# EDITOR

Andrew J. Flurkey 13841 Braun Dr. Golden, Colorado 80401-2142 (303) 271-1073

# **BOARD OF EDITORS**

#### SOCIAL SCIENCES

Marion O. Smith P.O. Box 8276 University of Tennessee Station Knoxville, TN 37916

# **EXPLORATION**

Louise D. Hose Department of Geology University of Colorado Colorado Springs, Colorado 80933-7150 Idhose@uccs.edu

Material to be included in a given number

LIFE SCIENCES

ANTHROPOLOGY

**BOOK REVIEWS** 

H. H. Hobbs III

Patty Jo Watson

**Betty Wheeler** 

1830 Green Bay St.

Wittenberg University

Department of Biology

Springfield, Ohio 45501

Washington University

St. Louis, Missouri 63130

LaCrosse, Wisconsin 54601

Department of Anthropology

must be received at least 90 days prior to the first of month in which publication is desired. No submission will be accepted for publication unless and until one of the three options in our printed "Copyright Agreement" form has been selected by the author(s) and the form has been properly dated, signed, and returned to the Editor.

Discussion of papers published in The Bulletin is invited. Discussion should be 2000 words or less in length, with not more than 3 illustrations; they should be forwarded to the appropriate editor within 3 months of publication of the original paper

A voluntary contribution of \$25.00 per page is solicited from authors after their manuscripts have reached page-proof stage. This represents

about one-quarter of the cost of publication. All issues through Volume 40 (1978) are copyrighted O by The National Speleological

Society; the photocopying or reproduction, or recording by any electrical or mechanical process of any issue still in print is a violation of copyright, unless prior permission has been granted. However, abstracts, figures, and tables may be freely copied by anyone so long as proper credit is given

Beginning with Volume 41 (1979), the complete issues are still copyrighted O by The National Speleological Society. Individual papers, however, may be in the public domain, copyrighted by the NSS, or copyrighted by the authors, personally (but with the right to grant permission for non-profit use delegated to the

NSS). The copyright status of each paper is given on its first page. No copyrighted paper still in print may be photocopied or reproduced, or recorded by any electrical or mechanical process without prior permission; permissions for the commercial use of papers copyrighted by their authors must be obtained from the authors. As previously, abstracts, figures, and tables may be freely copied by anyone so long as proper credit is given.

CONTRIBUTING EDITORS

EARTH SCIENCES

**CONSERVATION** 

University of Wisconsin, LaCrosse

Norma Peacock

Ira D. Sasowsky

Ira D. Sasowsky

118 Waupelani Dr.

**George Huppert** 

State College, PA 16801

Department of Geography

LaCrosse, Wisconsin 54601

Bulletin Index

Abstracts

A catalog of issues still in print and their cost can be obtained from our Business Office at no charge; facsimile copies of out-of-print issues can be supplied for a nominal fee.

The "fair use doctrine" permits free copying for scholarly or education purposes, the above conditions notwithstanding.

The NSS Bulletin (ISSN 0146-9517) is published semiannually by the National Speleological Society, Cave Avenue, Huntsville, Alabama 35810. The annual subscription fee, worldwide, by surface mail, is \$18 U.S. Airmail delivery outside the United States of both The NSS NEWS and The NSS Bulletin is available for an additional fee of \$40 (total: \$55); The NSS Bulletin is not available alone by airmail. POSTMASTER: send address changes to The NSS Bulletin, Cave Avenue, Huntsville, Alabama 35810.

Copyright © 1995 by the National Speleological Society, Inc. Stoyles Graphic Services Lake Mills, IA 50450

Peck, Stewart B., The Cave Fauna Of Alabama. Part II: The Insects: NSS Bulletin 57: 1-19.

6

1

 $\bigcirc$ 

6

 $\odot$ 

۲

Q

# THE CAVE FAUNA OF ALABAMA. PART II: **THE INSECTS**

STEWART B. PECK Department of Biology, Carleton University, Ottawa K1S 5B6 Canada

Results are presented from a survey of the insects inhabiting about 250 caves in Alabama, at the southern end of the Appalachian Mountains. A rich fauna of over 200 species of insects is now known from aquatic and terrestrial cave habitats in Alabama. Sixty-nine of these species are judged to be cave-limited troglobites, 69 are troglophiles, and 18 are trogloxenes. The troglobitic species consist of 9 collembola, 5 diplurans, 21 carabid beetles, 20 pselaphid beetles, and 13 leiodid beetles.

#### INTRODUCTION

This is the second part of a summary of the cave-inhabiting faunas of Alabama. The non-insect terrestrial invertebrates were covered in Part I (Peck 1989). That work also presented back-

ground information on Alabama physiography, geology, and cave distribution. The third part of this series will unite the data

of part I and II into a summary of faunal regions, geographic distributions and barriers to dispersal, and will present an overview on the origin, isolation, and evolution of the terrestrial invertebrate cave faunas.

Over 2000 caves are now known in Alabama. Most of them are in Madison, Morgan and Jackson Counties, in the northeastern corner of the state, in what is called the "Jackson County Mountains" (Fig. 1). Cave location is controlled by geology.



(from Johnson 1930). Most Alabama caves occur here. Very few are developed in Cretaceous or Tertiary rocks on the east Gulf Coastal Plain of southern Alabama.

Cover: Cylindrical rim and "stalagmite" with drip tube, Geophyzicheskaja Cave, Turkmenia. See Klimchouk and others, page 31.



Copyright © 1995 by the National Speleological Society.





Figure 2. Counties in Alabama from which cave-inhabiting insects are known. Abbreviations are the first letters for the following counties: Blount, Butler, Calhoun, Clarke, Colbert, Conecuh, De Kalb, Franklin, Jackson, Jefferson, Lauderdale, Lawrence, Limestone, Madison, Marshall, Morgan, Shelby, St. Clair, and Talladega.

Counties in which caves have been studied for invertebrates are shown in Figure 2. Other cave regions are the Highland Rim, Moulton Valley, Sequatchie Valley, and Wills Valley. Data on cave locations and descriptions can be found in Jones and Varnedoe (1968, 1980), Varnedoe (1973, 1975, 1981), and the publications of the Huntsville Grotto. Persons interested in studying Alabama caves should contact the Huntsville Grotto of the NSS or the National Speleological Society, 2813 Cave Avenue, Huntsville, Alabama, 35810.

#### CAVE FAUNAS

One of the most fascinating aspects of cave faunas is their evolutionary adaptation to life in rigorous subterranean environments. General background information on the evolution and ecology of cave animals can be found in Barr (1968), Barr and Holsinger (1985), Culver (1982), Holsinger (1988), and Howarth (1983).

Regional cave faunal surveys have been made for much of the southeastern United States. Examples are: Florida (Peck 1970), Georgia (Holsinger and Peck, 1971), and Tennessee and Virginia (Holsinger and Culver, 1988). The present report is a contribution to an understanding of the cave-inhabiting insects of Alabama, at the junction of the southern Appalachians and the Gulf Coastal Plain.

The purpose is to give a list of the species of insects found in caves, and to present data on their distribution.

#### FIELD STUDY

Collecting efforts in Alabama caves have been as extensive and as intensive as possible. In addition to direct visual searching I have used Tullgren funnel extraction of arthropods from organic debris and have extensively used dung and carrion baits.

Since 1963 I have devoted some 50 weeks of full-time field work to Alabama cave faunas. A total of 543 research visits has been made to 213 caves in 14 Alabama counties. Collecting by others brings the total to about 250 caves that have received some biological study. Faunas of the dark zone of the caves received the most emphasis. Entrance and twilight zone faunas are under-represented in this study as are cave litter and soil faunas and parietal (wall-inhabiting) faunas. The latter have been emphasized in studies of cave faunas in other areas (Peck 1988; Peck and Christiansen 1989). A general introduction to the study of cave biology is that by Cooper and Poulson (1968).

#### ANNOTATED FAUNAL LIST

The following list uses the same conventions as in Part I of this series (Peck 1989). Cave-inhabiting animals can usually be easily placed into one of the four ecological-evolutionary categories often used in cave biology (Barr 1968). (1) *Troglobites* (TB) are obligatory cave species that are morphologically spe-

cialized for, and restricted to, cave habitats and are unable to live in non-cave habitats. They always display some degree of troglomorphy (morphological specialization for subterranean life). (2) Troglophiles (TP) are facultative cave species, which frequently inhabit caves and complete their entire life cycles there, but many occupy ecologically similar (cool, moist, and dark) habitats outside of caves. They often display some degree of troglomorphy. (3) Trogloxenes (TX) are species that often occur in caves but are incapable of completing their entire life cycle in caves. They must at some time leave the cave, usually for feeding purposes. They only rarely display any troglomorphy. (4) Accidentals (AC) are species that accidentally wash, wander, or fall into caves and can exist there only temporarily. Although these may serve as food sources for regular cave inhabitants, the accidentals are of no importance in distributional or evolutionary analysis of cave faunas. I have listed most species judged to be accidentals (but excluded obvious herbivores such as leaf hoppers), even though this category could potentially, through time, come to embrace much of the fauna in the area containing the cave. In many cases, it is still too early  $t_0$ judge the relative degree of cave association of many species.] think it better to include the species than to lose the information. By so doing, patterns of cave association that are not yet apparent may emerge through the compilation of additional data (as was found for cantharid beetle larvae, Peck, 1975b), and the category to which the species is assigned may be changed.

The ecological term *endogean* (EN) or *edaphobite* (ED) may also be used for cave animals. There are species that normally live in soil, such as earthworms, and their occurrence in caves is usually sporadic. Subterranean habitats or organisms may be called *hypogean* and this contrasts with *epigean*, which means above the soil surface.

Many of the species found in the following list are still inadequately known in their distribution outside Alabama and in their ecology; their assignment to one of the above ecologicalevolutionary categories should be considered tentative and subject to revision when additional information is available. The following abbreviations, placed after the organisms' names, have been employed: TB = troglobite; TP = troglophile; TX = trogloxene; ED = edaphobite; AC = accidental.

Some of the taxa found in this list are still poorly known and, therefore, could not be determined to species. Other forms, such as millipedes, are not being studied and specific names are not available. Still other material represents undescribed species for which names and descriptions have not been published. Because of these reasons, this list should be regarded as subject to later refinement. However, considering the number of sites sampled, the data given in this list are believed to form a nearly complete picture of the invertebrate fauna of the caves of the region.

Because of space limitations, I do not give supporting data for species records presented here, such as date of collection, collector's name or collection containing the specimens. Records not found in the references listed for each species should generally be assumed to be new records made by me or provided by the specialists acknowledged at the end of the paper. Unpublished records made by other collectors are followed by the initials of the collector. These initiated collectors are listed in the acknowledgments.

