* perching on it.

*C. fendleri*, *C. linearis*, *C. maculata*, *C. multiramea*, *C. pallida*, *C. purdieana* and *C. scandens*. In general, the stems measure 2-25 mm in diameter and have a height of 1-12 m. The vegetation is very dense, and young shoots bend in the wind or under the weight of some *Golofa*, which is not the case for thicker shoots.

In general, a single male (often major in the development of its horns) is perched head down on a long stalk, at mid-height or three-quarters of the way up (Fig. 3).

### Male Combat

Looking at the long forelegs of males, one might think they pose a problem with motor skills, but this is not so. They climb well along the stems. *Golofa* feed on the tender or frayed parts of bamboo shoots (*Chusquea fendleri*) (Fig. 4). Our



observations are in every respect in accordance with what we read in the articles by W. G. Eberhard (1978) and the late Dr. Howden (1974).

A male, often smaller than the male who is already present at the top of the stem, tries to climb and join him. The male major descends slowly and the two opponents face each other (Fig. 5). The beetles emit a sound similar to stridulation: the ends of the elytra rub on the abdomen in a fast movement. The fight begins when the horns and tarsi of the opponents touch each other. Males seem very aggressive. A series of movements ensues until one of the males succeeds in gripping the tip of the opponent's abdomen with his forelegs while sliding his cephalic horn under the opponent. At this moment, in a quick and fast movement, the one



Fig. 4. Male of *Golofa porteri* feeding on *Chusquea fendleri*

who has succeeded in the manoeuvre makes his opponent fall from the stem. The winner "wins the right" to stay on the stem and feed, while the loser sometimes falls to the ground. It usually opens its elytra and quickly flies to the bottom of a new shoot, after which the process begins once again. The fights are usually brief and rarely exceed one to two minutes.

### Mating

Looking more closely at some bamboo shoots, females were observed, but those were always less numerous than the more clearly visible males. The females were mostly in the hollow of the stem or in a cluster of small stems (Fig. 6). When noticing a female, the male on the same stem rushes toward her. Mating takes place when the male is able to control the female (Fig. 7). To do this, he slows her down or immobilizes her with his middle tarsi placed on the sides of the female's abdomen. His long forelegs pass in front of her and help maintain position on the stem. These legs seem well adapted to encompass and secure the female and cling to the stem. The mating takes quite long, and the female sometimes continues to feed at the same time.

Unfortunately, no females were observed laying eggs. A search for larvae at the base of the bamboo shoots yielded no results. The surrounding soil was not composed of dead wood or compost, which appears to be commonly preferred breeding substrate for Dynastinae larvae. Thus, we do not know where the females lay eggs or where the larvae develop.

*Golofa porteri* is present in Colombia and Venezuela. F. Radnai (1995) also reports it in northern Brazil, but we believe this remains to be confirmed. In Venezuela, specimens were captured in April and May. Males and females come to light but have not been seen in large numbers during our night hunts. The species seems abundant in the wild at certain times.

Hogue (1993) reports the legend that some people believe that some *Golofa*, like *Dynastes*, would be a "sawyer" because of its imposing cephalic and thoracic horns. This is not the case, because even if the insect could deploy the necessary force in its horns, they are not sharp enough to cut or saw a stem of *Chusquea*.

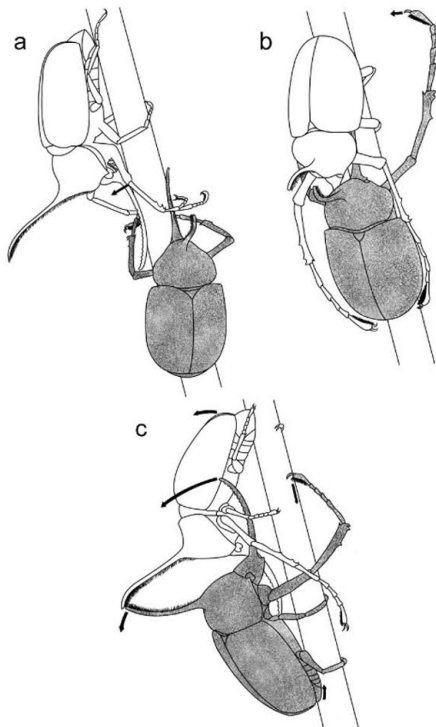


Fig. 5. Male of *Golofa porteri* fighting (modified from Eberhard (1978)).



Fig. 6. Female of *Golofa porteri* feeding on *Chusquea*



Fig. 7. Male and female *Golofa porteri* mating



Fig. 8. Larva (3<sup>rd</sup> instar) of *Golofa porteri*



### Breeding in captivity

Today, *Golofa porteri* is extensively bred in Asia and Europe. To our knowledge, Franck Radnai was the first in 1989 to complete the life cycle. The following summary of the captive breeding is largely taken from his articles and observations that are available on the Internet: a male and several females are placed in a large vivarium with branches and a specially prepared medium. The substrate used for growing most Dynastinae is a mixture of compost and untreated wood with rotting pieces. The preferred species are oak and beech. The beetles are kept under a cycle of 12 hours of day and 12 hours of night. In captivity, adults feed on apples and bananas. After mating, females spend much of their time underground. When the eggs are laid, they are isolated and placed individually in plastic breeding boxes. The eggs are white, ovoid and measure 4 x 3 mm. White, C-shaped larvae are typical of other Dynastinae (Fig. 8). The pupa is orange, and the long forelegs already appear. The complete cycle of the egg to imago lasts more or less 575 days. Temperature is likely to play a role in the speed of development in the laboratory.

As reported by Ratcliffe, Cave and Cano (2013), the larvae of only five species of the genus *Golofa* have been described to date, and almost nothing is known about the biology and ecology of these great beetles. Further efforts in breeding *Golofa* species and especially more field work (see e.g. Valois et. al. 2019) may resolve some of the questions still surrounding these magnificent beetles.

For more information on the diversity and distribution of the genus *Golofa*, we recommend Dechambre (1983) and Lachaume (1985), while Morón (1994) describes some aspects of the larvae and pupae of two species. The food plant genus *Chusquea* and some of its relatives as found in Venezuela are treated in Clark and Ely (2011).

