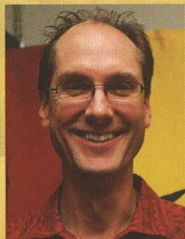




Can Dung Beetles Save the World?

BY MICHAEL J. SOBIECH



Dr. Keith Philips

"KEITH, WHY DON'T YOU START AN INSECT COLLECTION?" WITH THAT FATHERLY QUESTION, A SEVEN-YEAR-OLD KEITH PHILIPS, WHO WAS HOLDING A GRASSHOPPER, WAS SET ON COURSE TO BECOME A LIFETIME STUDENT, AND EVENTUAL GLOBAL RESEARCHER, OF A GROUP OF INSECTS THAT DOESN'T ALWAYS GET THE RESPECT IT DESERVES: THE SCARABAEINAE OR DUNG BEETLES. BUT THROUGH THE EFFORTS OF WKU'S DR. PHILIPS AND OTHERS, A LITTLE BEETLE MIGHT PROVIDE A BIG HELP IN THE ONGOING CAMPAIGN TO SAVE PLANET DIVERSITY.

Philips' interest in the natural world was a family affair. "I spent my summers at a cabin in the woodlands of Ontario. And my father and grandfather, while a radiologist and a banker, were 'closet' naturalists. In our home or at the cabin there were field guides on nature. I still have some of my childhood books on snakes and reptiles. And I was fortunate that my mother didn't complain too much when she found some of my first 'research samples' — snakes, rodents for my pet boa constrictors, and, one time, a bat — staring at her in the kitchen fridge."

But while his first love might have been for reptiles, eventually Philips decided to pursue insects. "It was while I was getting my biology degree at Carleton University (CU) in Ottawa that I decided to study entomology. I worked for a professor who studied insect diversity, and about twice a year he would go to some exotic locale and return with samples of insects. It was then that I decided that a life of traveling, teaching, researching, and being surrounded by professors and students would be a great job."





In the mountains of Bolivia

For his Master's in Science, Philips went to Montana State University, where he took his first entomology course: "I never took the two courses in entomology at CU, thinking that I already knew something about insect biology — how wrong I was!" From Montana, Philips then went on to Ohio State University, a school with a long and distinguished record in entomological research. It was here that Philips began his research on spider beetles (so named because of a resemblance to spiders). But it was while on a post-doc fellowship in South Africa that Philips decided to focus also on nature's fertilizer—the dung beetle.

"Dung beetles are most common in tropical or subtropical regions, but they can be found everywhere except for cold temperate regions and Antarctica," states Philips. Kentucky has about twenty species. Dung beetles are typically divided into two categories — "rollers" and "tunnelers" — with rollers making balls of dung and then rolling them away from a dung pile, while tunnelers burrow down underneath or next to the manure. "These beetles are absolutely critical in some

ecosystems for 'dung recycling' (or spreading the manure). In the process of burying their food, dung beetles bury seeds that then germinate." Dung beetles may not be as cute as squirrels burying acorns, but they provide as important a service.

"While I was still a graduate student at Ohio State, I went on a research trip to the Dominican Republic," Philips states. "I had helped document two new species of dung beetles, but at the beginning of my post-doc I was still quite naïve about their evolution." But Philips' naivety was to his — and the scientific world's — advantage. Prior to his work in South Africa, the accepted view among entomologists was that rollers and tunnelers had each evolved from a separate ancestor; the rollers had a common ancestor and the tunnelers had a common ancestor, but never the two did meet: "My study showed that their evolution had not taken place separately — at several different points in time, their developmental paths had crossed: rollers evolved many times from tunnelers. This was a dramatic modification of the accepted view."

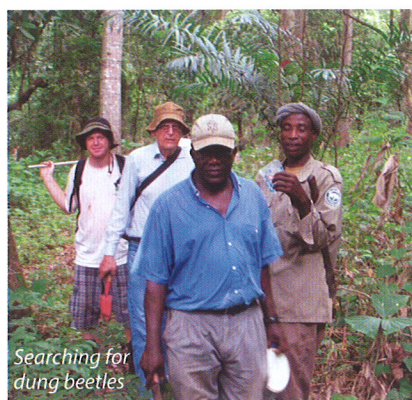
In the days since his groundbreaking work in South Africa, Philips has continued to expand the boundaries of knowledge about the dung beetle, and, just as importantly, he has used these beetles to diagnose the current health of the planet. "Dung beetles are perhaps one of the best groups to examine in monitoring the health of various ecosystems: they are easy, quick, and cheap to sample; using them in surveys does not negatively affect the viability of their population; and their diversity and abundance, or lack thereof, correlates well with the diversity of other species and overall ecosystem health. I can go into a forest in West Africa and after two days have a pretty good idea how stable and well functioning the forest ecosystem is, based on the number and types of dung beetles."