Published cave names that do not agree with present usage are placed in parentheses following the currently accepted cave names. Sometimes there is more than one cave in a county with the same name. When this occurs, the Alabama cave survey number (e.g., AL 60) is used to indicate the identity of the cave. Some cave names used here are not known to the Alabama cave survey. They are included here as they are stated on the specimen label so that the data and record will not be lost.

Where species names and names of higher taxa do not correspond to those given in some of the older literature, it is because we have used names based on more recent revisional studies. Where more recent studies have shown older literature locality records to be based on inaccurate identifications, I have not listed the erroneous localities.

The higher taxa have been listed in generally accepted phylogenetic sequence. Genera within families and species within genera have been listed in alphabetical order. Localities are listed alphabetically by county within the state and by cave within the county.

Counties are useful geographical units under which caves can be grouped. They may or may not have natural physiographic boundaries that relate to cave faunas. The Alabama counties mentioned in the following faunal listing are shown in Figure 2. Some new records are given for poorly known invertebrates in adjacent states, to help document their distributions.

Notes on some cave localities.

Three caves listed below have been destroyed. Town Creek Cave (AL 40) has been flooded, and Toll Gate Natural Well (AL 61) and Sinks Cave (AL 102) have been filled in.

Nickajack Cave has its sole entrance in Tennessee, but it extends under Jackson County, Alabama, so has been included as an Alabama cave site. The entrance passage is now flooded by a TVA impoundment, but the terminal rooms, in Alabama, should be above the water level.

Early collections by Walter B. Jones were made in the following caves, which can no longer be identified or located; Spring AL 31; Terrill AL 32, Kelly Natural Well AL 49, Ingram AL 70, Clemons AL 73, Wolf Den AL 83, Dickey AL 84, Spring AL 85, Pack Rat AL 89 caves.

SUPERCLASS HEXAPODA

Class Parainsecta Order Collembola

The springtails of North America have been summarized to species level by Christiansen and Bellinger (1980), and keys to genera are given by Christiansen (1990). Many species live in

caves. Cave colembola evolution and distribution are summarized by Christiansen (1961, 1965, 1982, 1985) and Christiansen and Culver (1987). The Alabama cave collembola fauna is probably richer in species that is indicated by the following records.

## Family Entomobryidae

*Pseudosinella argentea* Folsom, TP. Jefferson County: Mc-Cluney (Crystal) Cave.

*Pseudosinella collina* Wray, TP. Blount County: Bryant Cave. Calhoun County: Weaver Cave. Jackson County: Tumbling Rock Cave. Jefferson County: Crystal (McCluney) Cave. This primarily surface species occurs in caves through most the southeastern states (Christiansen 1960a; Christiansen and Bellinger 1980).

*Pseudosinella christianseni* Salmon, TB. De Kalb County: Mose's Tomb and Talley Cave. Jackson County: Cornellison No. 2, Indian Rock, and Horseshoe caves. Morgan County: Wolf Cave. This species is also known, but only from caves, from Kentucky, Georgia, and Tennessee. It was once called *P. boneti* (Christiansen 1960a) and is a highly troglomorphic derivative of *P. hirsuta* (Salmon 1964; Christiansen and Bellinger 1980).

Pseudosinella folsomi Denise, TP. Blount County: Cedar Grove River Cave. The species ranges from Illinois and Arkansas to Louisiana and Texas and is known from a cave in Missouri (Christiansen 1960a; Christiansen and Bellinger 1980). Pseudosinella hirsuta (Delamare Deboutteville), TB. Blount County: Bangor Cave, Bryant Cave, Horseshoe-Crump, and Randolph (JEC) caves. Calhoun County: Daugette Cave #1 and Wrights Cave (WBJ). Colbert County: Galleymore, Keeton, and Murrels caves. De Kalb County: Cemetary, Cherokee, Manitou, Section 26, Stanley-Carden, and Talley caves. Jackson County: Crossing, Edgefield, Greising, Horseskull, Kennamer, New Fern, Paint Rock, Pig Pen, Rainbow, Salt River, Sheldons, and Steele Saltpeter caves. Lauderdale County: Bone, Collier and Key (JEC) caves. Limestone County: Spence Cave. Madison County: Alladin, Burwell, and Hurricane caves. Marshall County: Bishop, Cathedral Caverns, Davidson, Guntersville Caverns, Kirkland, Lower Four Lane, McHardin, Merrill, Painted Bluff, and Porches Spring caves. Morgan County: Inge and Talucah caves. Shelby County: Anderson Cave. St. Clair County: McLendon Cave. The species is also known from Tennessee Kentucky, Virginia, and Georgia, but with one exception only

from caves (Christiansen 1960a; Christiansen and Bellinger 1980; Delamare and Debouteville 1949). Geographic variation has been studied by Christiansen and Culver (1968).

*Pseudosinella nata* Christiansen and Bellinger, TB. Jefferson County: McCluney (Crystal Cave) (type locality). Known only from this cave (Christiansen and Bellinger 1980).

*Pseudosinella pecki* Christiansen and Bellinger, TB. Jackson County: Unspecified cave. Also known only from caves in Georgia (Decatur, Randolph, and Stewart counties) and Jackson County Florida (Christiansen and Bellinger 1980). *Pseudosinella rolfsi* Mills, TP. Blount County: Bryant Cave. *Pseudosinella spinosa* (Delamare Debouteville), TB. Jackson County: Bucks Pocket, Engle Double Pit, Hambrick, Jesse Elliott, McFarland, Paint Rock, Rising, Scott, Sheldons, and Tumbling Rock caves. Madison County: Aladdin Cave (type locality!), Green Grotto, Chapman Cave Spring (A60), and Jacks caves. Marshall County: Guffey Cave. Morgan County: Wolf Cave in Newsome Sinks. Shelby County: Anderson Cave. The species is limited to caves and occurs in central Tennessee and northeastern Alabama and adjacent Georgia (Christiansen 1960a, Christiansen and Bellinger 1980).

*Pseudosinella violenta* (Folsom), TP. Blount County: Cedar Grove, River Cave.

Sinella barri Christiansen, TP. De Kalb County: Cook Cave. The species is distributed from Arkansas, through Kentucky, to Virginia, and south to Alabama. There are some records from non-cave habitats (Christiansen 1960a).

*Sinella (Coecobrya) caeca* (Schott), TP. Calhoun County: Weaver Cave. The species is widely distributed across the United States and is frequently found in caves (Christiansen and Bellinger 1980).

*Tomocerus (Pogonognathellus) bidentatus* Folsom, TP. Blount County: Bryant and Randolph caves. Colbert County: unspecified cave. De Kalb County: Cook Cave. Jackson County: Merrill Cave. Madison County: Barclay, Bishop, and Cold Spring caves. Marshall County: Guntersville Caverns and Porches Spring Cave. The species is widespread and is known from caves in California and seven eastern states (Christiansen 1964, Christiansen and Bellinger 1980).

*Tomocerus (Pogonognathellus) dubius* Christiansen, TP. De Kalb County: Cook and Kelly Girls caves. Jackson County: Paint Rock Cave. Madison County: Hurricane Cave. This species is spread over much of the United States, is common in epigean sites in Alabama, and is also known from caves in Kentucky and Tennessee (Christiansen 1964, Christiansen and Bellinger 1980).

*Tomocerus (Pogonognathellus) flavescens* (Tullberg), TP. Blount County: Bryant Cave. Jackson County: Horseshoe Cave. Marshall County: Cathedral Caverns. The species occurs commonly across the continent, and is known from caves in ten states (Christiansen 1964, Christiansen and Bellinger 1980).

*Tomocerus (Tomocerina) lamelliferus* (Mills), TP. Jackson County: Paint Rock Cave. Madison County: Burwell Cave. The species ranges from Oregon and Ontario southward to North Carolina and Alabama. It is occasionally found in caves (Christiansen 1964; Christiansen and Bellinger 1980).

#### Family Hypogastruridae

Hypogastrura (Ceratophysella) denticulata group, TP. Jackson County: Doug Green and Limrock Blowing caves.

*Hypogastrura essa* Christiansen and Bellinger, AC. Madison County: Cave Spring Cave (A 60).

*Hypogastrura sparta* Christiansen and Bellinger, AC. Madison County: Cave Spring Cave (A 60).

Schaefferia (Typhlogastrura) alabamensis Thibaud, TB. Blount County: Bryant Cave (type locality). Jackson County: Swain Cave. Known only from specimens from the stomachs of Eurycea lucifuga salamanders caught in these caves (Peck and Richardson 1976; Thibaud 1975).

Schaefferia (Typhlogastrura) christianseni Thibaud, TB. Morgan County: Cave Spring Cave (type locality). Known only from this cave (Christiansen and Bellinger 1980, Thibaud 1975).

#### Family Isotomidae

Folsomia candida Willem, TP. Colbert County: McKinney Cave.

*Folsomia penicula* Bagnall, AC. Madison County: Aladdin and Simmons Caves.

*Folsomia* sp., TP. Blount County: Bryant Cave. Jackson County: Sheldons Cave (Christiansen 1960c).

#### Family Onychiuridae

*Onychiurus* sp., TP. Madison County: Hurricane Cave (Christiansen 1960c).

*Onychiurus (Onychiurus) paro* Christiansen and Bellinger, TB. Marshall County: Dunham Cave (type locality). Known only from this cave (Christiansen and Bellinger 1980).

*Onychiurus (Onychiurus) janus* Christiansen and Bellinger, TB. Calhoun County: Weaver Cave (type locality). Known only from this cave and a cave in Greenbrier County, West Virginia (Christiansen and Bellinger 1980).

#### Family Sminthuridae

Arrhopalites pygmaeus (Wankel), TP. Blount County: Bangor Cave. Jackson County: Crossing Cave. Madison County: Barclay, Burwell, Cold Spring, and Sinks caves. Marshall County: Cathedral Caverns. Widely distributed in epigean sites from Alaska to Connecticut and south to Louisiana and Florida and in caves in nine southeastern states (Christiansen 1960c, 1966, Christiansen and Bellinger 1980).

Arrhopalites whitesidei Jacot, TP. Talladega County: DeSoto Caverns (Kymulga Cave). The species is reported from epigean sites from California to New York, and in caves from Wisconsin, Missouri, Iowa, and Indiana (Christiansen 1966; Christiansen and Bellinger 1980).

#### CLASS INSECTA

# Order Diplura

Diplurans are frequent inhabitants of soil and cave habitats. The United States cave fauna has been reviewed by Ferguson (1981), and the US fauna in general by Ferguson (1990a).

#### Family Campodeidae

*Litocaìnpa cookei* (Packard) TB. Jackson County: Nickajack Cave. The species ranges through Tennessee (Cave 5 km (3.5 mi) SSW Bradyville, Cannon County: Burke Cave, Coffee County) into caves in Warren, Greene, Hardin, and Edmonson Counties, Kentucky.

