INSECT SURVEYS IN THE SOUTHEAST: INVESTIGATING A RELICTUAL ENTOMOFAUNA

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ABSTRACT

Rare insects can occur in specialized niches of familiar habitats. For example, the burrows of rodents, such as the pocket gopher, contain a relictual entomofauna of surprising diversity. The discovery and cataloging of this "cryptic" diversity is an ongoing process that will require patience, time, and resources. The role of the amateur naturalist and collector is far from extinct in modern systematics, particularly in surveys of these specialized environments. They can provide much of the manpower for local surveys and often have extensive regional knowledge.

Key Words: Coleoptera, Histeridae, Geomyidae, Pocket Gopher, Rarity, Burrow fauna

RESUMEN

En nichos especializados de hábitat familiares, pueden encontrarse insectos poco comunes. Por ejemplo, las madrigueras de roedores, tales como las de la ardilla terrera, contienen una entomofauna de diversidad sorprendente. El descubrimiento y catalogamiento de esta diversidad "críptica" es un proceso continuo que requerirá paciencia, tiempo y recursos. El rol del naturalista principiante y colector está lejos de extinguirse en las sistemáticas modernas, particularmente en los estudios de estos ambientes especializados. Ellos pueden proveer gran parte de la mano de obra para inspecciones locales y usualmente tienen conocimiento regional extenso.

Only recently with The Great Smokey Mt. National Park—All Taxa Biotic Inventory (ATBI) has a serious concerted effort begun to sample and catalogue biodiversity in a large U.S. National Park. Undoubtedly, a major factor contributing to the overall disinterest regarding inventories and the search for new species here at home is the impression that our insect fauna is largely known. While this may be true for some areas of the U.S., most areas have been poorly studied. In addition, tucked within well-studied areas are various microhabitats and niches that have not been properly sampled for insects. To illustrate this point, Karl Stephan, an avocational coleopterist, has discovered dozens of beetles new to science in the vicinity of Red Oak, Oklahoma. Another avocational coleopterist, Roy Morris recently discovered two new species of long-horned beetles and three new species of scarab beetles in relictual sand scrub habitat in central Georgia. Further sampling in fossil dune systems in the southeast has netted several additional undescribed scarab beetles, some rare staphylinid beetles in the genus *Platydracus*, and a rare myrmecophilous carabid beetle *Pseudomorpha excrucians* Kirby, one of only two eastern members of a predominantly western genus. Sampling in remnant beech / magnolia ravines has led to the discovery of several undescribed species of weevils and significantly extended the known range for other insect species.

The chronicle of events leading up to some of these amazing discoveries can be as interesting as the discoveries themselves. While the initial phase of the discovery process may be entirely serendipitous, ultimately, it is persistence and cunning that yields results. As an example of how a full blown biotic survey can materialize from a relatively focused quest, we shall recount the history of our survey of the insects endemic to the burrows of the southeastern pocket gopher, *Geomys pinetus* (Rafinesque) (Geomyidae). The southeastern pocket gopher is a fossorial rodent restricted to well-drained soils in Florida, Georgia, and Alabama. Avise and Laerm (1982) characterized them as "homely, belligerent sausages". Pocket gophers remain hidden in their burrows during daylight hours, and thus, are rarely seen. However, their burrowing generates conspicuous earthen mounds indicating their presence. The burrow system created by an individual gopher can be in excess of a hundred meters in length. The mounds are connected to the burrow system by diagonal tubes that are generally plugged with dirt so that no open entrances are visible above ground (Avise and Larem 1982). Pocket gophers require open grassland or marginal habitats rich in grasses and herbaceous vegetation for their survival and are an important grazing herbivore in longleaf pine/wiregrass ecosystems. Their constant burrowing enhances soil fertility by moving

nutrients to the surface that would be otherwise lost via leaching or other factors (Grant & McBrayer 1981).

History of the Pocket Gopher Survey

The origin of this study was the search for a beetle, *Onthophilus giganteus* Helava (Histeridae), known from a single specimen collected in the mid-1970s. The holotype was collected in Alachua County, Florida near Archer during January and was found frozen in a pitfall trap. After its description, it was accidentally fragmented in route back to the Florida State Collection of Arthropods.