### Acknowledgements

We thank Dr. Lynn G. Clark of the Department of Ecology and Evolution at the University of Iowa who has confirmed the identification of *Chusquea fendleri*, which is the plant on which the *Golofa porteri* of Venezuela feed. Some photographs come from the late Jacques de Tonnancour and the others are from the second author. We also sincerely thank Annibal Chacon, Dr. Jose "Pépé" Clavijo, and Dr. Alberto

Fernandez Badillo from the University of Maracay for their warm welcome and assistance during our visits to Venezuela. Finally, thanks to Virginie Juteau for the redrawing of the fighting sequence in the paper of Eberhard (1978).

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# A Goliath Undertaking: Notes on African giants in America *Goliathus* Lamarck, 1801 (Coleoptera: Scarabaeidae: Cetoniinae)

by  
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As with many of you reading this, some of my earliest childhood memories are of collecting insects. I remember keeping bess beetles and fire ants in large, glass jars when I was very young and spending many hours observing them.

My insect-related urges subsided for a while during my teen years, but were rekindled in my 20's (late 1990's) after coming across a beetle in a parking lot that I wanted to identify. I turned to the internet and managed to identify the beetle as a "fiery searcher" (*Calosoma scrutator* (Fabricius, 1775)). I also quickly realized that keeping and breeding beetles was actually "a thing" and that there were other passionate, crazy people out there with the same interests.

Since then, I have kept and attempted to breed almost any species within Scarabaeoidea fortunate (or unfortunate) enough to cross my path. I have always been fascinated by the huge and amazingly diverse beetles from other countries, but my breeding has been limited, by law, to beetle species native to whichever state I happened to be living in at any given time.

For many years I have had a dream that one day I would work with live, exotic beetles on some professional level. I have often searched for loopholes that would allow me to obtain and keep some of the larger species of beetles, without the need for me to construct a costly, permitted containment facility. Through these searches I eventually discovered that dung beetles (Scarabaeinae) are not regulated by the USDA/APHIS and can freely be kept and shipped between states. Upon learning this, my first thoughts jumped to the huge, exotic African or South Asian dung beetle species like *Heliocopris*. However, through further research and many conference calls I learned that the USDA Veterinary Services does not allow dung beetles from countries where hoof-and-mouth disease

could be found – yet another obstacle. With my growing understanding of our laws and policies I was increasingly certain that beetle breeders in the USA could never have access to the overabundance of species available to insect enthusiasts in Japan or even most of Europe. Here in the USA we are supposed to have permits not only for exotic species but also for native beetle species being shipped from other states, even when that species occurs in both states.



Fig. 1. Newly eclosed male *G. goliatus*.

Then, out of the blue, something changed, and I was able to be a part of it. I was south of Tucson, AZ in the summer of 2015, and was talking to a friend who happened to be a decision maker within the APHIS/PPQ. We were speaking about beetles, as we often do, and he mentioned that he had been looking into goliath beetles and whether or not they could be removed from permitting. I was in shock for a while; I had never paid very much attention to *Goliathus*, figuring it was just another genus I would never be able to work with. The PPQ were still undecided at that point, so I ended up spending the next year submitting anything I could find on the lifecycle or captive



breeding of *Goliathus*. This was in an attempt to help the decision-making process, although I am unsure about how influential I was.

Finally, in 2016, an initial decision was made that three of the five species of *Goliathus* would officially no longer require PPQ permits from the USDA/APHIS to be owned or shipped between states. Individual states still retain individual jurisdiction and all of the species still require permits to be imported from other countries. The species allowed are *G. goliatus*, *G. regius* and *G. cacicus*. The other two, *G. orientalis* and *G. albosignatus*, as of the writing of this article still require permits.

“But why do they no longer need permits?” you may ask. The current thinking of the USDA/APHIS/PPQ is that, if a given species eats any part of any plant at any point of its life cycle, then this species would be regulated and would require permits. In terms of *Goliathus*, the change in permitting came about after advances in the understanding of their life cycles and breeding requirements, both in the wild and in captivity. In the wild, adults are not considered to be plant-pests, as the flows of tree sap they often feed on are pre-existing and have been started by other animals. Hence, a standard method used to collect adults is to strip an easily accessible portion of the outer bark of certain species of trees, and return very early the next morning before any adults that were attracted have had time to warm up and are capable of flying away from an approaching human. If adults could start their own sap flow, they would most likely be happier to be high up in the canopy and likely not as easily attracted to a purposefully created flow.



Fig. 2. Male *G. goliatus* enjoying a beetle jelly.

The other reason is that goliath larvae are solely protein feeders; they will starve in the absence of an all-protein diet (Lai 2016), and because of this are in no way harmful to plants or agriculture. The larvae hunt prey and will eat each other if given the opportunity. *Goliathus* larvae will also not survive if they are kept below 73°F (22°C) for any length of time. One interesting fact is that we don't yet know what exactly the larvae are feeding on in the wild.

Taking these factors into consideration, it was decided that these species no longer fall under the same permitting requirements as almost all other large beetle species do. After finally confirming with the USDA<sup>1</sup> and the state of Louisiana that I would be allowed to obtain *Goliathus* beetles, I was able to release my pent-up enthusiasm. In May 2016 I received my first *G. goliatus* adults and larvae. When I first got to see my own large, exotic beetles up close and hold them in my hands, it was truly a magical experience.

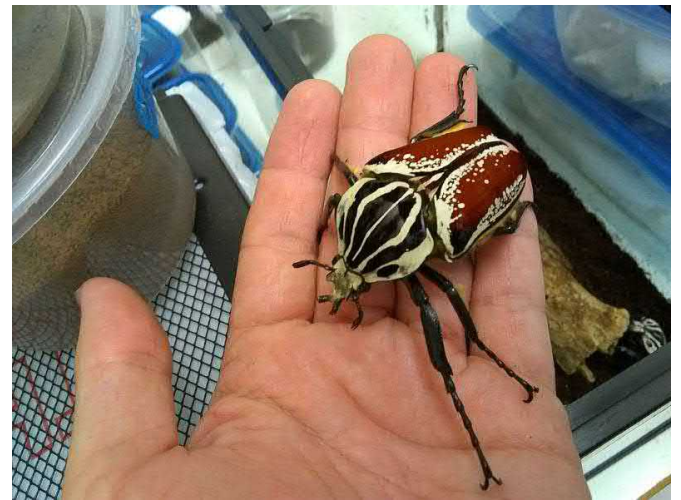


Fig. 3. Male *G. goliatus*

Usually, I have multiple native species in culture simultaneously, mainly for live insect displays and events, but I have had to minimize everything else to make time and room for *Goliathus*. I am currently the caregiver for around 180 larvae and pupae of *G. goliatus*, which all need to be kept in their own individual containers.