*Litocampa (Tychocampa) henroti* (Condé) TB. Madison County: Green Grotto, Matthews, and Shelta (type locality) caves. The species seems restricted to caves in western outliers of the Cumberland Plateau in Madison County, Alabama (Condé 1949).

Litocampa (Cocytocampa) valentinei (Condé) TB. De Kalb County: Stanley-Carden Cave. Jackson County: Bouldin (RCG), Crossing, Crow Creek (RCG), Edgefield, Fern (RCG), Indian Rock (RCG & WT), Larkin, Limrock Blowing (RCG), Pigpen, Roadside, Russell, Sheldons, Valhalla (WT), and Gary Self Pit (Rousseau entrance) caves. Madison County: Aladdin, Grayson Spring (RCG), Hering (Cave Spring) (type locality), and Styles Spring caves. Marshall County: Cathedral Caverns, Kellers, Kristys (WT), Ledbetter (RCG) and Roaring River (RCG) caves. The species also occurs in caves in Franklin and Grundy counties, Tennessee. It is distributed in caves of the southern Cumberland Plateau.

*Litocampa* n. sp. C, TB. Colbert County: McKinney Pit. De Kalb County: Cherokee Cave. Jefferson County: Cedar Pole Cave. The species is also known from caves in Dade and Walker counties, Georgia.

*Plusiocampa* n. sp. D, TB. Blount County: Bryant and Catfish caves. De Kalb County: Goat House Cave (T. Iles). Jackson County: Salt River Cave. The species is also known from Dade and Walker counties, Georgia, and Bedford and Warren counties, Tennessee.

*Plusiocampa* spp. TB. Calhoun County: Millers Cave (WBJ), Wrights Cave (LGC). De Kalb County: Kelly Girls Cave (WBJ). Jackson County: Bell, Driftwood, Guess Creek, McFarland, Paint Rock, Tate, and Wynne Caves. These represent observed populations which were not collected, which most probably are *P. valentinei* Condé.

#### Family Japygidae

"Japyx" sp., TP-ED. Jefferson County: McCluney (Crystal Caverns) Cave (TCB). Japygids are soil inhabitants that are occasionally found in caves (Reddell 1983).

#### Order Archeognatha

#### Family Machilidae

*Machilus* sp., AC. Franklin County: Ezell Cave (F. Shires). These jumping silverfish are sometimes found inside of cave entrances. so Th Ke

# Order Thysanura Family Nicoletiidae

*Nicoletia* sp., TP-ED. De Kalb County: Cemetary Cave. Jackson County: Talley Ditch Cave. Madison County: Shelta Cave. This is an eyeless and unpigmented soil-inhabiting silverfish. Keys for the identification of silverfish are in Ferguson (1990b).

# Order Orthoptera Family Rhaphidophoridae; the cave-crickets

Cave crickets may be the most conspicuous and common animals in most caves. The fauna in Alabama is quite rich, with 11 species known from Alabama caves. Positive identification can only be made with adult male specimens. A question mark indicates that only immatures (nymphs) or females were collected.

Ceuthophilus gracilipes (Haldeman), TX. Figure 3. Blount County: ?Catfish, ?Cedar Grove River, ?Horseshoe-Crump, ?Ingram (WBJ), and ?Pass caves (WBJ, OP, JMV). Butler County: Hinson (WBJ), and Rock caves (WBJ). Calhoun County: Daugette, Erby, Weaver (Lady) (WBJ), ?Wilson, and Wrights caves. Clarke County: Broadenax (WBJ), ?Elam Church (WBJ), and McVay caves (WBJ). Colbert County: ?Dickey (WBJ), ?Galleymore (WBJ), ?Gist (WBJ), McCluskey, McKinney Pit, ?Spring (WBJ), and ?Wolf Den caves (WBJ). Conecuh County: Sanders (=Turks) Cave (WBJ, L.G. Sanford). De Kalb County: ?Cherokee, ?Manitou (=Fort Payne) (WBJ), and ?Section 26 caves. Jackson County: Horseskull, and Schiffman caves. Jefferson County: McCluney (=Alabama or Crystal) Caverns and Pinson (=Hickman) Cave (OP, WBJ, JMV). Lauderdale County: ?Gravelly Springs Cave (WBJ). Lawrence County: ?Bradford (WBJ), ?Cave Spring (WBJ, IR), ?Check (WBJ, IR), ?Indian



Figure 3. The cave cricket *Centhophilus gracilipes*. This is the most conspicuous insect in Alabama caves. It may occur in large numbers in the daytime just inside of cave entrances. These crickets leave their caves at night to feed in forests.

(WBJ), ?Ivey Hollow (WBJ), ?Thomas (WBJ, IR), Thrasher, (WBJ, IR), Whitlow (WBJ, IR), and ?Unnamed caves in Black Warrior National Forest (WBJ). Madison County: Barclay, Ellis, ?Lott (WBJ), Matthews, Shelta, and Spook caves. Marshall County: ?Dunham, ?Jackson (WBJ), ?Painted Bluff, and Terrill caves. Morgan County: ?Barrell (WBJ, IR), ?Bat (WBJ), Cave Spring (WBJ), Echols (WBJ, IR), ?Hughes (WBJ), ?Inge (WBJ, IR), Lipscomb (WBJ), ?Lost Mule (WBJ, IR), ?Painted Room (WBJ, IR), ?Roper (WBJ, IR French), ?Royer, Sans Souci (WBJ, W.H. Baker), Trinity (WBJ), Whitlow Hole (WBJ, IR), and ?Winchester caves (WBJ, IR). Shelby County: Lous Crawl Cave. St. Clair County: ?McLendon Cave (WBJ). Talladega County: ?DeSoto (Kymulga) Cave (WBJ). Wilcox County: ?Mt. Moriah Cave (WBJ). This camel-cricket species occurs in forests and other epigean habitats and ranges from the New England states southward along the Appalachians, through most of Alabama, to the Florida panhandle and then northwestward to the Ozarks. The range does not overlap with that of the very close species C. stygius except perhaps in Madison and Jackson counties, Alabama. C. gracilipes occurs in caves and frequently in forest habitats in Arkansas, Florida, Georgia, Illinois, Missouri, New York, North Carolina, Ohio, Oklahoma, Tennessee, Virginia and West Virginia (Hubbell 1936 and Hubbell unpubl.).

Ceuthophilus stygius (Scudder), TX. Jackson County: ?Clemens, (WBJ), House of Happiness, ?McFarlen (WBJ), ? McFarlen Spring (WBJ), Gross-Skeleton (=Mink, Out), ?Pack Rat (=Mink, Out) (WBJ), Williams Saltpeter and Unnamed caves (1 mi E Scottsboro, W.H. Baker). Madison County: Cave Spring Cave #60, Jacks, Morring Spring, ?Natural Well (WBJ), and ?Scott caves (WBJ). The species is not frequently found outside of caves. It is distributed in the Interior Low Plateaus from southern Ohio and Indiana southward to Madison and Jackson counties, Alabama, where it comes in close geographic contact with C. gracilipes. C. stygius occurs in caves in Indiana, Kentucky, and Tennessee. The following localities in Jackson County are known to have either C. gracilipes or C. stygius but mature males have not been collected from the sites to make definite determinations in this area of geographic contiguity of the two species: Santa (=Blowing), Boxes Cove, Doug Green, Tony, and Swaim caves.

*Ceuthophilus ensifer ensifer* Packard, TX. Nickajack Cave, Marion County, Tennessee is the type locality for this subspecies. It has been found in Alabama in Jackson County, 7 mi N Flat Rock, but is not yet known from Alabama caves. It is known from caves to the east in Dade County, Georgia.

*Ceuthophilus ensifer* n. ssp. *ap* Hubbell MS, TX. Jackson County: Buds, Clemens (WBJ), ?Coon Creek (WBJ), Crossing, ?Devils Stair Step (WBJ), Doug Green, Gary Self Pit (Rousseau entrance), ?Gross Skeleton (=Mink, Out), ?Hambrick (WBJ), House of Happiness, Isbell Spring, Kennamer, McFarland, Mc-Farland Blowing, McFarland Spring (WBJ), Nat, Sauta (=Saltpeter Cave #50), Schiffman, Sheldons, Slippery Pole, Small, Swaim, Tony, ?Tony Sinks, and Unnamed caves, 1 mi E Scottsboro (W.H. Baker). Madison County: Aladdin, (WBJ), Herin (Cave Spring), Cold Spring, Grayson Spring, Candlestand (=Goat) (WBJ, OP), Hurricane, Hutton (WBJ), Moon (WBJ), St. Clair (AFA), and Scott caves. The species is distributed from Smith and Overton counties, Tennessee to Madison County, Alabama and Dade County, Georgia. It is found in the outer parts of caves as well as forested talus slopes and rocky ravines. These above two subspecies represent two of the four species. Note: The Cold Spring Cave locality overlaps with the range of *C. dioxyurus* n.sp. and det. should be checked.

*Ceuthophilus* n. sp. *ph* MS Hubbell, TX. Marshall County: ?Dunham, Guffey (WBJ), Honeycomb (WBJ), Jackson (WBJ), Kellers, ?Kirkland, ?MacHardin (WBJ), Merrill, Town Creek (Cave Ms 2, WBJ), King School (=Cave Ms-2a of Hubbell, WBJ), Bluff (Cave Ms-3, WBJ), Honeycomb School (Cave Ms-4, WBJ), Bishop (Cave Ms-5, WBJ), Hambrick (Cave Ms-6, WBJ), Painted Bluff, and ?Walnut caves. The species is closely related to *ensifer* and n. sp. *(dioxyurus)*, and it has a range limited to Marshall County, on both sides of the Tennessee River. The ranges of these three species do not overlap.

*Ceuthophilus* n. sp. *di* MS Hubbell, TX. Colbert County: Wolf Den Cave (WBJ). Lauderdale County: Basket (WBJ), ?Coffee (WBJ), ?Collier (WBJ), and Key caves. Limestone County: Rockhouse Cave. Madison County: Barclay, Burwell, Byrd Spring, Cave Spring #60, ?Clark Bluff, Cold Spring, Ellis, ?Kelly Natural Well (WBJ), ?Lott Spring (WBJ), Morring, Sadler Spring (WBJ), ?Sinks (WBJ), Spook, and Toll Gate Natural Well (WBJ) caves.

