

2008

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Recommended Citation

Kovarik, Peter W.; Chordas, Stephen W. III; Robison, H.; Skelley, P.; Connior, M.; Fiene, J.; and Heidt, G. (2008) "Insects Inhabiting the Burrows of the Ozark Pocket Gopher in Arkansas," *Journal of the Arkansas Academy of Science*: Vol. 62 , Article 12.

Available at: <http://scholarworks.uark.edu/jaas/vol62/iss1/12>

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Abstract

Pocket gopher burrows provide a stable environment for a variety of inquilines; hence this mammal is regarded as a keystone species. Most of the arthropods inhabiting pocket gopher burrows are restricted to this microhabitat. As part of a planned state-wide biotic survey of insects inhabiting this unusual microhabitat, we have focused our initial sampling efforts on the Ozark pocket gopher (*Geomys bursarius ozarkensis*; Geomyidae). In 2004 and 2005, pitfall traps were established in pocket gopher burrows and in 2007 and 2008, nests and associated chambers were excavated. Retrieved samples contained scarab, histeoid, and rove beetles, cave crickets and anthomyiid flies. The histeoids consisted of five species, one of which is undescribed, and all of which are new state records. A total of five species of scarab beetles were collected and all of these represent new state records. Two species of cave crickets were collected; one appears to be undescribed, and the other is essentially a Great Plains species and represents a considerable range extension. Both crickets are new to Arkansas.

Introduction

Pocket gopher burrows harbor a niche-specific arthropod fauna consisting mainly of beetles, cave crickets and flies (Hubbell and Goff 1939, Hubbell 1940, Ross 1940, 1944a, 1944b, Skelley and Gordon 2001, Skelley and Kovarik 2001, Skelley and Woodruff 1991, Kriska and Katovich 2006, Paulsen 2006). The beetles and flies tend to inhabit the nest and fecal chambers of the pocket gopher while the cave crickets tend to inhabit the burrow runways. Recently, an improved understanding of the distributions of many of these insects has been achieved through the combined sampling efforts of a growing number of biologists. In some cases these surveys focused on insects inhabiting burrows of a particular species or subspecies of pocket gopher while in other instances

the surveys were geopolitically bounded. Some of this work has been published, but much of it remains unpublished.

In 2000, Elrod et al. published an intriguing paper describing an isolated subspecies of pocket gopher (*Geomys bursarius ozarkensis*) inhabiting the Ozark Mountains in Arkansas. According to Elrod et al. (2000), this subspecies is more closely related to a subspecies in Missouri (*Geomys bursarius missouriensis*) than to the geographically proximate species *G. breviceps*. Insect sampling from pocket gopher burrows thus far had indicated that there was a correlation between isolated populations of *Geomys* and insects new to science, and all indications were that the same should hold true for the Ozark pocket gopher. Accordingly, we selected Izard County as the starting point for a planned state-wide survey of insects inhabiting pocket gopher burrows in Arkansas. In April of 2004, three pitfall traps were established in pocket gopher burrows next to the White River in Guion, Arkansas. In only two days time, these traps had produced two beetle species and two species of cave crickets, which were all new state records and one species of crickets was new to science. More extensive pitfall sampling was conducted at several different localities the following year, and in 2008, nests and associated chambers of this species were excavated and sampled for the first time for insects. Some of the scarab records that appear in this paper were recently published by Gordon and Skelley (2007). This paper also includes new generic level combinations for the species of scarabs formerly included in the genus *Aphodius*.

Materials and Methods

Pitfall sampling was done during April in 2004 and 2005. Nest/chamber excavations were done during January, February, and March of 2008. Methods used in locating burrows, removing gophers, and pitfall trapping insects are described in detail by Skelley and

Gordon (2001) and Skelley (1992). Radio telemetry was employed to locate nests before subsequent excavation. Methods and live traps used to capture pocket gophers are described in detail in Connior and Risch (2008a). After capture, radio transmitters were implanted (PD-2H, Holohil Systems, Ltd., Carp, Ontario, Canada) subcutaneously in the individuals at the field site (Connior and Risch 2008b). Probable nest sites were located by repeatedly tracking these individual pocket gophers via radio telemetry to a static location inside their burrows. Subsequent excavation of seven of these areas resulted in a nest find, thus validating the reliability of this methodology. In December 2007, latrine chambers that had been pushed above ground during mound building were collected opportunistically when noticed. Insects were gathered from three localities within Izard County. Since all of the areas where the gophers occur are in private hands, the localities chosen for sampling were those for which we were able to obtain permission from the landowner. These localities were as follows:

- 1) Guion, Hwy. 58 at White River bridge (35°55.55'N; 091°56.85'W)
- 2) North of Guion, 10 km. N. jct. Rt. 58 & White River bridge (35°58.30'N; 091°52.02'W)
- 3) South of Melbourne, 2.4 km. S. jct. Rt. 9 & CR. 3 (36°1.53'N; 091°54.81'W)

Specimen identifications were furnished by the following specialists for each group as listed: T. Cohn, University of Michigan (Gryllacrididae); P. W. Kovarik, Columbus State Community College (Histeridae); P. E. Skelley, Florida State Collection of Arthropods (Scarabaeidae).