*Goliathus* larvae require a specific temperature range, so I have a heater and an AC unit both set to different temperature switches to keep the breeding room between 73° and 78° Fahrenheit (22.8°–25.5° Celsius). I think of it as my little slice of African jungle in south Louisiana.

Also, since they do not eat the substrate they are living in, the larvae need to be fed every two to three days (usually in the form of fish food pellets or other high-protein food), which requires much more time than most species. Even with these added requirements, they are still fascinating to breed. I estimate I have worked with over 200 *G. goliatus* to date, and I am working on two different projects to help make them more available. As seen in some of the photos in this article, *G. goliatus* have varying patterns and colors. Male elytra are often mahogany colored, while females have white elytra with black patterns, but so far, every adult I have worked with has been at least slightly different from the others.

I hope that this change in *Goliathus* permitting will allow many more people to breed and experience these amazing giants. Although not exactly an easy genus to breed in comparison to other genera of similarly sized beetles, they are definitely worth the effort.

What is next? I am currently researching relatives of *Goliathus* in hopes of finding a species similar enough to deregulate, like *Argyrophegges*, *Fornasinus*, *Hypselogenia* or *Hegemus*. I would also like to gather enough information on *G. regius* and *G. albosignatus* to help deregulate them if possible. If anyone has helpful information toward this goal, I would be very glad if you contacted me.



Fig. 4. L3 *G. goliatus* larva, the last of the 3 larval stages

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Fig. 5. Eleven female *G. goliatus* in a feeding container.

## Footnotes

- <sup>1</sup> The three aforementioned species of *Goliathus* are now classified as “no permit required” by the USDA.



## The discovery of Edgar von Harold type material in the Museum of Zoology, Dresden

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As every systematist knows, a painstaking study of any insect collection can reveal a lot of surprises, even in those which have already been extensively investigated and which have not incorporated much material recently. I made one such unexpected discovery during recent visits to European museums for my on-going taxonomic revision of the *Ateuchus* Weber, 1801 dung beetles (Scarabaeidae: Ateuchini). The discovery concerns the hitherto unknown existence of type specimens of nominal species authored by the German coleopterist Edgar von Harold (1830-1886) in the collection of the Museum für Tierkunde, Senckenberg Naturhistorische Sammlungen Dresden, Germany.

### A brief biographical sketch of Edgar von Harold

Harold's life was briefly sketched in obituaries by Anonymous (1886), McLachlan (1886) and Fairmaire (1887), and more recently by Cambefort (2006). Born in Munich on the 30<sup>th</sup> of May 1830 to a noble family of English ancestry and in his early years educated at the page house of the King of Bavaria, Harold was to become one of the most influential scarab specialists of the second half of the 19<sup>th</sup> century. After leaving the Gymnasium in 1848, he started a 20-year-long career in the infantry of the Royal Guard of Bavaria that would last until 1869, when he retired as captain 1<sup>st</sup> class. In 1870, however, he briefly returned to the Royal Guard to serve in the Franco-Prussian War. Harold had previously also fought in the Austro-Prussian War of 1866 and is said to have been severely wounded at the Battle of Kissingen, when the Bavarians were defeated by the Prussians. Towards the end of his period in the Royal Guard, Harold was

allowed to go on a trip to the Mediterranean coast of Spain and Morocco and study their insect fauna. Upon his return to Europe, he visited several major cities, including London and Paris, to meet fellow entomologists and examine their beetle collections. Probably the most important visit made by Harold during that tour was the one to the Jardin des Plantes (i.e., the Muséum nationale d'Histoire naturelle, Paris) in 1869, when he could finally examine in person the type series of nominal species established by French entomologists such as Lucas and Blanchard and whose identities he had been unable to decipher from their original descriptions only (cf. Harold, 1869a). After his retirement from the Royal Guard, Harold could devote the rest of his life to entomology.



Fig. 1. Edgar von Harold (1830–1886), the Bavarian coleopterist who was one of the leading authors in scarab studies during the second half of the 19<sup>th</sup> century, here photographed in Munich around 1865. Previously believed to be housed only in Paris, Munich, and Berlin, it is now known that at least some type specimens of nominal species established by Harold are held in museums in Cambridge, MA, Brussels, and, as firstly reported here, in Dresden. Image by courtesy of Editha Schubert (Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany).

Harold's first entomological publication appeared in 1859 as a paper in the *Berliner Entomologische Zeitschrift* dealing with several taxa of Scarabaeinae and Aphodiinae. As he explains in its introduction, that article was written

with the goal of fixing some problems in the taxonomy of those groups for the preparation of a work that would eventually mark his name in history, the *Catalogus Coleopterorum*. Organized in collaboration with his Munich coleopterist friend Max Gemminger (1822–1887) and listing more than 77,000 species in 12 volumes issued between 1868 and 1876, this catalogue of the world's beetles was the largest and most authoritative of its kind at the time of its publication. Known to 19<sup>th</sup>-century specialists simply as the “Munich catalogue”, it has been serving – directly or indirectly – as the basis for the preparation of virtually every new Coleoptera catalogue published ever since. But apart from this general work, some others in Heteroptera (cf. Deckert 1999) and occasional descriptions of new species in other beetle groups (e.g., Harold 1874c, 1875a, c, d, 1876, 1877, 1878, 1879a, b), Harold's true focus were scarabs, particularly the laparostict ones. Even though he did publish several papers over the years in which a miscellany of different new species were presented only by a short description and no taxonomic discussion, Harold himself said that he saw little value in this kind of approach and he rather preferred new taxa to be described in monographic revisions (Harold 1859). Indeed, he was the author of groundbreaking revisions that, for several scarab groups, are even today the only general treatments that have ever been published for them. Among these general taxonomic treatises, I should cite his revisions of *Glaphyrus* (Harold 1869e), *Trox* (Harold 1872), Hybosoridae (Harold 1874a), *Ataenius* (Harold 1874b), *Euparia* (Harold 1870), *Ammoecius* (Harold 1871), *Caccobius* (Harold 1867a), *Onthophagus* (Harold 1867b, 1869c), *Canthidium* (Harold 1867c, d), *Choeridium* (= *Ateuchus*) (Harold 1868d), *Canthon* (Harold 1868a), *Uroxys* (Harold 1868b), *Pinotus* (= *Dichotomius*) (Harold 1869d), and the Mexican scarabaeines (Harold 1863, 1869b).