Ceuthophilus n.sp. di n. ssp. sp MS Hubbell, TX. Blount County: Bangor, ?Bryant, Catfish, Cedar Grove River, Dixon, Frenchs (=Saltpeter) (WBJ, OP), Pass (WBJ, OP, JMV), Posey Spring, (WBJ, OP, JMV), and Randolph caves. Colbert County: Georgetown (WBJ), McKinney (WBJ), and McKinney #2 caves. Marshall County: Davidson, Eudy (WBJ), Griffith (WBJ), ?Guffey (WBJ), Halbrook (T.H. and S.P. Hubbell), Light (WBJ) (=Eudy Cave, AL107), Lime Point (WBJ), Rockhouse (WBJ), ?Saltpeter #37 (WBJ), ?Spring (WBJ), and Warrenton caves (WBJ). Morgan County: Bartee, Blowing #48 (WBJ), Cave Spring (WBJ), ?Houston (WBJ, IR), Hughes, Intreken, ?Lipscomb (WBJ), Skidmore, Talucah (WBJ), and Vandiver Cave #824. The species is known mostly from caves. It has a fairly linear range along and near the Tennessee River from Marshall County westwards to Colbert County. It is divisible into two subspecies, one mostly north of the river in Madison, Lauderdale and (far western) Colbert counties, and the other south of the river in central Colbert, Morgan, Marshall, and Blount counties.

*Ceuthophilus latens* Scudder, TX. Comments. This species is known from caves in Alabama only in Saltpeter (Guntersville Cavern) Cave, Marshall County (WBJ). It is known from epigean sites in northern Alabama, and in caves in Illinois, Kentucky, and Tennessee.

6 • The NSS Bulletin, June 1995

*Euhadenoecus puteanus* (Scudder), TX. De Kalb County: Bartlett, Cherokee, Manitou (=Fort Payne), and Section 26 caves. Jackson County: Coon Creek Saltpeter Cave. The species is distributed from southern New York southwestward along the Appalachians to northeastern Alabama. It occurs in wet to mesic forests, especially where it is rocky, and often in cave entrances, but rarely deep inside caves. It is also known from caves in Georgia, Kentucky, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia (Hubbell and Norton 1978).

*Euhadenoecus insolitus* Hubbell, TX. De Kalb County: Bartlett and Cathcart caves (the location of this cave is not known to the ALA survey). Marshall County: King School (Cave Ms-2a of Hubbell, WBJ), Jackson (= Fort Deposit ) (now submerged), Terrill, and Town Creek caves. Jefferson County: Cedar Pole and McCluney (=Alabama or Crystal) Caverns (type locality). St. Clair County: McLendon Cave. The species also occurs in caves in central Tennessee and perhaps in Barren County, Kentucky. The range is remarkably discontinuous (Hubbell and Norton 1978), and some populations are parthenogenetic.

Hadenoecus jonesi Hubbell, TX. Figure 4. Jackson County: Bouldin, Boxes, Tony Sinks (=Cox), Devils Stair Steps, Doug Green, Engle Double, Fern, Gary Self (Rousseau and Cave Stand entrances), Gross-Skeleton (=Mink, Out), Hambrick, Horseshoe, Keel, Kennamer, Limrock Blowing (type locality), McFarland, McFarland Blowing, McFarland Spring, Montague, Orgy Cave System (an entrance to Kennamer Cave (L. McLennon), Paint Rock, Pig Pen, Ridley, Saltpeter, AL74, Saltriver, Schiffman Cove, Tally Ditch, and Williams Saltpeter caves. Madison County: Aladdin, Cave Spring (Hering), Cold Spring, Grayson Spring, Hutton, Scott Cave, and Walnut Bottom caves. Marshall County: Bishop (Cave Ms-5), Cathedral Caverns (= Bat Cave), Dunham, Gross Skeleton, Guffey, Hambrick (Cave Ms-6), Honeycomb, Kellers, Kirkland, MacHardin, and Merrill caves.



Figure 4. The cave cricket *Hadenoecus jonesi*. This is the second most conspicuous cave insect in Alabama.

Ha se

The species is known from the above records and two sites in Franklin and Lincoln Counties, Tennessee. This is a distribution encompassing the caves at the edge of the Cumberland Plateau, north of the Tennessee River, which seems to represent a barrier. To the northeast is a distribution gap before encountering *H. barri* Hubbell (in Hubbell and Norton 1978) (in the same species group) in caves at the edge of the Cumberland escarpment in Grundy and Warren Counties. Collecting between known sites in Grundy and Franklin Counties would be interesting to see how closely the species come to each other (Hubbell and Norton 1978).

*Tachycines asynamorus* Adelung, AC. Lawrence County: Indian Cave (WBJ, 1961). Madison County: Barclay Cave (at cave mouth, T.H. & S.P. Hubbell). This introduced Asiatic species has rapidly spread in the United States in both natural and manmade environments. It may replace native cave crickets. The occurrence, as known in 1944 is recorded by Rehn (1944). The only other cave record I know of for this species is Cave-in-Rock, Illinois.

# Order Dermaptera Family Carcinophoridae

*Euborellia annulipes* (Lucas), AC, TP?. Marshall County: Hambrick Cave (in bat guano). This is a predator on other insects.

# Order Hemiptera Family Dipsocorida

*Dipsocorus* sp., AC. Jackson County: Indian Rocks Cave (2 adults, 1 immature; which suggests that these reproduce in the cave); they are normally soil inhabitants.

#### Order Psocoptera Family Psocidae

*Episocus (Berthauia) orosbyanus* Chapman, AC. Lauderdale County: Basket Cave. This species is widespread in the eastern U.S. in forest litter. This record was taken from the stomach of the salamander *Eurycea lucifuga*. The salamander may have captured the insect outside the cave (Peck and Richardson 1976).

*Liposcelis* sp. AC?. Jackson County: Tumbling Rock Cave (on dry human feces, one female).

*Psyllipsocus ramburii* Selys-Longchamps, TP. Blount County: Catfish and Horseshoe caves. Calhoun County: Weaver Cave. Colbert County: McKinney and Murrells caves. De Kalb County: Lois Killian and Sequoyah caves. Limestone County: Indian and Rockhouse (WBJ) caves. Jackson County: Cornellison no. 2, Sauta, Larkin, and Tumbling Rock (on dry human feces) caves. Madison County: Byrd Spring Cave. Marshall

County: Cave Mountain (Neotoma nest), Dunham, Terrill, and Quarry caves. St. Clair County: McLendon Cave. This species is also known from Europe, and is often in human habitations. In North America it ranges from Mexico to Michigan. It is recorded from caves in Texas and Tennessee (Barr 1961), Gurney (1943), Mockford (1950), Reddell (1965)). The species prefers dry habitats in caves and feeds on organic materials. The populations are usually all female and parthenogenetic, and adults may or may not have fully developed wings.

# Order Coleoptera Family Carabidae

Alabama lies at the southern end of the rich carabid beetle fauna of the Appalachians. This beetle fauna, especially the cave carabids, has been well summarized by Barr (1969, 1981a, 1985).

Agonum (Circinalia) punctiforme (Say), AC. Jackson County: Upper Rainbow (=Happy Hollow) Cave. Madison County: Barclay and Ellis caves. The species is widespread from California to Massachusetts to Florida.

Amara (Celia) cf. muscula Say, AC. Madison County: Barclay Cave.

Anillinus spp., TP-ED. Blount County: Horseshoe Cave (HRS & TCB). Colbert County: Gist Cave. De Kalb County: Cemetary and Cherokee caves. Jackson County: Gary Self, Cornelison, Crossing (HRS), Paint Rock, Reece, and Tupelo caves. Marshall County: Cathedral Caverns, Cave Mountain, Creek Cave near Grant (TCB) (not in AL survey), and Guffey (TCB) caves. Madison County: Aladdin (TCB, HRS) and Herin caves. St. Clair County: McLendon Cave. These are small, pale, eyeless beetles that live in soil. These collections represent several undescribed species. Several are undoubtedly troglophiles since they also occur outside the caves. A. longiceps Jeannel, TB, is known from Crystal Cave, Marion County, Tennessee (Jeannel 1963, Loding 1945).

Anisotarsus terminatus (?), AC. Madison County: Barclay Cave.

Atranus pubescens (Dejean), TP. Calhoun County: Weaver Cave. De Kalb County: Talley Cave. Jackson County: Dripping Spring, Gross-Skeleton, and Indian Rock caves. Madison County: Ellis, Hawkins, and Shelta caves. This species occurs throughout caves in the eastern United States, the Ozarks, and Texas. It is distributed across Alabama (Barr 1964, Loding 1945, Reddell 1966).

Bembidion affine Say, AC. Madison County: Barclay Cave. Bembidion (Notaphus) nigripes Kirby, AC. Madison County: Ellis Cave.

Bembidion lacunarium Zimmerman, AC. Madison County: Barclay Cave.

Brachinus sp., AC. Madison County: Ellis Cave. Dischirius sp., AC. Madison County: Sinks Cave. Evarthrus sp., AC. Madison County: Ellis Cave. Galerita sp., AC. Marshall County: Keller Cave.

Harpalus sp., AC. Jackson County: Upper Rainbow (=Hz y

Hollow) Cave.

Harpalus (Pseudophonus) pennsylvanicus DeGeer, Madison County: Barclay Cave.

Harpalus (Pseudophonus) erythropus Dejean (?), AC. M son County: Ellis Cave.

Loxandrus sp., AC. Madison County: Barclay Cave.

Patrobus longicornis, AC. Jackson County: Rousseau trance of Gary Self Cave.

Progaleritina lecontei, AC. Madison County: Cave Spr ..., and Cold Spring caves.

Lebia ornata Say, AC. Madison County: Barclay Cave A single specimen, recorded as possibly hibernating (Barr 196

Platynus tenuicollis LeConte, TP. Blount County: Bar Cave. Calhoun County: Weaver Cave. Jackson County: BC and Russell caves. Madison County: Cold Spring Cave Green Grotto. Marshall County: Honeycomb and Keller ca This species, also listed as Agonum reflexum, occurs comme in caves in the eastern United States (Barr 1964, Lindroth 19 641). It can be found along wooded creeks throughout eas North America and all populations are fully winged.

1

*Pseudanophthalmus*, the cave carabid beetles. This genu: f beetles contains more eyeless cave-inhabiting species than other in the United States. Additionally, there are more spec in this genus than in any other beetle genus in the USA. On few species live outside of caves in the mountains of Kentuor West Virginia. There are many species groups and each groups represents the descendents from a single ancestral species. Th beetles are still under study by Dr. T.C. Barr, Jr.

#### The alabamae species group

Pseudanophthalmus alabamae Valentine, TB. De K County: Bartlett, Cherokee, Kelly Girls, Lykes, Manitou (ty locality), Section 26, Stanley-Carden, and Talley caves. Limi to caves on the east side of Little Wills Valley (Barr 19 1981b; Jeannel 1949; Valentine 1932). The group otherw contains only P. georgiae from Chatooga and Walker counti Georgia.

#### The cumberlandus species group

Pseudanophthalmus n. sp. C, TB. Limestone County: Gaste Indian and Pope caves. The group also occurs to the north Tennessee.