But while Philips has an eye to the earth, he has not forgotten the students in — or outside — his classroom. Several of Philips' graduate and undergraduate students have gone on to become medical doctors or high school teachers. And as he benefited from fieldwork with his professors, so now he helps train a new generation of biologists and entomologists. "I have been fortunate to work with several excellent students here, including students from Columbia, Australia, and Ghana. In fact, one of our Ghanaian students recently finished his doctorate at Auburn, working with fruit tree insect pests. He's actually in a post-doc at Auburn right now. And when he's



finished, he'll return to Ghana to begin a research position at one of their agricultural stations. In light of the 'brain drain' that some countries experience, where their students learn abroad but do not return, his going back is a really good thing."

Philips has more than one tie to Ghana. In addition to his work with Ghanaian graduate students, Philips continues hard at work on the Ghana Insect Project. For WKU, this project is noteworthy for several reasons including both its being funded by the National Science Foundation (NSF) and the sizeable amount of the grant — more than \$400,000. "The Ghana Insect Project had several goals including student training, and studies on both dung beetles and spider beetles. Additionally, we are helping create in Ghana the National Insect Collection at the University of Ghana in Accra, which will be a collection not just of the insects in Ghana but of all the insects in the Guinean forests." This past summer Philips worked in the highest mountain range in West Africa: "The Nimba region in Guinea has a largely unstudied and poorly known insect fauna, and most of the specimens we gathered on this trip will be placed in the collection." As he ponders the future of the work in Ghana and his own future, Philips sees a continued relationship with the efforts in Ghana: "I see myself working with this project for the rest of my career."



Philips believes that he and his colleagues are close to securing another grant from the NSF. "In January 2010, a large group of us applied to the NSF for three-million dollars for five years of support. While we were not at that time successful, all the reviews ranged from very good to excellent — which is just indicative of how difficult it is to acquire NSF funding. But I am optimistic that we will be successful with our resubmission. If funded, we will be able to establish a Planetary Biodiversity Inventory accessible via the Web. The creation of various on-line resources will greatly

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facilitate the study of the diversity of the dung beetles, as well as helping with a relatively massive evolution study using a vast amount of evidence from specimens that will be supplied from collaborators located in nearly every corner of the planet!"

While Philips and his colleagues wait to hear from the NSF, they continue their work of preserving ecological diversity — a diversity that he hopes to secure with the help of another old friend, the spider beetle. "While I always had an interest in dung beetles, I never switched to 'dungers' completely; while they were a side line during my post-doc in South Africa, spider beetles receive an equal emphasis in my lab." Today, using both spider and dung beetles, Philips collaborates with other scholars to determine new sites to be preserved. "South Africa is arguably one of the world's leaders in conservation efforts; nevertheless, their reserve system has been created in somewhat of an *ad hoc* manner. It is well known that there is still a tremendous amount

of diversity that is not protected in any manner, and the threats from continuing population growth and human development, along with invasive, non-native species, are some of the greatest threats. The work we are doing now, documenting spider beetle diversity, will in the long term prove to be extremely helpful in identifying and protecting biodiversity hotspots — areas with species found nowhere else on the planet, and often with a very small and restricted distribution, putting them at greater risk of extinction than more numerous species with larger ranges," Philips explains.

"Everyone should have an interest in documenting and preserving biodiversity because everyone is affected, ultimately, by the health of the earth," Philips continues, "I think this is an ethical issue for humans: we have no right to entirely eliminate from existence another species. If one is religious, he or she can think of this as destroying the creations of God. Once a species is gone, it's gone and can never be replaced. And perhaps we will have lost something that may ultimately have been shown to be of great importance to humans — maybe a new gene to improve crop yields or a new drug against cancer. All species have a right to exist, and we should do our utmost to protect them."

Can 'dungers' save the world? Maybe that's asking too much of one little beetle. But as they roll and tunnel, the humble Scarabaeinae are proving to be invaluable colleagues for Keith Philips and others in global efforts to conserve the abundance — and beauty — of life in the world's biodiversity hotspots. ■