From our 21<sup>st</sup>-century perspective, in all those works Harold showed a fairly modern style. His descriptions are so accurate that very often it is possible to identify the species without needing to examine the type specimens, which is quite remarkable for a 19<sup>th</sup>-century scarab beetle author. Likewise, his usage of zoological nomenclature was quite near to ours, for he had a clear concept that Dejean's and others' names not published accompanied by descriptions were

not, to use our current jargon, available, and that neither were the dozens of nomina in litteris that he found during his museum studies. Furthermore, he sometimes stated in his revisions where the specimens he examined were deposited and labeled type specimens in a manner that allowed their ready identification (by writing either “typ” or a “t” in their identification labels). Harold also explicitly expressed the value of knowing the precise distribution of the species, complaining when he had just vague provenance data for his specimens such as only the name of the country where they were collected (e.g., Harold 1875b). A final aspect in which Harold's works compare favourably to modern ones compared to many of his contemporaries' is his clear notion that species do show intraspecific variation, particularly in color. Hence, unlike many other 19<sup>th</sup>-century and early 20<sup>th</sup>-century beetle specialists, he did not feel compelled to establish new species names for every color variant he found. Thanks to these characteristics, Harold's revisions are still a valuable source of information for anyone revising scarab species.

Harold's involvement with the entomological community of his time seems to have been intense. He was apparently very highly regarded by his fellow entomologists (see Cambefort 2006 for an example). As it is obvious from the reading of his works, he received specimens from several of them, including people such as Henry Walter Bates, Frédéric Tarnier (1822–1890), Henry Achard de Bonvouloir (1839–1914) and the Deyrolle insect dealers, and he also studied in person the institutional collections of the Paris, Munich<sup>1</sup> and Berlin<sup>2</sup> museums. Harold was a member of academic societies such as the Entomological Society of London (current Royal Entomological Society) and the Société entomologique de France, and also founded and edited the beetle-focused journal *Coleopterische Hefte*, where he published several of his works and which lasted from 1867 to 1879. Then, from the latter year to 1881, he took the editorship of the *Mittheilungen des Münchener Entomologischen Vereins*, only leaving that post when the journal was discontinued. His final professional position was that of curator for the insect collection of the Berlin museum, which he briefly occupied from 4<sup>th</sup> May 1877 to 1<sup>st</sup> July 1880. According to McLachlan (1886), that was not a pleasant period in Harold's life though. After the resignation of Carl Eduard Adolf Gerstaecker



(1828–1895) from the post of insect curator, Harold was persuaded to assume that position during Wilhelm Carl Hartwig Peters' (1815–1883) directorship for the opportunity to have an easy access to the rich material stored in the museum. Unfortunately, it seems that not everything went as expected as he left the post after a little more than three years of service. His final years were not any happier. After suffering from eyesight problems that almost prevented him from working, he died from stomach cancer on 1<sup>st</sup> August 1886 at the age of only fifty-six in Possenhofen, Bavaria. I could not find any information on his family or whether he was married or had children.

Nowadays, specimens studied by Harold are mostly housed in the Paris museum. These are the ones that originated from his personal collection, which was probably the largest 19<sup>th</sup>-century scarab collection in the world. After Harold's death, the greater part of his collection was bought in January 1887 by the renowned French beetle collector René Oberthür (1852–1944). The Palaearctic portion, however, was at least partly purchased by the German August Öttel (1838–1905) and has been in the possession of the Munich museum since the latter's death (Horn et al. 1990b; Scherer 1992). According to Oberthür (see Cambefort 2006), the part of the Harold collection he bought was put up for sale by the Munich insect dealer Maximilian Korb (1851–1933) for 1,500 marks, which ended costing him 1,940 francs. The collection arrived in Rennes, where Oberthür was based, on the 9<sup>th</sup> of February 1887 and was composed of 7,064 specimens belonging to – as then identified – about 1,808 species. Among those specimens, there were several types of nominal species established by Harold and at least some specimens of the Gernar collection originally belonging to the Berlin museum. Even though it seems that Hermann Julius Kolbe (1855–1939), one of Harold's successors in Berlin, accused him of having stolen material from the museum (see Cambefort 2006), it is difficult to know whether this is really accurate or not due to the clear personal conflicts that Harold had with the Berlin museum. It would not be impossible to imagine that this story may have been created by people who disliked Harold simply to damage his reputation, and that the Gernar material present in the Harold collection may have been there just by accident (a non-returned loan?) or was exchanged or donated in agreement with the museum. At the moment, no evidence exists supporting either version of the story. Other entomologists' material that was part of

the Harold collection, like specimens collected by Bates and Eduard Wilhelm Steinheil (1830–1879), were most probably donated or exchanged in good faith with Harold. Then, after Oberthür's death, his gigantic Coleoptera collection, including the Harold specimens contained within it, was bought by the Paris museum in 1952 and has been in the museum's possession ever since.

### Harold type specimens and the Dresden Museum

For the preparation of my *Ateuchus* revision, I spent four weeks in the Paris museum in September 2019 studying its dung beetle holdings, and paid special attention to the Harold collection's specimens. Of the thirty nominal species established by Harold, I found there at least one potential syntype of eighteen of them (i.e., a specimen that had at least a label identifying it with a particular Harold name by Harold himself and which did not bear any data that would indicate it was not in his possession when the species was published, or that contradicted in some way the original description). Several of these syntypes are Bates specimens that Harold mentioned in the original descriptions, particularly in his 1868 revision of *Choeridium*. Potential syntypes were also found in the Munich and Berlin museums, whose holdings were at least partly studied by Harold for that work, as he remarked several times in the text (but at least one of the specimens Harold said was in Berlin – the holotype of *Choeridium breve* Harold, 1868 – is now in the Paris museum via the Harold collection). For the twelve remaining nominal species, no clue existed about the whereabouts of their type material and I was going to consider them as lost. But then, a short one-day visit to the Dresden museum, where I had gone with the main goal of studying some type material of Balthasar's nominal species, revealed a huge surprise: a syntype of one of those twelve missing type series.