#### The englehardti species group

This group contains species in caves in the Appalachian V ley from Lee County, Virginia to northwest Georgia and t lower Tennessee River Valley in Alabama.

Pseudanophthalmus alladini Valentine, TB. Jackson County: Bucky, Cagle, Cave Stand, Doodlebug, Dripping Springs, Engle Double Pit, Gary Self, Horseshoe, Keepout (?), McFarland, Moon Spring, Roadside, Rover, and Stiles Spring Caves. Madison County: Alladin, and Scott caves.

Pseudanophthalmus distinguens Valentine, TB. Morgan County: Anvil, Horseback, Inge (type locality), and Roper caves. This species has previously been considered a subspecies of P. loedingi (Jeannel 1949, Valentine 1948).

Pseudanophthalmus fluviatilis Valentine, TB. Marshall County: Rock House cave (type locality). Morgan County: Hughes, Laughlin Spring, Lamons, Mill Bluff, Shine, Talucah, Turtle, and Wolf caves (JEC) (Jeannel 1949, Valentine 1948).

Pseudanophthalmus humeralis Valentine, TB. Tennessee. Franklin County: Caroline Cove and Dry caves. Grundy County: Crystal, and Wonder caves. This species could occur to the south in Jackson County, Alabama.

Pseudanophthalmus loedingi Valentine, TB. Madison County: Barclay, Canoe, Ellis, Glover Sink (?), Goat (?), Hoopers Well, Huntsville Spring, Jacks, Kelly Natural Well, Matthews, Shelta, Spook and Sinks caves.

Pseudanophthalmus meridionalis Valentine, TB. Marshall County: Beech Spring, Bishop, Davidson, Guntersville (Saltpeter, Nyman) Caverns, Hampton (?), Old Blowing and Warrenton caves. This species has previously been considered a subspecies of P. loedingi.

Pseudanophthalmus profundus Valentine, TB. (= P. aquaticus Val.) Jackson County: Crossings (= Stewart), Gary Self (Cave Stand and Rousseau entrances) (?), Nat, and Paint Rock, caves. Madison County: Cave Spring (Herrin), Chapman Mt. Cave Spring (A60) (?), Graham Spring, Grayson Spring, Natural Well (?), Water (caves on Monte Sano where drainage is east to Flint River).

Pseudanophthalmus steevesi Barr, TB. Blount County: Bryant, Horse, Randolph (type locality), and Rickwood Caverns caves (Barr 1981).

Pseudanophthalmus n. sp. E, TB. Lauderdale County: Collier Cave.

Pseudanophthalmus n. sp. D, TB. Colbert County: Cobbs Bear Pit, McKinney Pit, McKinney #2.

Pseudanophthalmus n. sp. K, TB. Lawrence County: Tingling Hole.

Pseudanophthalmus n. sp. G. TB. Morgan County: Cave Spring Cave.

Pseudanophthalmus n. sp. H. TB. Jackson County: Jess Elliott Cave.

Pseudanophthalmus n. sp. J. TB. Marshall County: Cathedral, Guffey, Keller (?), Kelly Ridge, Lim Rock Blowing ?, McAllister (A 275), Saltpeter (near Grant), and Walnut caves. Jackson County: Beanfield Hall, Henshaw Spring, House of Happiness, Larkin, Little Sink (A 657), Pig Pen, and Roadside caves.

Pseudanophthalmus n. sp. L, TB. Jackson County: Driftwood Cave.

#### The fulleri species group

Pseudanophthalmus nickajackensis Barr, TB. Jackson County: Nickajack Cave (type locality). Known only from this cave, whose now-flooded entrance is in Marion County, Tennessee (Barr 1981b).

Pseudanophthalmus fulleri Valentine, TB. This species is recorded from caves in Hamilton County, Tennessee and Dade County, Georgia. The species may occur in adjacent De Kalb County, Alabama (Barr 1965, 1981b; Jeannel 1949; Valentine 1932, 1948).

#### The hirsutus species group

Pseudanophthalmus assimilis Barr, TB. De Kalb County: Ellis (Sequovah) (type locality) and Kudzu caves (Barr 1981b). This is the only Alabama member of the species group, which occurs from southwest Virginia through Tennessee to northwest Georgia and adjacent Alabama.

#### The intermedius species group

Pseudanophthalmus n. sp. A, TB. Jackson County: Bell Spring (?), Cagle, Guess Creek, Indian Rocks, Kyles Spring (?) (Barr and Peck 1965), Limrock Blowing and Loki's (Crow Creek area) caves. The species also occurs in adjacent Tennessee

Pseudanophthalmus n. sp. B. TB. Jackson County: Horseskull (?), McFarland (?), Russell (Montague Entrance), Salt River, Talley Ditch, Tate, Tumbling Rock Upper Rainbow (= Happy Hollow) caves.

Pterostichus (Euferonia) relictus Newman, AC. Blount County: Banger Cave.

Pterostichus (Lagarus) lecontianus Lutshnik, AC. Madison County: Ellis Cave. This is the first Alabama record for this species.

Rhadine caudata LeConte, TP. Blount County: Catfish Cave. Colbert County: McKinney Cave. De Kalb County: Talley Cave. Jackson County: Isbell Spring Cave. Jefferson County: Mc-Cluney (=Crystal) Cave. Limestone County: Rockhouse Cave. Marshall County: Dunham, Eudy, Merrill, and Painted Bluff caves. Alabama cave localities are mentioned for this species by Barr (1964) but are not named. The species is distributed from Arkansas to Wisconsin to Pennsylvania to Georgia and is frequently found in caves.

Rhadine larvalis LeConte, TP. Conecuh County: Sanders (Turks) Cave (type locality)! (Barr 1964) (described as Rhadine jonesi Barr). The species is otherwise known in Arkansas, Missouri, Mississippi, and Florida (Choate and Rogers 1976).

Stenolophus sp., AC. Madison County: Barclay Cave.

Tachys (Tachyura) ferrugineus (Dejean), TP. Conecuh County: Sanders Cave. Marshall County: Eudy and Honeycomb caves. Morgan County: Bat and Royer caves. Though this species occurs rarely in caves in the east, it is common in caves in Texas (Barr 1964, Loding 1945, Reddell 1966).

Trichotichnus dichroas Dejean, AC. Madison County: Ellis Cave.

*Troglanillus valentinei* Jeannel, TB-ED. De Kalb County: Killian Cave (TWD), Manitou Cave (type locality). Jefferson County: McCluney (=Crystal) Cave (Jeannel 1963, Loding 1945).

#### Family Histeridae

Geocolus sp., TP-ED. Jackson County: Paint Rock Cave. Lauderdale County: Butler Cave (both records in *Plethodon glutinosus* salamander stomachs). This genus of eyeless, soil histerid beetle was previously known only from central Georgia.

*Neosaprinus* sp., TP?. Jackson County: Sauta Cave. This is an undescribed species, near *N. rubicola*, from under rocks with guano, at "Jack Rock."

#### Family Ptiliidae

*Micridium* sp., AC. Jackson County: Schiffman Cave. A forest-litter species taken on *Neotoma* dung.

#### Family Pselaphidae

This is a large family of small-sized beetles living in forest litter and soil. Many are known from caves and both cave and soil species can be eyeless. Chandler (1990) gives a key to the genera.

Arianops cavernensis Park, TB. Marshall County: Guntersville (=Nymans Saltpeter) Caverns (type locality). The species is known only from the type locality (Barr 1974; Park 1951, 1960). All species in this genus are eyeless. Five species are probably troglobites, and at least 26 species are edaphobites in the Appalachians (Barr 1974).

Arianops steevesi Barr, TB. Jackson County: Horseshoe and Williams Saltpeter caves. Another Arianops (A. externa Barr) is known from forest litter outside of Horseshoe Cave (Barr 1974).

*Batrisodes (Babnormodes) jocuvestus* Park, TB. Madison County: Aladdin Cave (type locality). The species is known only from the type locality. It may be a dimorphic minor male form of *B. specus* (H.R. Steeves, in litter) (Park 1960).

*Batrisodes (Babnormodes) jonesi* Park, TB. Colbert County: Dickey, Gallymore, Gist, Little Bear (type locality), McCluskey, McKinney, McKinney Pit, and Wolf Den caves (Park 1951, 1958, 1960).

*Batrisodes (Babnormodes) profundus* Park, TB. Conecuh County: Sanders (Turks) Cave (type locality). Known only from the type cave. The species has not been found in the cave in the *Batrisodes (Babnormodes) specus* Park, TB. Colbert County: Georgetown Cave. Jackson County: Cornellison and Indian Rock caves. Madison County: Aladdin (HRS), Cave Spring A60, Big (Huntsville) Spring, Hutton (type locality), Lott, Pitts, and Twin caves. Marshall County: Terrell Cave. This species is also known from Indian Cave, Jefferson County, Tennessee. It has been found only in caves (Park 1951, 1958, 1960).

Batrisodes (Babnormodes) subterraneus Park, TB. Marshall County: Griffith Cave (type locality). Known only from the type locality (Park 1951, 1958, 1960).

*Batrisodes (Babnormodes) tumoris* Park, TP. Colbert County: McCluskey Cave (type locality). Known only from the type locality (Park 1960).

*Batrisodes (Babnormodes) valentinei* Park, TB. Jackson County: Clemons and Gross-Skeleton (=Out) caves. Morgan County: Talucah Cave. Madison County: Candlestand (=Goat) (type locality), Hurricane, and Toll Gate Natural Well caves. The species is known only from caves. It is also recorded from Crystal Cave, Grundy County, Tennessee. Its ecology is discussed in (Park 1951, 1956, 1958, 1960).

*Batrisodes (Babnormodes)* sp., TB. This undescribed species is known only from Marshall County, Campbell Cave (H.R. Steeves, in litter) (not in AL survey).

*Batrisodes (Excavodes) cavernosus* Park, TB. Butler County: Hinson Cave (type locality). Clarke County: Chastain Cave, near Rockville (HRS). The species is known only from these cave collections (Park 1951, 1958, 1960).

*Batrisodes (Excavodes)* sp., TB. An undescribed species known only from Sanders (=Turks) Cave, Conecuh County (H.R. Steeves).

*Batrisodes globosus* (LeConte), TP. Calhoun County: Weaver (Lady) Cave (HRS). Conecuh County: Sanders Cave (=Turks). Species is widespread in the eastern United States. It is apparently replacing *B. profundus* in Sanders Cave (Park 1947: p.82).

*Batrisodes* sp., TB. Jackson County: Cave Stand entrance to Gary Self Cave (WBJ). Madison County: Chittonwood (WBJ), Jett (WBJ), and Sublett (WBJ) caves. These records are based upon females.