Material from this study will be deposited in the collections of the following institutions: Arkansas State University, Florida State Collection of Arthropods, and the University of Michigan.

Results

Insects collected in Ozark pocket gopher burrows include cave crickets, anthomyiid flies, and histerid, rove and scarab beetles. Species of both rove beetles and anthomyiid flies remain undetermined. The list of identified species is listed in the following format: scientific name, abbreviated locality, date, number collected, and collecting method.

Coleoptera

Histeridae

Atholus minutus Ross

North of Guion, 9-12.IV.2005, (2), pitfall traps

South of Melbourne, 9-12.IV.2005, (1), pitfall traps

Atholus nubilus J. L. LeConte

South of Melbourne, 9-12.IV.2005, (6), pitfall traps

Geomysaprinus new species

South of Melbourne, 10-12.IV.2005, (4), pitfall traps

Onthophilus kirni Ross

Guion, 2-4.IV.2004, (2) pitfall traps

South of Melbourne, 27.I.2008, (93), nest/chambers excavation

South of Melbourne, 3.II.2008, (30), nest/chambers excavation

South of Melbourne, 23.III.2008, (11), nest/chambers excavation

South of Melbourne, 26.III.2008, (4), nest/chambers excavation

South of Melbourne, 28.III.2008, (2), nest/chambers excavation

Spilodiscus gloveri (Horn)

South of Melbourne, 10-12.IV.2005, (1), pitfall traps

South of Melbourne, 27.I.2008, (3), nest/chambers excavation

South of Melbourne, 3.II.2008, (9), nest/chambers excavation

South of Melbourne, 23.III.2008, (2), nest/chambers excavation

South of Melbourne, 28.III.2008, (3), nest/chambers excavation

Scarabaeidae

Cryptoscatomaseter haldemani (Horn)

Guion, 2-4.IV.2004, (2) pitfall traps

South of Melbourne, 20.XII.2007, (9), surface latrine mound

South of Melbourne, 6.I.2008, (1), pitfall traps

South of Melbourne, 27.I.2008, (22), nest/chambers excavation

South of Melbourne, 3.II.2008, (4), nest/chambers excavation

South of Melbourne, 23.II.2008, (1), nest/chambers excavation

South of Melbourne, 23.III.2008, (1), nest/chambers excavation

Cryptoscatomaseter oklahomensis (Brown)

South of Melbourne, 9-12.IV.2005, (16), pitfall traps

South of Melbourne, 19.XII.2007, (5),

South of Melbourne, 20.XII.2007, (12) surface latrine mound

South of Melbourne, 6.I.2008, (1), pitfall traps

South of Melbourne, 27.I.2008, (62), nest/chambers excavation

South of Melbourne, 3.II.2008, (8), nest/chambers excavation

South of Melbourne, 23.II.2008, (47), nest/chambers excavation

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South of Melbourne, 23.III.2008, (59), nest/chambers excavation

South of Melbourne, 26.III.2008, (3), nest/chambers excavation

South of Melbourne, 28.III.2008, (22), nest/chambers excavation

Dellacasiellus kirni (Cartwright)

North of Guion, 9-12.IV.2005, (1), pitfall traps

South of Melbourne, 9-12.IV.2005, (4), pitfall traps

South of Melbourne, 12-22.IV.2005, (5), pitfall traps

Geomyphilus insolitus (Brown)

North of Guion, 9-12.IV.2005, (3), pitfall traps

North of Guion, 12-22.IV.2005, (4), pitfall traps

South of Melbourne, 10-12.IV.2005, (1), pitfall traps

South of Melbourne, 12-22.IV.2005, (1), pitfall traps

South of Melbourne, 20.XII.2007, (23), surface latrine mound

South of Melbourne, 27.I.2008, (203), nest/chambers excavation

South of Melbourne, 3.II.2008, (59), nest/chambers excavation

South of Melbourne, 23.II.2008, (13), nest/chambers excavation

South of Melbourne, 23.III.2008, (18), nest/chambers excavation

South of Melbourne, 28.III.2008, (72), nest/chambers excavation

Scabrostomus sepultus (Cartwright)