As far as I know, no one has ever recognized a Harold specimen in the Dresden museum. The staff currently responsible for the museum's Coleoptera collection were also not aware of that possibility (Olaf Jäger and Klaus-Dieter Klass, personal communication, 13<sup>th</sup> December 2019). Indeed, Horn et al. (1990a) list only Paris, Berlin, and Munich as museums known to house Harold specimens, and Cupello & Vaz-de-Mello (2018) added Brussels to this shortlist<sup>3</sup>. Now, the Dresden

museum should also be included<sup>4</sup>. The type specimen found in Dresden is a syntype of *Choeridium granigerum* Harold, 1875, currently known as *Ateuchus granigerus*. It was described along with three other new dung beetle species belonging to different genera in Harold's 1875 paper on the material collected by a certain Dr. Teuscher in the municipality of Cantagalo, in the Brazilian state (then province) of Rio de Janeiro (Harold 1875b). Even though Harold did not provide this information in his paper, there is no doubt that the Cantagalo specimens were deposited in his personal collection, for they are easily found in the Paris museum. The best way to recognize them is by their typical labeling: the Cantagalo specimens (or at least one of each species series) bear a small rectangular cream label bordered at one side in red and at the other in black and with the word "Canta / gallo" broken into two lines handwritten by Harold (Fig. 2). This labeling style is unique to these specimens and has been recorded in some revisions (e.g., Génier 1996; Edmonds 2000).

Of special interest for my work, Harold cited four species of *Ateuchus* (as *Choeridium*) in that paper: *A. subquadratus* (Harold, 1868), *A. mutilatus*

(Harold, 1867), *A. carbonarius* (Harold, 1868), and his new species *A. granigerus* (Harold, 1875). I could find, however, only a single specimen bearing the typical "Cantagallo" label in the Paris museum, a female *A. subquadratus*. Even though I found several specimens of *A. mutilatus* and *A. carbonarius* in that museum, including specimens from the Harold collection, none of them bears a label indicating it to be part of the Cantagalo series. Finally, only one Harold collection *A. granigerus* was seen in Paris, a female bearing a label with Harold's handwriting identifying it as "*Choerid. / granigerum / Harold*", but without any indication of belonging to the Cantagalo series. As Harold (1875b) discussed sexual dimorphism in his description of *A. granigerus*, it is clear that he had individuals of both sexes in front of him for his work and, thereby, the Paris museum female may potentially be a syntype. Nevertheless, because, unlike the other type specimens established in that paper, this female bears no labels indicating it came from Cantagalo, and because its identification label does not have Harold's typical information indicating it as a type, there is no evidence that this particular specimen was indeed studied for Harold's Cantagalo work, and consequently should not be considered a syntype of *A. granigerus*.

Having found no other specimens that could potentially be part of this type series during my stay at the Paris museum, I assumed they were all definitively lost. But when I was in Dresden, I found the specimen depicted in Fig. 2 that, to my great surprise, bears a provenance label identical to the "Cantagallo" label of the Paris museum specimens. Even though it does not have an identification label by Harold, this specimen not only perfectly matches Harold's 1875 description of *A. granigerus*, but is also conspecific with the Paris museum female identified by Harold with that name. With no evidence indicating the contrary, I consider this specimen to be one of the syntypes of *A. granigerus*. But how did this specimen get to Dresden? Between leaving Harold's collection and ending up in that museum, it belonged to the Carl Felsche collection, as stated on its green label typical of Felsche material housed in the Dresden museum (Fig. 2). Little has been written about the life of Carl Felsche apart from Blumenthal's (2004) brief biographical sketch. Born in Leipzig, Kingdom of Saxony, on 9<sup>th</sup> October 1839, Felsche was a rich amateur coleopterist who published a number of papers on several groups of worldwide Scarabaeoidea between 1898 and 1912. But it

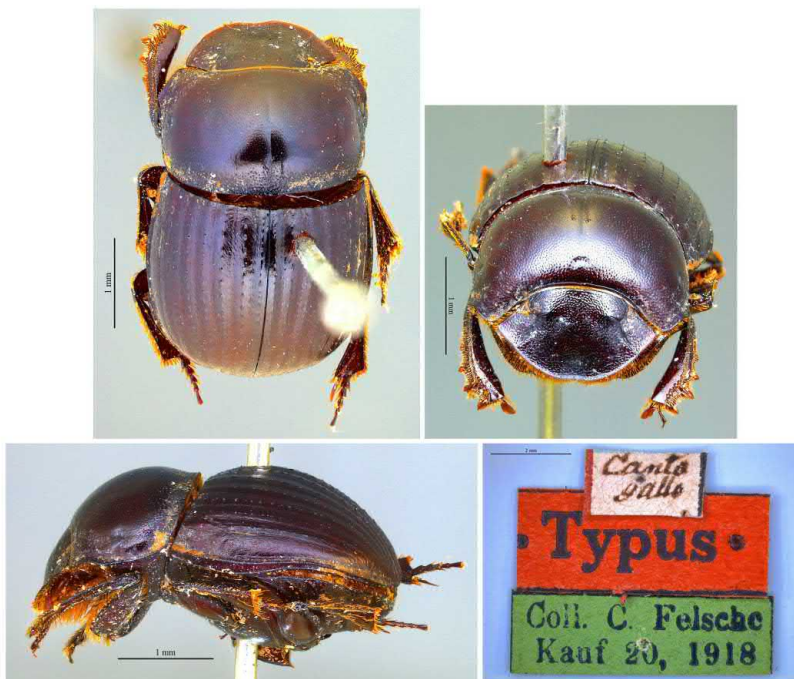


Fig. 2. The syntype of *Choeridium granigerum* Harold, 1875 (currently *Ateuchus granigerus*) newly found in the collection of the Dresden museum. The style of its "Cantagallo" provenance label leaves no doubt that this specimen is indeed one of the syntypes studied by Harold (1875) for his paper on the Cantagalo dung beetles. How this specimen came to be in the Felsche collection is, however, still unknown. Image by courtesy of Klaus-Dieter Klass (Museum für Tierkunde, Senckenberg Naturhistorische Sammlungen Dresden, Germany).



seems that his entomological activities started much earlier, for Horn et al. (1990a) stated that Felsche's first Coleoptera collection was sold in parts as early as 1875 by Maximilian Korb, the same insect dealer who would later sell the Harold collection to René Oberthür. The size of this collection, whether it was specialized in any particular beetle group, and the precise whereabouts of its specimens are all unknown. But, later, Felsche built a new beetle collection that was the one used for his 1898–1912 works. Single and childless, Felsche died on 11<sup>th</sup> April 1914, of unknown causes. Upon a previous agreement with the University of Leipzig, he bequeathed all of his possessions to that institution in exchange for the construction and perpetual maintenance of a tomb for his body. Judging that being deposited in a simple university was not appropriate for as important a collection as Felsche's, the University of Leipzig Institute of Zoology sold the collection in 1918 to the then Königliches Zoologisches und Anthropologisch-Ethnographisches Museum in Dresden, precursor of today's Museum für Tierkunde. It is important to note, however, that smaller parts of the post-1875 Felsche collection had already been sold even before Felsche's death (cf. Horn et al. 1990a; Cambefort 2006), including a portion in 1907 to the Dresden museum itself. The part that was sent to Dresden in 1918 contained over 48,000 Scarabaeidae specimens belonging to more than 11,000 species (Blumenthal 2004). Among those specimens was Harold's syntype of *Choeridium granigerum*, as stated on its green label (Fig. 2).