In 1987, Rupert Wenzel of the Field Museum of Natural History drove to the type locality of *O. giganteus* which was essentially an old pasture. Wenzel, a histerid specialist, was interested in seeing the habitat where this beetle had been collected. He informed PES (at the time a graduate student) that members of *Onthophilus* are often associated with burrowing rodents, and the only rodents apparent at the type locality were pocket gophers. PES began scouring the literature for papers on pocket gophers and on prior survey work of insects associated with pocket gopher burrows.

Following Hubbell and Goff's (1939) sampling technique, PES set pitfall traps in the burrows at the type locality in January. Surprisingly, three *O giganteus* were caught overnight, along with additional insects that were rare or undescribed. Energized, PES trapped in the pasture for an entire year. This year proved enlightening, as the burrow fauna was found to have distinct seasons of insect activity. The majority of the fauna was active from late Fall to Spring. All prior work had been done in late Spring and Summer, well past the period of peak activity.

News of unique discoveries travel fast in small coleopterist circles prompting PWK, the junior author to contacted PES with a request for live histerids for rearing purposes. PWK was beginning a revision of the subfamily to which *Onthophilus* belongs and was building a histerid larval collection to study their chaetotaxy. PES suggested that PWK visit the following winter to assist with burrow sampling efforts. In late December 1990, we drove to the pasture near Archer, set a few traps and overnight had 50 live adults! During the remainder of PWK's visit, we decided to go to the Florida panhandle to do some additional sampling for pocket gopher burrow insects. Our foray yielded some additional specimens of the same species that were collected in Archer, a few other species that we had not seen before including the scarab beetle *Aphodius pholetus* Skelley and Woodruff.

Some colleagues and PES continued to randomly collect in pocket gopher burrows for a few more years and found more interesting insects. All of them were rare in collections, but not so in the field. Some of the scarab beetles collected include: *Euphoria aestuosa* Horn, a scarab not previously known east of the Mississippi River; *Aphodius dysptisus* Skelley and Woodruff and *A. laevigatus* Haldeman, two abundant scarab species; and *A. platypleurus* Skelley and Woodruff a scarab that appears to prefer relatively undisturbed habitats. The hister beetles collected during this period included *Spilodiscus floridanus* Ross, the largest histerid in the Southeast, and *Onthophilus kirni* Ross, a species formerly known only from Texas and Louisiana. Other arthropods taken include *Ptomaphagus schwarzi* Hatch, an abundant cholevine leiodid beetle previously known from 6 specimens, *Typhloceuthophilus floridanus* Hubbell, a blind pallid cave cricket, and some nearly blind lycosid spiders.

In January 1995, PWK moved to Tallahassee, Florida and we began to sample burrows in the vicinity of Thomasville, Georgia just north of where PWK was living. Much to our amazement this area yielded more undescribed species including two species of hister beetles, three species of aphodiine scarabs, and a species of camel cricket. It was at this point that PWK, Robert Turnbow, and PES decided to embark on a major insect survey project that would cover the entire range of the southeastern pocket gopher.

Now the real work began. We needed to learn more about the habits and habitat of the pocket gopher in order to improve our sampling efficiency and accumulate literature records of the known distribution of the gopher. We also needed to be able to distinguish pocket gopher mounds from fire ant nests which they resembled. This can be difficult, especially while traveling in a car at 70MPH. We also had to develop a sampling procedure, decide how many sites to visit, and how may burrows to sample. Permits to trap gophers were obtained for Florida, Georgia, and Alabama. We sought assistance from Joshua Larem, Wilson Baker, Mark Bailey and William Michener to assist us in locating additional populations of pocket gophers and facilitate access to quail plantations. We were able to recruit Roy Morris and Philip Harpootlian, avocational entomologists, for assistance in monitoring traps at remote sites and were moderately successful at finding taxonomic support with groups for which we lacked expertise.