Batriasymmodes spelaeus Park, TP. Blount County: Bangor (type locality), Bryant (TK), Catfish, Dixon, Frenchs, Horseshoe, Ingram, Pass, and Posey (Spring) caves. De Kalb County: Manitou Cave. Jackson County: Coon Creek (Pisgah) Saltpeter (HRS) and Nickajack caves. Lauderdale County: Bat Cave. Lawrence County: Cave Spring (WBJ), Thomas, and Tingling Hole caves. Marshall County: Lime Point, Kelly Ridge, and Warrenton caves. Morgan County: Barrel, Cave Spring, Echols, Inge, Ladder, Lost Mule, Royer, and Winchester caves. St. Clair County: McGlendon Cave. Walker County: Devils Ladder (HRS). Winston County: Natural Bridge Rock Shelter. This species is also recorded from caves in Clay, Grainger, Van Buren, and White Counties, Tennessee. It was previously known only from caves. The Walker and Winston county records represent rockshelters that do not possess a dark zone. This toleration of twilight and the wide and abundant distribution suggests a recent if not present dispersal and invasion into caves.

*Batriasymmodes troglodytes* Park, TP. Butler County: Rock Cave (type locality). Known only from the type locality (Park 1951, 1956, 1960, 1965).

*Batriasymmodes* sp., TP. Jackson County: Rainbow Cave (1 female). Marshall County: Dunham Cave (1 female).

*Batriasymmodes (Batriasymmodes)* sp., TP. This apparently undescribed species has been collected in Colbert County: Gallymore Cave, and Winston County: Natural Bridge Rock Shelter, in the light and twilight zones of rockshelters as well as in the dark zone of caves (H.R. Steeves, in Litt.).

*Batriasymmodes (Batriasymmodes)* sp, TP. Jackson County: Coon Creek (Pisgah) Saltpeter Cave, and Marshall County: Guffey Cave. This is an apparently undescribed species.

*Bythinopsis jonesi* Park, TP. Colbert County: Wolf Den Cave (type locality). The species is known only from the type locality (Park 1951, 1953, 1960).

Speleochus croceus (Park), TB. Madison County: Lott Cave (type locality), Twin Cave (Park 1960). This and following species in the genera *Speleochus* and *Subterrochus* were once placed in the genus *Macherites*. *Macherites* is now understood to be limited to the Old World.

Speleochus stygicus (Park), TB. Madison County: Cave Spring Cave AL60, Big (=Huntsville) Spring, Kelly Natural Well, and Toll Gate Natural Well caves (Park 1951, 1953, 1960).

*Speleochus synstygicus* (Park), TB. Madison County: Barclay Cave (type locality). The species is known only from the type locality (Park 1956, 1960).

Subterrochus eurous (Park), TB. Jackson County: Jess Elliott Cave (type locality). The species is known only from the type locality (Park 1960).

Subterrochus ferus (Park), TB. Madison County: Aladdin Cave (type locality) and Hutton Cave. Jackson County: Devil Stair Step, Hambrick, and Keel Sinks caves (Park 1951, 1953, 1960).

Subterrochus steevesi (Park), TB. Marshall County: Guffey Cave (type locality). The species is known only from the type locality.

Speleobama vana Park, TB. Jefferson County: McCluney (=Crystal) Caverns. This species is known only from the type locality cave (Park 1951).

*Tmesiphorus costalis* LeConte, TP. Marshall County: Terrell Cave. Morgan County: Lost Mule Cave. This is a widespread species, usually associated with ants (Park 1951).

Undetermined Genera and species. De Kalb County: Bartlett, Lykes, and Talley caves. Jackson County: Driftwood (with dung) and Happy Hollow caves. Marshall County: Cave Mountain, Davidson, and Painted Bluff caves. Madison County: Hurricane Cave. Morgan County: Thomas Cave (ICR).

#### Family Agyrtidae

*Necrophilus pettitii* Horn, TP-ED?. Jackson County: Russell Cave (Pig Entrance). This wingless species occurs in much of the eastern United States through and near the Appalachians, and into Florida, Louisiana, and Missouri. It usually occurs at high elevations, or in soil and cave entrances at lower elevations (Peck 1981).

#### Family Leiodidae

This is a diverse family of small carrion beetles and small fungus beetles, living in forest litter, soil, caves, and animal burrows and nests (Peck 1990). Many hundreds of species in the tribe Leptodirini exist in Europe in caves.

Adelopsis appalachiana Peck, TP. Blount County: Bangor Cave. De Kalb County: Cherokee, Cook, Kelly Girls, Lykes, and Manitou (type locality) caves. Calhoun County: Wrights Cave. Morgan County: Inge Cave. Marshall County: Kelly Ridge Cave. The species is distributed south of the Tennessee River in north-central Alabama and into Georgia. It is also frequent in leaf-litter habitats (Peck 1978).

Adelopsis cumberlanda Peck, TP. Jackson County: Clemons, Keel, and Rousseau entrance to Gary Self caves. Marshall County: Creek (not in AL survey), Guffy, and Hampton Caves. The species is limited to cave and forest-litter habitats in the Cumberland Plateau of north eastern Alabama (Peck 1978).

Adelopsis jonesi Peck, TP. Colbert County: Gist, McClusky, and Wolf Den (type locality) caves. Known only from these caves and other Alabama soil-litter records (Peck 1978).

*Catopocerus alabamae* Peck, TP-ED. Madison County: Cave Spring Cave (A 60) (type locality) (in *Eurycea lucifuga* salamander stomach). Known only from this locality (Peck 1974a). All members of this genus are eyeless, soil inhabitants.

*Catopocerus appalachianus* Peck, TP-ED. Madison County: Barclay, Cave Spring, and Ellis caves. This species is distributed along the Appalachians from Madison County, Alabama, to Pocahantas County, West Virginia (Peck 1974a).

*Catopocerus jonesi* Peck, TP-ED. Marshall County: Eudy Cave (type locality). Morgan County: Shine and Vandiver caves. Jackson County: House of Happiness Cave. The species is known only from these caves (Peck 1974a).

*Catops gratiosus* Blanchard, TP. Colbert County: McCluskey (in *Neotoma* nest), and Wolf Den caves. De Kalb County: Killian (H&D) and Manitou (WBJ) caves. Jackson County: Cox entrance to Tony Sinks Cave (WBJ). Madison County: Scott and Sinks (WBJ) Caves. Marshall County: Griffith Cave (WBJ). Morgan County: Trinity Cave (WBJ). The species is frequent in caves in the southern Appalachians and occurs in forests in more northerly localities. It is found in caves on animal dung or carrion.

Nemadus horni Hatch, TP. Blount County: Bangor Cave. Calhoun County: Lady (WBJ) and Weaver (WBJ) caves. Colbert County: Wolf Den Cave (WBJ). Conecuh County: Sanders (=Turks) Cave. Deklab County: Bartlett (WBJ), Cook (WBJ), Lykes, and Manitou (WBJ) caves. Jackson County: Coon Creek Cave. Limestone County: Pope Cave (WBJ). Morgan County: Talucah Cave (WBJ). Talladega County: Dulaney Cave (WBJ). The species is distributed from northern Florida, northwards through much of the eastern United States. It occurs frequently in caves in the northern part of its range, often in large numbers in bat guano.

Prionochaeta opaca (Say), TP. Blount County: Catfish Horseshoe-Crump, and Randolph caves. Calhoun County Robertson and Weaver caves (WBJ). Conecuh County: Sander (=Turks) Cave. De Kalb County: Cherokee and Lois Killia caves. Calhoun County: Weaver Cave (WBJ). Jackson County House of Happiness and Rousseau entrance to Gary Self caves Madison County: Burwell, Ellis, Hurricane, Matthews, and Scott caves. Marshall County: Eudy (WBJ), Honeycomb, Mer rill, Painted Bluff, and Terrill caves. Morgan County: Lipscoml Cave (WBJ). The species ranges from northern Florida to south eastern Canada. It is frequent in caves in the southeastern state where it occurs on carrion, animal dung, and bat guano (Pecl 1977).





Ptomaphagus, the cave carrion beetles. The cave inhabiting Piomaphagus beetles of Alabama have had a rich history of taxonomic study (Barr 1963; Jeannel 1933, 1936, 1949; Peck 1973, 1983, 1984). Their name changes will not be given in detail below. Their ecology, evolution, and life cycles have been only partially studied (Peck 1975c, 1976, 1984, 1986). The complex geographic distributions of some of the Alabama species, and the limited distributions of some of these species are shown in Figure 5.

Ptomaphagus cavernicola Schwarz, TP. Morgan County: Talucah Cave. Known in Alabama only from this locality. The species otherwise occurs in caves from north Florida to Iowa, Texas, and Mexico, and in forests in north Florida and Georgia (Peck 1982).

Ptomaphagus chromolithus Peck, TB. Jackson County: Beanfield, Doodlebug Hole, Doug Green, Fortyeight Ten, Horseshoe, Little Sink, Moon Spring, Section 20 (not in AL survey), and Williams Saltpeter caves. The species also occurs in Franklin County, Tennessee. All caves are located in the upper Paint Rock River Valley. The species distribution is not continuous, for some caves in this valley are instead occupied by P. hatchi Jeannel (Peck 1984).

Ptomaphagus consobrinus LeConte, AC. De Kalb County: Manitou Cave (WBJ). Madison County: Aladdin Cave (Jeannel 1949). Morgan County: Inge Cave (TCB). This is a widespread southeastern forest litter species (Peck 1973).

Ptomaphagus episcopus Peck, TB. Marshall County: McHardin (type locality) and Honeycomb caves. The species is known only from these caves in Bishop Mountain, an isolated remnant of the Cumberland Plateau (Peck 1973).

Ptomaphagus hatchi Jeannel, TB. Jackson County: Borderline, Bouldin, Buds, Cagle, Clemons, Cornellison no. 2, Crowson, Devils Stairstep, Dripping Spring, Dry, Fourth of July, Gary Self (Cave Stand and Rousseau entrances), Guess Creek, Haddon Spring, Hambrick, Honey Hollow Saltpeter, Hurricane, Indian Rocks, Jess Elliott, Kennamer, McFarland, McFarland Blowing, McFarland Spring, Morgue entrance to Fern, Nat, Upper Rainbow, Roadside, Russell (Pig Entrance), Slippery Pole, Swaim, Talley Ditch, Tate, and Trenton caves. Madison County: Aladdin, Hutton, Jacks, and Scott caves. The species also occurs in caves in Franklin and Grundy counties, Tennessee (Peck 1973, 1984). It is the most widespread troglobitic Ptomaphagus at the southern end of the Cumberland Plateau.

Ptomaphagus hazelae Peck, TB. Jackson County: Driftwood, Ivey Bottom, and Tumbling Rock (type locality) caves. The species is known only from these caves, in the headwaters of Mud Creek (Peck 1973).