Studying basically only the *Ateuchus* material of the Dresden museum, I could find two additional individuals that, like the *C. granigerum* syntype, most probably belonged to Harold before Felsche<sup>5</sup>. One is a female *Ateuchus apicatus* (Harold, 1867) bearing an identification label with Harold's handwriting identifying it as "*Choeridium (Canthidium) apicatum* Harold, *Copris bidentula* Klug i. litt." and a provenance label also handwritten by Harold as "Rio Grande do Sul." Differently from the *A. granigerus* specimen, this cannot be a syntype for Harold (1867a) mentioned "Buenos-Ayres" as the type locality; besides, the identification label was certainly prepared after the description of *A. apicatus*, for the species was originally described in *Canthidium* and Harold instead combined the specific name with *Choeridium* in the label. Lastly, the third *Ateuchus* specimen found in the Dresden museum that

probably belonged to the Harold collection is a male *A. substriatus* (Harold, 1868) labeled with the handwritten information "Tapajos". From this provenance and the labeling and pinning style compared with other known specimens in Paris, London, and Brussels, this individual was certainly collected by Henry W. Bates during his exploration of the lower Tapajós River in 1852 (see Cupello & Vaz-de-Mello 2018 for more details). As said earlier, Harold indeed received specimens from Bates and described several new species from material collected by the latter over his time in the Amazon Basin. Among those new species was *A. substriatus*, whose collecting data mentioned by Harold (1868c, d) state precisely that the type series had been collected by Bates along the Tapajós. But despite being part of the same series as the syntypes of *A. substriatus*, because this specimen bears no labels with Harold's handwriting and Felsche may have acquired it from other sources (e.g., through other entomologists who bought Bates material from the latter's London agent Samuel Stevens), it is not possible to be completely confident as to whether this particular specimen belonged to Harold at some moment and, more specifically, whether it is a syntype of *A. substriatus*. Therefore, of the three most likely Harold *Ateuchus* specimens housed in Dresden, only one is certainly a type.

Apart from these three specimens, it is possible that many other Felsche collection *Ateuchus* in the Dresden museum were originally owned by Harold, some of them being potential syntypes. This possibility arises from the fact that many Felsche specimens bear green provenance labels that would indicate they came from localities that Harold cited for their respective species in his papers, albeit those provenance labels were clearly prepared after their incorporation into the Dresden museum. An example are the six specimens of *A. robustus* (Harold, 1868) labeled as coming from Rio de Janeiro. Even though in the original description Harold (1868c) mentioned only Brazil ("Brasilia") for the distribution of the species, in his revision of *Ateuchus* published that same year (Harold 1868d), he ascribed a much wider and detailed range to *A. robustus*, saying that the species was widespread from Rio de Janeiro south to Montevideo and Buenos Aires ("Von Rio Janeiro an südlich bis nach Buenos Aires verbreitet; La Plata und Montevideo"). In actuality, as my investigations have shown, *A. robustus* is endemic to the open grasslands and

chaco of south and southwestern Brazil, Uruguay, northern Argentina, Paraguay, and southern Bolivia, and is not present north of the state of Rio Grande do Sul along the Brazilian coast. Therefore, the specimens cited by Harold from Rio de Janeiro are either mislabeled or misidentified. If the latter is the case, then the specimens probably belong to *A. pauperatus* (Germar, 1823), a close relative to *A. robustus* that has a few old -and dubious- records from Rio. In any case, I did not find either in Paris, Berlin, Munich, or any other museums any *A. robustus* or *A. pauperatus* labeled as coming from Rio that could have been traced to Harold. So, where are the Rio de Janeiro specimens studied by Harold? Since we now know that the Felsche collection had at least two specimens that certainly at some moment belonged to Harold (the *A. granigerus* syntype and the female *A. apicatus* mentioned above), it is possible that these Dresden *A. robustus* are the missing "Rio de Janeiro" specimens. But if that is indeed the case, their original labels must have been removed at some point and replaced with their current green labels, something which did not happen with the two certain Harold specimens in the Felsche collection. A further possibility is that those specimens never belonged to Harold and, after their transfer to the Dresden museum, their original labels (if they had one) were discarded, and someone replaced them with new labels simply repeating one of the localities mentioned in Harold's revision regardless of the fact of whether they had indeed been collected there or not.

A final example (and one even more compelling) concerns that of the three *A. calcaratus* (Harold, 1868) males labeled as coming from Cayenne in the Dresden museum. In his original description, Harold (1868d) mentioned precisely that he had only three males in front of him when he wrote the text on *A. calcaratus* and that they came from Cayenne. I found in the Paris museum a single specimen – a male – labeled by Harold with that name, but it bears neither a provenance label nor Harold's typical type notation on its identification label. This, consequently, raises the question of whether that Paris museum specimen is indeed one of the three syntypes. Be it as it may, one thing should be certain: as the Paris specimen was identified by Harold himself and matches perfectly the 1868 description of *A. calcaratus*, even if this specimen is not a syntype it does belong to the same species as them. And what is important is that, based on all the 876 individuals of *A. calcaratus* examined by me, this species certainly does not occur in French Guiana (nor in

Brazil, as later amended by Harold (1869f)), but rather is distributed along northern Venezuela and throughout most of the Lesser Antilles. Therefore, either Harold's specimens were mislabeled or Harold misreported their label content (or whatever source of provenance they had) in his text. If the former scenario is true, then one must wonder whether those three Felsche collection specimens in Dresden could be the vanished syntypes, and whether someone replaced their original labels with the more modern ones they currently bear without modifying the original "Cayenne" information. Indeed, one of those males bears a "Type" label attached to it by either Felsche or someone else after it got to Dresden, even though this label does not mention which nominal species the specimen would be a type of. Alternatively, as in the case of the "Rio de Janeiro" *A. robustus*, it is also possible that these three specimens came to Dresden unlabeled (or with different labels) and that someone simply copied the type locality mentioned by Harold for the newly-prepared "provenance" labels (this person's reasoning may have been something like "since Cayenne was the distribution ascribed by Harold for the species, this is the most likely locality where these unlabeled specimens were collected and they should be labeled accordingly"). But the fact that the Dresden specimens are three males exactly as mentioned by Harold makes me strongly suspect that they are indeed the real syntypes. It should be noted that we can be sure that Harold's specimens were indeed males because both his Latin and German descriptions mention the hooked metatrochanter typical of males of *A. calcaratus*, a character also referred to by Harold's chosen specific name and absent in females.