We searched for pocket gophers at all localities documented in literature, and were unable to find them at many of their former haunts. Many hours were spent combing these areas without luck. Factors such as fire suppression and development have apparently taken their toll on some local populations, especially those in central Georgia, west central Alabama, and south central Florida (see Fig. 4. on our web site http://www.famu.org/gopher). We began to keep records of all confirmed

sightings of pocket gopher mounds. The confirmation process usually consisted of stopping the car so that one of the mounds could be kicked to see if any fire ants were there. If not, the mound was scraped away to the soil surface to look for a plugged burrow entrance. Slowly, a more accurate map showing the distribution (past and present) of the southeastern pocket gopher began taking shape. After three winters of intensive field-work, we had samples from over 200 burrows throughout the range of the southeastern pocket gopher. At this point we began compiling and mapping our distribution data, but continued sampling a few sites for two additional seasons to get a complete picture of the entire range.

Most of the material collected from the burrows has been curated and some of it is now in the hands of specialists who are in the process of identifying the specimens. We are presently preparing manuscripts describing some of the new species and have began a GIS analysis of the insects distribution patterns.

Man has long regarded the pocket gopher as a pest. Our study has helped support the notion that the pocket gopher is also a keystone species with some ancient associations. We have significantly added to the list of species that are entirely dependent on the pocket gopher for their existence. We hope our study fosters further work on the arthropods inhabiting pocket gopher burrows.

Inherent Pitfalls of Insect Surveys

The easy part of an insect survey is gathering the material. It is another matter entirely to get it curated, identified to the species level, and the data compiled. Taxonomists willing and able to help with species identifications are becoming increasingly scarce, thus limiting the scope of an intended project. Surveys tend to generate a large volume of material, which represents raw data. This material needs to be properly cared for and housed in an insect collection. If the material is mounted, properly labeled, and identified, finding a repository is usually not be a problem. In the case of our survey, most of the material was originally collected in propylene glycol and then transferred to whirl packs containing 75% alcohol. Fortunately, most beetles hold up well when stored in alcohol but this is not the case for other insect groups. Survey projects targeting a specific group of insects invariably generate "residues" of non-target insects. If a survey is conducted in a remote locality or a microhabitat for which sampling is specialized and labor intensive (as with our study) every effort should be made to preserve residues for future study.

Obtaining permission to conduct field-work can be difficult. Permits were required by various state agencies to trap gophers. No permits were generally required to collect insects from pocket gopher burrows. However, we often had to do a great deal of explaining (sometimes in writing) as to why we sought access to trap gophers on private property. It was often difficult for private landowners to grasp the purpose of our study. While we were rarely denied access to areas we wished to sample, we were sometimes permitted entry only after hunting season was over. Hunting season coincides with peak activity of the insects and this may have cost us some data.

Obtaining funding to do most basic research is often problematic. With the exception of some modest monetary support provided by Theodore Cohn, an orthopterist assisting with our project, our survey was funded out of pocket. We pursued grant funding, but unfortunately we were unable to obtain any additional financial support. We hope that publishing our results will facilitate obtaining money so that we may continue to explore the pocket gopher burrow fauna for other insect taxa and in other parts of the U.S.

Final Comments

It is important to acknowledge the role amateur or avocational entomologists have played in improving our knowledge of insects. These entomologists voluntarily provide much needed man power for surveys and often do so with personal funds. In addition, these entomologists frequently have extensive regional knowledge, as well as collections of literature and insects that rival those in larger institutions. It benefits all of us to support and encourage their efforts.

Entomologists conducting insect surveys quickly discover that these endeavors are difficult. On one hand, the abundance and diversity of insects make them perhaps the most ideal subjects available for ecological and biogeographical studies. On the other hand, because of their diversity and abundance, it may take many years to sort, mount, label, and identify the insects gathered in a passive trap like a Malaise or flight intercept trap run in a given area for a single season. Evidence suggests that certain insects are habitat specific. These taxa may be useful for conservation and land management decisions. However, for many insects we know little of their distributions or habitat specificity. The only way to remedy this is through dedicated field studies, survey work, and the support of the avocational entomologists.

To summarize, local faunal surveys give us a better understanding of the insect life around us. They can help us to answer larger questions concerning the geographic and temporal distributions and help us to better understand their ecological associations. They can show us where our knowledge is deficient and where we have a handle on things. We need to remember that there is still much to discover in our own backyards.

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