South of Melbourne, 12-22.IV.2005, (1), pitfall traps

South of Melbourne, 20.XII.2007, (15), surface latrine mound

South of Melbourne, 6.I.2008, (1), pitfall traps

South of Melbourne, 27.I.2008, (5), nest/chambers excavation

South of Melbourne, 3.II.2008, (14), nest/chambers excavation

South of Melbourne, 23.II.2008, (1), nest/chambers excavation

South of Melbourne, 23.III.2008, (1), nest/chambers excavation

Orthoptera

Gryllacrididae

Ceuthophilus fusiformis Scudder

Guion, 2-4.IV.2004, (3 ♂) pitfall traps

Ceuthophilus new species

Guion, 2-4.IV.2004, (several ♂) pitfall traps

[note: *Ceuthophilus* spp. were collected at additional localities in 2005 but have not yet been identified]

Discussion

The pitfall sampling in April 2004-2005 yielded five species of histerids, five species of scarabs, and two species of cave crickets. All of these species were new state records for Arkansas, and one of the crickets and one of the histerids are new to science. Prior sampling of inquilines in the burrow of *Geomys pinetus* (Rafinesque) by Skelley and Kovarik (2001) demonstrated that if at least three pitfalls were allowed to operate undisturbed in a given area during the period of peak insect activity, most of the niche-specific species could be collected. Although we had problems with flooding, a total of seven pitfall traps were successfully run in Izard County and we had every reason to believe that we had collected most of the insect species inhabiting the burrows of the Ozark pocket gopher. In 2007 and 2008 additional pitfall sampling and excavations of nest/associated chambers were carried out. Since most of the beetles inhabit the nest/fecal chambers, excavations are an extremely thorough means of sampling. The extra sampling produced no additional species of insects.

While the known distributions of most of the determined insects inhabiting the burrows of the Ozark pocket gopher should be regarded as preliminary, some general trends are apparent. All of the scarabs are essentially Great Plains species. Three species, including *C. haldemani*, *C. oklahomensis*, and *S. sepultus* are confined to the southern Great Plains while *D. kirni* and *G. insolitus* extend into the northern Great Plains, including prairie remnants in Illinois, Indiana, and Wisconsin (Kriska and Katovich 2006, Gordon and Skelley 2007). Otherwise, none of the scarabs occur east of the Mississippi River. Two of the histerid species, *O. kirni* and *A. minutus*, do occur east of the Mississippi River (Helava 1978, Ross 1940). *Atholus minutus* also occurs in the northern Great Plains whereas *O. kirni* does not occur north of southern Kansas (Kovarik unpubl.). With regard to the crickets, *Ceuthophilus fusiformis* inhabits the northern and southern Great Plains (Hubbell 1936) and occurs west of the range of the eastern pocket gopher (*Geomys* spp.) where it presumably associates with the western pocket gopher (*Thomomys* spp.). *Ceuthophilus fusiformis* ranges just east of the Mississippi River in Illinois but remains west of Mississippi in the southern part of its range. Conversely, the new *Ceuthophilus* is known to occur in western Florida and Alabama.

The discovery of the histerid *A. nubilus* in the burrows of the Ozark pocket gopher was surprising. This is the first time that this species of beetle has been collected from pocket gopher burrows. Enough specimens of this species were collected to make it

unlikely that its occurrence in the burrow was accidental. This species is obviously not restricted to pocket gopher burrows, as it occurs in Mississippi where pocket gophers are absent. *Atholus nubilus* is the same size class as the common and widespread burrow inhabiting histerids, *Geomysaprinus goffi* Ross and *G. rugosifrons* (Fall), which were notably absent from the burrows of the Ozark pocket gopher. It is tempting to postulate that a vacant niche has been filled by a species not normally associated with pocket gophers.

A survey of the Coleoptera inhabiting burrows of *Geomys breviceps* in Louisiana (Tishechkin and Cline 2008) demonstrated a significant overlap in the burrow fauna of IZard County and Louisiana. Missing from Louisiana were the scarab *C. oklahomensis* and the histerid *Geomysaprinus* new species. Missing from IZard County were the scarabs *Cryptoscatomaster acuminatus* (Cartwright) and the histerid *G. goffi*.

Acknowledgments

We wish to thank Andrea Daniel of the Arkansas Game and Fish Commission for granting us permits to sample. We also thank the landowners Y. D. Whitehurst and Sonny Brooks for providing access to their property. Identifications of the gryllacridids were kindly provided by Theodore Cohn, Professor Emeritus of the University of Michigan. We wish to acknowledge Eric Chapman's contribution to field work at Guion in 2004. We also thank Andrew Cline for reviewing and commenting on this manuscript.

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