But how could Felsche acquire all these Harold specimens? One possibility of course, was through exchanges with Harold himself, since, as previously discussed, Harold is known to have done that with several other entomologists. I could find however no mention of Felsche's name in Harold's papers, though my searches were far from being exhaustive. A further scenario is that Felsche got his Harold specimens from Maximilian Korb, the dealer who was responsible for selling Harold's collection after the latter's death in 1886. We know that Felsche had had at least some kind of contact with Korb a decade earlier, for Korb was also responsible for selling Felsche's first collection while he was based in Felsche's home city of Leipzig in 1875 (Horn & Kahle 1935). Could it be possible for instance, that Korb, having a good relationship with Felsche and



knowing he was particularly interested in Scarabaeoidea, let him select specimens in the Harold collection before selling the bulk of that collection to Oberthür? Even though, to my knowledge, this has never been ventured in the literature before (e.g., this possibility is mentioned neither in Horn et al. 1990 nor in Cambefort 2006), I believe this possibility cannot be ruled out and that more investigations should be done in the Felsche collection as a whole (not only in a tiny fraction of it as I did for my *Ateuchus* studies) in order to find out whether there exist more instances of potential Harold specimens deposited in Dresden. Furthermore, more historical and biographical research should be done about Harold and especially Felsche, of whom almost nothing is known. Perhaps a painstaking investigation of the Oberthür, Harold, Korb, and Felsche correspondences (if they exist) may reveal more details about how the Harold specimens came to be in the Felsche collection. And now that at least one type specimen was certainly found in Dresden, that museum should be reviewed for other Harold types that have been deemed lost by previous taxonomic revisions (e.g., Edmonds & Zidek 2010; Génier & Kohlmann 2003; Silva & Valois 2019; Smith 2017). Hopefully, at least some of them will after all be found there.

**The Atlantic Forest, Harold's precipitate optimism, and Darwin's still incomplete catalogue.**

To finish this essay, I would like to mention a curious remark made by Harold in his 1875 Cantagalo paper where he established *A. granigerus*, the nominal species whose syntype was found in Dresden. In that paper's second paragraph, Harold noted that because only five<sup>6</sup> of the fifty-five species caught in Cantagalo were new, it would be fair to believe that the coastal fauna of Brazil, particularly that of Rio de Janeiro, was, at least for most groups, fully represented in European collections and already well known. These comments are particularly curious when we contrast them with Charles Darwin's observation made a mere four decades prior about the insect fauna of that same region. After remarking that his collecting experience had shown him that the European cabinets were mostly limited to the larger and more showy species, whereas the smaller, duller ones were usually not represented, Darwin made the now famous remark that it was "sufficient to disturb the composure of an entomologist's mind, to look forward to the future dimensions of a complete catalogue" (Darwin 1839).

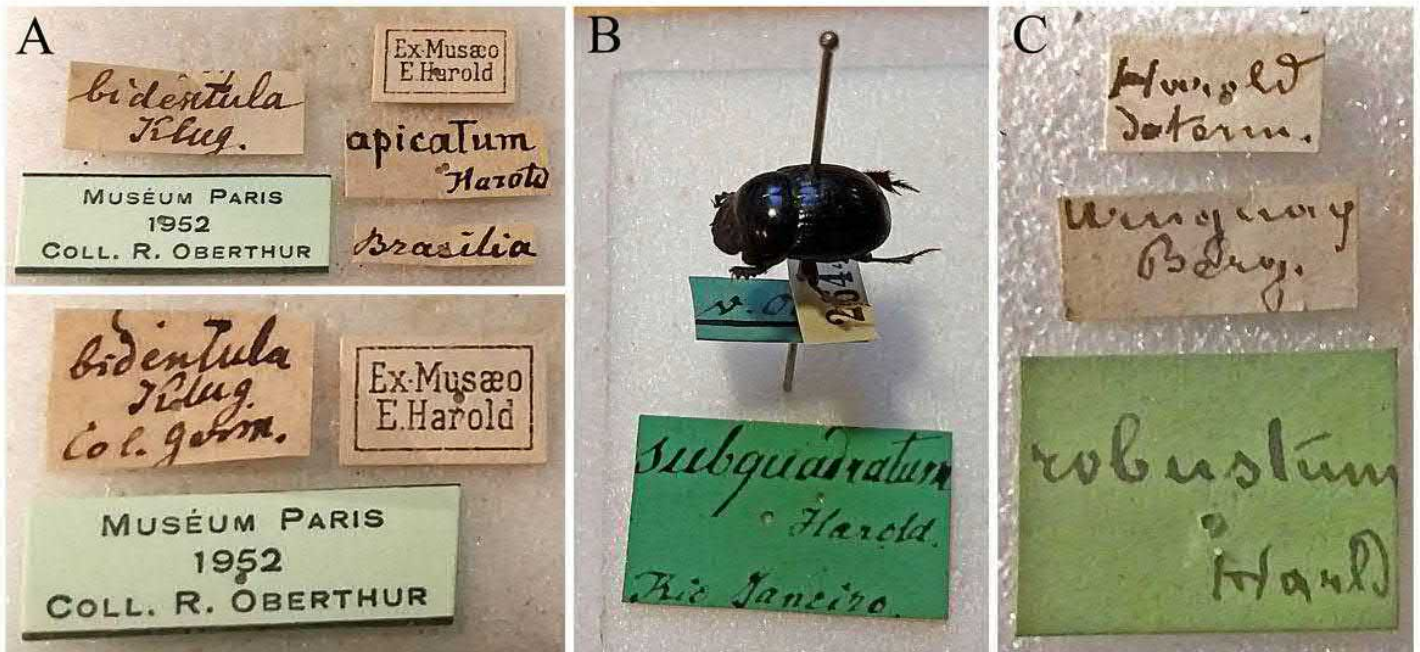


Fig. 3. Harold's specimen labels as found in different museums. A) Examples of labels borne by two different Harold collection specimens in the Paris museum. Note the "Ex Musæo E. Harold" label pinned to those specimens after they had been incorporated into the Oberthür collection in 1887. All handwritten labels by Harold. B) A specimen in the Berlin museum. The large green label shows Harold's handwriting and was probably prepared during Harold's term as the museum's insect collection curator. C) Labels of a specimen identified by Harold in the Munich museum. The handwriting in both the label at the top ("Harold / determ.") and the green one at the bottom seem to be Harold's (see, for instance, the style of the "b" in "robustum" and that of the "d" in "Harold").