Ptomaphagus julius Peck, TB. Jackson County: House of Happiness (type locality) and Lindsay Spring caves. The species is limited to caves in July Mountain, an isolated outlier of the Cumberland Plateau (Peck 1973, 1984).

Ptomaphagus laticornis Jeannel, TB. Jackson County: Rousseau entrance to Gary Self Cave. Madison County: Hutton

and Scott caves. The species is known only from these caves along the west flank of Bice and Bingham mountains, of the Cumberland Plateau (Peck 1984).

Ptomaphagus longicornis Jeannel, TB. Figure 6. Jackson County: Crossing, Greising, and Paint Rock caves. Madison County: Bee Sinkhole, Chittonwood, Candlestand (=Goat), Grayson Spring, Hering (Cave Spring) (type locality), Labyrinth, and Moon Sinkhole caves. The species is limited to caves in Keel Mountain, an isolated remnant of the Cumberland Plateau (Peck 1973, 1984).

Ptomaphagus loedingi Hatch, TB. Madison County: Barclay, Buford, Byrd Spring, Cold Spring, Canoe, Cave Spring (AL 60), Drake, Green Grotto, Jett, Kelly Natural Well, Lott, Natural



Figure 6. Ptomaphagus longicornis, probably the most caveevolved species in the genus. Notice the long antennae and long legs which are typical of cave-evolved insects. This species is limited to caves in Keel Mountain, east of Huntsville, Alabama. Total body length is about 3 mm.

Well, Pitts Sinkhole, Sadler Spring, Shelta (type locality), Sinks (AL 102), Spook, The Sinks (AL121), Taploe, Toll Gate Natural Well, and Twin caves. The species occurs only in caves in western outliers of the Cumberland Plateau west of Flint River.

Ptomaphagus solanum Peck, TB. Jackson County: Sheldons Cave (type locality). The species is limited to caves in Tater Knob, a remnant of the Cumberland Plateau, at Scottsboro (Peck 1984).

Ptomaphagus torodei Peck, TB. Jackson County: Two Way (type locality) and Hall caves. The species is known only from these caves in Boxes Cove (Peck 1984).

Ptomaphagus valentinei Jeannel, TB. Jackson County: Larkin, Limrock Blowing, Lost, Mink, Pigpen, Sauta, and Schiffman Cave caves. Marshall County: Cathedral Caverns, Guffey, Kirkland, Royal Shaft, and War Eagle caves. The species is limited to caves in Gunters Mountain, an isolated remnant of the Cumberland Plateau (Peck 1973, 1984).

Ptomaphagus walteri Peck, TB. Blount County: Bryant, Bangor, and Wildcat caves. The species is known only from these caves in the southern end of the Sequatchie Valley (Peck 1973).

Ptomaphagus whiteselli Barr, TB. De Kalb County: Cave in Deer Head Cove, and Sequoyah Caverns. The species also occurs in caves in Lookout Valley in adjacent Dade County, Georgia (Peck 1973).

#### Family Staphylindae

This is a very large family of beetles, and most of the species are predators. A few are associated with caves, but no species are troglobitic in the United States.

Aleochara (Echochara) lucifuga (Casey), TP. Lawrence County: Ivy Hollow Cave. Morgan County: Blowing Spring Cave. This is a widespread eastern species, known mostly, and abundantly, from caves (Klimaszewski 1984; Klimaszewski and Peck 1986).

Aleochara (Xenochara) castaneipennis Mannerheim, TP. Marshall County: Warrenton Cave. This species is widely distributed across the United States, and occurs on occasion in caves (Klimaszewski 1984; Klimaszewski and Peck 1986).

Aleochara (Xenochara) fumata Gravenhorst, TP?. Marshall County: Warrenton Cave. Morgan County: Vandiver Cave. A widely distributed species, also known from a cave in Missouri (Klimaszewski 1984; Klimaszewski and Peck 1986).

Aloconota neospelea Klimaszewski, TP?, Madison County: Barclay Cave (type locality). Known only from this cave.

Aloconota insecta (Thomson), TP. Jackson County: Montague and Russell caves. Madison County: Barclay Cavé. The species occurs in Europe and the eastern United States. It is known from caves from many states (Klimaszewski and Peck 1986).

Anotylus tetracarinatus, AC. Jackson County: Hall Cave. Anotylus exiguus (Erichson), AC. DeKalb County: Lykes Cave.

Apocellus sp. AC. Madison County: Barclay Cave. Atheta (Atheta) alabama Klimaszewski, TP?. Morgan County: Vandiver Cave (type locality). Known only from this cave,

Atheta (Atheta) annexa Casey, TP. Blount County: Horseshoe-Crump Cave. Calhoun County: Robertson Cave. Conecuh County: Sanders (=Turks) Cave. De Kalb County: Lykes, Lois Killan, and Manitou caves. Limestone County: Indian Cave, Madison County: Barclay, Burwell, Byrd Spring, Ellis, and Hurricane caves. Marshall County: Cathedral, Green Bar, Hampton, and Honeycomb caves. St. Clair County: McLendon Cave, Talladega County: Dulaney and Kymulga caves. The species is widespread in the eastern United States and is known mostly from caves (Klimaszewski and Peck 1986).

Atheta (Dimetrota) troglophila Klimaszewski, TP. Blount County: Bangor, Catfish, Bryant, Horseshoe-Crump, and Randolph caves. Calhoun County: Robertson Cave. Colbert County: McCluskey and McKinney caves. De Kalb County: Bartlett, Manitou, Lois Killian, Lykes, Sequoyah, and Section 26 caves. Jackson County: Coon Creek, Cornelison, Cox entrance to Tony Sinks, Doug Green, Edgefield, Rousseau, Horseshoe, McFarland, Montague, Nat, Schiffman, Rainbow, Swaim, Talley Ditch, Tumbling Rock, Twoway, and Williams Saltpeter caves. Limestone County: Pope Cave. Madison County: Aladdin, Barclay, Byrd Spring, Burwell, Ellis, Candlestand (=Goat), Hurricane, and Scott caves. Marshall County: Cathedral, Griffith, Dunham, Merrill, Keller, Porches Spring, Old Blowing, Painted Bluff, and Walnut caves. Morgan County: Blowing Spring, Horseback, and Royer caves. The species is widely distributed in eastern North America and is very common in caves in many states (Klimaszewski and Peck 1986).

Atheta (Dimetrota) lucifuga Klimaszewski, TP. Blount County: Horseshoe Crump Cave. Jackson County: Cornelison and Nat caves. Madison County: Barclay, Burwell, and Hurricane caves. Marshall County: Green Bar (type locality) and Painted Bluff caves. The species ranges from Missouri and Kentucky south to Florida and Texas. It is known only from caves (Klimaszewski and Peck 1986).

Belonuchus sp., AC. Jackson County: Nat Cave.

Blepharrhymenus illectus (Casey), TP. Jackson County: Paint Rock Cave. Limestone County: Duck, Gaston, and Spencer caves. The species is otherwise known only from Oregon and caves in Missouri and Tennessee (Klimaszewski and Peck 1986).

Brathinus nitidus Leconte, TP. De Kalb County: Manitou Cave. Limestone County: Spence Cave. Madison County: Cave Spring Cave. Marshall County: Kirkland and Natural Bridge caves. The species occurs along cave streams. It ranges from Alabama to eastern Canada. Most records from the south are from caves (Peck 1975a).

Carpelimus sp., AC. St. Clair County: McLendon Cave.

Cryptobium carolinum Erichson, AC. Jackson County: Iron Hoop entrance to Jess Elliot and Rousseau entrance to Gary Self caves.

Frichsonius patella (Horn), AC. St. Clair County: McLendon Cave.

Geodromicus brunneus Say, AC. Jackson County: Beanfield Cave.

Lesteva cribatulus Casey, AC. Jackson County: Grahams Pit. st Clair County: McLendon Cave.

Lesteva pallipes Leconte, TP. Madison County: Barclay Cave, Marshall County: River Cave at Grant (HRS) (not in AL survey). Jackson County: Coon Creek (=Pisgah Saltpeter) (HRS) and Tumbling Rock caves (HRS). The species is found along rocky cave streams.

*Qmalium* sp, AC. Jackson County: Cox entrance to Tony Sinks Cave.

Quedius erythrogaster Mannerheim, TP. Blount County: Randolph Cave. Colbert County: Wolf Den Cave. Jackson County: Cornellison No. 2, Hall, Upper Rainbow (=Happy Hollow), Horseshoe, House of Happiness, Indian Rock, Moody, Nat, Putman, Rainbow, Sheldons, Swaim, and Two Way caves. Madison County: Barclay, Burwell, Cave Spring AL60, Cold Spring, Ellis, Hering (Cave Spring), and Hurricane caves. Marshall County: Bishop, Dunham, Merrill, Painted Bluff, Steves, and Walnut caves. The species is distributed across the continent, and is frequently found in caves (Smetana 1971).

Quedius fulgidus Fabricius, TP. Calhoun County: Weaver Cave. This is the only Alabama record for this species that is spread across the United States. It occurs occasionally in caves (Smetana 1971).

Thinodromus sp. AC. Jackson County: Hall Cave.

### Family Cantharidae

Cantharis ? sp., TX. Jackson County: Indian Rock and Trenton caves. Limestone County: Indian Cave. Madison County: Barclay, Cave Spring, and Morring caves. Marshall County: Warrenton Cave. Only larvae of these beetles have been found in caves. They are also known from caves in Georgia, Illinois, Kentucky, Tennessee, West Virginia and Ontario, Canada (Peck 1975b).

#### Family Chrysomelidae

Rhabteropterus sp., AC. Limestone County: Gaston Cave.

Family Melyridae

Collops sp., AC. Morgan County: Blowing Spring Cave.

#### Order Trichoptera

Caddis flies are often found in large numbers at springs flowing from caves. No careful study has been conducted on species associated with cave springs.

Scoliopteryx libatrix Linnaeus, TX. Jackson County: Limrock Blowing, and Rousseau entrance to Gary Self caves. Madison County: Cave Spring, Clark Bluff, and Scott caves. This beautiful, multi-colored, and velvety appearing species is found in most parts of the United States and Europe. It may occur in any cave over the range. Caves are used for winter hibernation or summer estivation.

Monopis, prob. crocicapitella (Clemens), TP. Calhoun County: Weaver Cave. Another record probably of this species is from Little Cedar Mountain Indian Cave, Marion County, Tennessee. This species seems to be nearly worldwide in distribution (Robinson 1980).

#### Family Hydroptilidae

Hydraptila sp., AC. Jackson County: Tumbling Rock Cave (in Eurycea lucifuga salamander stomach).

Ochrotrichia sp., AC. Jackson County: Doug Green Cave (in *Eurycea lucifuga* salamander stomach). Also known from Burk Hollow Cave, Rutheford County, Tennessee.