Had entomology progressed so much between the publication of Darwin's text and Harold's that Darwin's "future catalogue" had already been completed by 1875, or was Harold being too naive in relation to that catalogue's actual dimensions? I would say it was a little of both. Entomology, like the systematics of every other macroscopic group, had indeed witnessed great progress over the 19<sup>th</sup> century. Furthermore, compared to the faunas of the other regions of South America, the Atlantic Forest has indeed always been the one most heavily collected and, consequently, the most well-understood (it struck me how poorly represented in European museums the Amazon and, particularly, the Cerrado dung beetle faunas are compared to the Atlantic Forest, particularly that of its southern half). Nevertheless, the Atlantic Forest scarabaeines are still far from being completely surveyed. The great number of new species recently described in a relatively small lineage endemic to that biome by Pacheco & Vaz-de-Mello (2017, 2019, 2020) makes this clear, and so do many new species of *Ateuchus* awaiting description. Therefore, a clear message from this essay is that we still have much to learn about dung beetles both in collections and in the field. Exciting discoveries lie ahead for us!

### Acknowledgements

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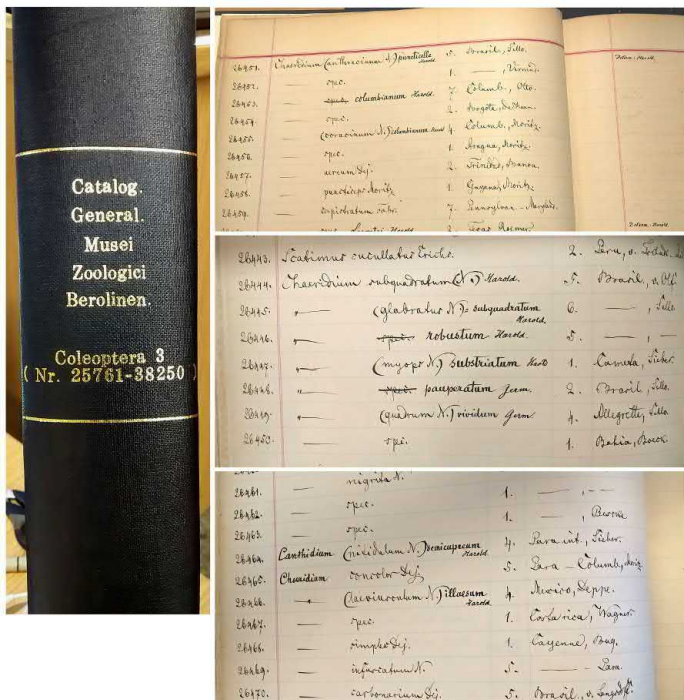


Fig. 4. One of the volumes of the Berlin museum's Coleoptera collection accession book. The specimens were entered in this book probably in the 1870s (Olaf Jäger, personal communication, December 2019), and some of the original identifications were later amended by Harold while curator of the collection (note the information on the right page of the image at the top). Harold's amendments are darker than the original writing and have his clear handwriting.



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## Footnotes

- <sup>1</sup> Currently, Zoologische Staatssammlung München, Munich, Germany.
- <sup>2</sup> Currently, Museum für Naturkunde Berlin, Leibniz-Institut für Evolut'- und Biodiversitätsforschung, Berlin, Germany.
- <sup>3</sup> It is worth noting that Cupello & Vaz-de-Mello's (2018) identification of a syntype of *Canthon candezei* Harold, 1869 (currently *Sylvicanthon candezei*) in the Brussels museum (ex Ernest Candèze collection) was possible because the specimen bears an identification label with Harold's handwriting and its provenance label indicates that it is a Bates Tapajós specimen as precisely informed by Harold in the original description.
- <sup>4</sup> Additionally, one syntype of *C. lecontei* Harold, 1868 (currently a paralectotype since Kohlmann's 1984 designation of a Paris museum syntype as the lectotype) with a label handwritten by Harold was found by me in 2018 in the Museum of Comparative Zoology, Harvard University, USA. That specimen belongs to the LeConte collection and was probably sent for Harold to identify by John Lawrence LeConte (1825–1883) himself. Images of this specimen can be seen online at [http://140.247.96.247/mcz/Species\\_record.php?id=3455](http://140.247.96.247/mcz/Species_record.php?id=3455).
- <sup>5</sup> It should be noted here that, despite its Cantagalo origin, the individual listed by Nunes & Vaz-de-Mello (2019) as the holotype of *Pinotus quadraticeps* Felsche, 1901 (currently *Dichotomius quadraticeps*) is not a Harold specimen. Its labeling style differs from the pattern of Harold's Cantagalo specimen in that the word "Cantagalo" is not broken into two lines and the label is entirely bordered by a fine black line instead of the red and black lateral bordering of Harold's Cantagalo specimens. Besides, the handwriting is certainly not Harold's (it is instead probably Felsche's; see example in Horn et al. 1990b). Having said that, it is possible that this specimen was part of the same series collected by that Dr. Teuscher in Cantagalo and that served as basis for Harold's (1875) work. Harold mentioned in his introduction that Teuscher's material came to him via Friedrich Brüggemann (1850–1878), and it is possible that Brüggemann sent Teuscher's specimen to others as well, including Felsche. In any case, I have serious doubts about this Felsche Cantagalo specimen being the actual holotype of *P. quadraticeps*, for Felsche (1901) expressly said that the specimen(s) he based his description upon was labeled just "Bresil", whereas the specimen listed by Nunes & Vaz-de-Mello (2019) not only has the more precise Cantagalo provenance label but also lacks any labels stating the "Bresil" information. Moreover, it is also unclear whether this specimen originally belonged to the Chevrolat collection as Felsche said the type material of *P. quadraticeps* had been.
- <sup>6</sup> In fact, only four of the 55 species presented in that work were described as new species by Harold (1875): *Choeridium granigerum*, *Ontherus erosus*, *Phanaeus rhadamanthus* (currently in *Sulcophanaeus* d'Olsoufieff, 1924), and *Onthophagus janthinus*.



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