# Order Lepidoptera Family Noctuidae

#### Family Tineidae

Amydria arizonella Dietz, TP. Blount County: Horseshoe Crump Cave. Jackson County: Cornellison, Crossing, Upper Rainbow (=Happy Hollow), Nat, and Pigpen caves. Marshall County: Dunham Cave. This clothes moth feeds on dry protein materials in caves, especially bat guano. I also have records for Henpeck Mill Cave, Franklin County, Tennessee; and Harrisburg and Pettijohn caves, Walker County, Georgia. The species occurs in Texas bat caves and Carlsbad Caverns, New Mexico.

# Order Hymenoptera Family Braconidae

Aspilota sp., TP. De Kalb County: Talley Cave. Jackson County: Larkin, Russell, and Talley Ditch caves. Madison County: Barclay and Cave Spring (A60) caves. These were all taken in carrion-baited pit traps. They are probably parasitoids on fly larvae.

#### Family Formicidae

Prenolepis imperis Say, AC. Blount County: Cedar Grove River Cave, in a debris-filled fissure.

#### Order Siphonaptera

Fleas of bats and rodents in Alabama caves have not been studied.

#### Family Hystrichopsyllidae

*Ctenophthalmus pseudagyrtes* Baker, AC. Marshall County: Gamble Cave. The normal hosts of this flea are insectivores and small rodents.

#### Order Diptera

Flies have usually not received much attention in surveys of North American cave faunas. A large fauna of flies in caves is known from Ontario, Canada and Great Britain (Peck 1988, Jefferson 1981). They are most abundant on cave walls in the twilight zone or just inside the dark zone.

#### Family Anisopodidae

Anisopus sp., AC. Comments. One specimen was taken in a carrion-baited trap in Scott Cave, Madison County. The flies are normally found in moist areas containing decaying organic matter.

#### Family Chironomidae

Genus undetermined, TX. Jackson County: Nickajack Cave (abundant along mud bank at cave river), Sheldon Cave (in carrion traps), and Salt River Cave (in stomach of *Gyrinophilus palleucus* salamander).

Orthodadius (Orthocladius) sp., TX. Jackson County; Sheldons Cave (carrion bait traps). This is an undescribed species.

*Polypedilum (Tripodura)* sp., TX. Jackson County: Nickajack Cave (22 males, 1 female, from debris alongside cave stream).

#### Family Helomyzidae

Amoebaleria defessa, TX. Franklin County: Belgreen Cave. Jackson County: Paint Rock (*Eurycea* stomach) and Russell caves. Limestone County: Forked Stream Cave (JEC) (not in AL survey). These flies occur in almost every cave, and are far more numerous than this list of records indicates. Both adults and larvae frequent refuse in moist, dark areas. The adults are conspicuous on cave ceilings.

Aecothea sp., TX. Limestone County: Cave Spring (not in AL survey), Duck and Forked Stream (not in AL survey) caves.

#### Family Mycetophilidae

Undetermined genera and species, TX. These flies occur in decaying debris and guano in caves. They have been observed in a number of caves, and collected from Cold Spring, Madison County, and Eudy caves, Marshall County (*Exechia*). They form swarms at cave entrances in the winter and are often mistaken for mosquitoes.

Leia cuneola (Adams), TX. Madison County: Cold Spring Cave. Also collected in Mountain Cove Farm Cave, Walker County, Georgia.

Rymosia triangularis Show, TX. Madison County: Cold Spring Cave.

#### Family Phoridae

Conicera pauxilla, AC. Marshall County: Honeycomb Cave. Dorniphora cornuta, AC. Marshall County: Honeycomb Cave.

Dorniphora perplexa, AC. Jackson County: Crossing Cave (entrance zone).

*Megascelia cavernicola* Brues, TP. Conecuh County: Turks (Sanders) Cave. Jackson County: Crossing and Sheldon caves. Madison County: Barclay, Cold Spring, and Scott caves. Marshall County: Cathedral and Terrill caves. Georgia. Chatooga County: Blowing and Parker caves. Dade County: Johnson Crook Cave. Polk County: White River Caves. Walker County: Byers, Cave Spring, Horseshoe, Mountain Cove Farm, and Pettijohn caves. This species occurs widely in caves. It can be taken in large numbers at carrion baits (Peck 1976). Virtually nothing is known of the ecology of this cave-dwelling species (Robinson 1971). Over 1000 species worldwide are placed in this genus.

Puliciphora suavis, AC. Jackson County: Crossing Cave (entrance zone).

*Spiniphora slossonae*, AC. Jackson County: Crossing Cave (entrance zone).

#### Family Psychodidae

*Psychoda* sp., TP?. Jackson County: Sheldon Cave. Madison County: Aladdin and Scott caves. Marshall County: Eudy Cave. These flies are often associated with dung and sewage. Some have aquatic larvae (Quate 1954).

#### Family Sciaridae

*Sciara* sp., TP. Blount County: Bryant Cave. Franklin County; Belgreen Cave (*Pseudotriton* stomach). Marshall County; Cathedral Caverns and Painted Bluff caves (guano). The larvae of these flies feed on fungi and would be expected in many more caves around debris.

#### Family Sphaeroceridae

Spelobia tenebrarum (Aldrich), TB. Jackson County: Crossing, Nat, Horseshoe, and Schiffman caves. Madison County: Byrd Spring Cave. The species is widely distributed and very common in eastern North American caves (Marshall and Peck 1984, 1985). Its ecology in caves is poorly understood (Peck 1976). Sphaerocerid ecology has been studied in Hungary (Papp and Plachter 1976). *Telomerina cava* Marshall and Rohacek, TP. Jackson County: Nickajack Cave. Marshall County: Merrill Cave (type locality). The species is known only from caves in Alabama, Tennessee, and Oklahoma (Marshall and Rohacek 1984).

#### FUTURE STUDIES

The insect and terrestrial invertebrate fauna of Alabama caves is still incompletely known. The taxonomy of several important groups, especially millipedes of the genus Scoterpes, has vet to be resolved. And the distributions of most of the troglobitic species have yet to be fully discovered and mapped. Only then will it be possible to understand fully the barriers that form the boundaries of the distributions of these species. Frequently, closely related species seem to be unable to co-exist. The distributions of the species of Ceuthophilus and Euhadenoecus crickets and some Ptomaphagus beetles suggest that they are mutually excluding other members of their genus from specific caves. How and why this happens is an interesting topic in evolutionary and population biology. Life history, population, and genetic studies have been made only on the *Ptomaphagus* beetles (Peck 1984, Peck 1986). And only for these and some Collembola has an evolutionary explanation been offered for the development of the present fauna (Christiansen and Culver 1987; Peck 1984). Only three ecological studies have been made in Alabama caves; one on the distribution of invertebrates around a cave entrance (Peck 1976), and two on salamanders that eat cave insects (Peck 1974b, Peck and Richardson 1976).

There is abundant opportunity to continue to understand the composition, the dynamics, and the origin of the fauna. Why are there not more southeastern biologists involved in such faunal, ecological, or evolutionary studies? After all, caves are excellent model laboratories for the study of the dynamics of ecological assemblages, and adaptation to extreme habitats (Christiansen 1992).

#### ACKNOWLEDGEMENTS

I thank William W. Varnedoe Jr. of Huntsville, and the members of the Huntsville Grotto of the National Speleological Society for providing help with locations and descriptions of Alabama caves. William Torode has been especially helpful throughout his energetic efforts at cave exploration and mapping. Appreciation is expressed to the land owners or managers who allowed access to property under their control; in particular I thank Mr. Jay Gurley of Cathedral Caverns, Mr. Myron Raymond of Manitou Cave, Mr. Alva Hammond of Sequoyah Cave, and Mr. Herbert Olsen, Superintendent of Russell Cave National Monument.

Dr. and Mrs. Walter B. Jones receive my deepest appreciation, for without their generosity and encouragement this study could not have been conducted. Various collections and records were contributed to the study by Allan F. Archer (AFA), John E. Cooper (JEC), Thomas C. Barr, Jr. (TCB), Tim King (TK), R.C. Graham (RCG), Lynn Guy (LG), Walter B. Jones (WBJ), Chris Kroeger (CK), Orlando Park (OP), Harrison R. Steves (HRS), William Torode (WT), and J.M. Valentine (JMV).

The following taxonomic specialists are thanked for their help in making identifications. T.C. Barr, Carabidae; K. Christiansen, Collembola; Bruce Cooper, Tipulidae; D. Davis, Lepidoptera; L. Ferguson, Campodeidae; A. B. Gurney, Psocoptera and Dermaptera; T. H. Hubbell, Orthoptera; D. Oliver, Chironomidae; W. H. Robinson, Phoridae; and J. R. Vockeroth, Mycetophilidae.

The manuscript was reviewed in whole or in part by Theodore Cohn, Don Chandler, Ken Christiansen, H. H. Hobbs III, J. R. Holsinger, Lynn Ferguson, S. A. Marshall, and William Torode. Bill Torode deserves special thanks for trying to see that I have used correct cave names, as registered in the Alabama Cave Survey of the NSS. Field work was partially supported by operating grants from the Natural Sciences and Engineering Research Council of Canada.

#### LITERATURE CITED

- Barr, T.C. Jr. 1961. The caves of Tennessee. Tennessee Div. Geol. Bull. 64: pp. 1-567.
- Barr, T.C. 1963. Studies on the cavernicole *Ptomaphagus* of the United States (Coleoptera: Catopidae). Psyche 70: 50-58.
- Barr, T.C. Jr. 1964. Non-troglobitic Carabidae (Coleoptera) from caves in the United States. Coleop. Bull. 18: 1-4.
- Barr, T.C. Jr. 1965. The *Pseudanophthalmus* of the Appalachian Valley (Coleoptera: Carabidae). Amer. Midl. Nat. 73: 41-72.
- Barr, T.C., Jr. 1968. Cave ecology and the evolution of troglobites. Evol. Biol., v.2: 35-102.
- Barr, T.C. Jr. 1969. Evolution of the (Coleoptera) Carabidae in the southern Appalachians.
- Barr, T.C. Jr. 1974. The eyeless beetles of the genus Arianops Brundel (Coleoptera, Pselaphidae). Bull. Amer. Mus. Nat. Hist. 154: 1-51.
- Barr, T.C. Jr. 1981a. The cavernicolous carabid beetles of North America. Proc. 8th Int. Cong. Speleol. (Bowling Green, KY) 1: 343-344.
- Barr, T.C. Jr. 1981b. *Pseudanophthalmus* from Appalachian caves (Coleoptera: Carabidae). The *Engelhardti* Complex. Brimleyana 5: 37-94.
- Barr, T.C. Jr. 1985. Pattern and process in speciation of trechine beetles in eastern North America (Coleoptera: Carabidae: Trechinae) pp. 350-407, *in* Ball, G. E., *ed.* Taxonomy, Phylogeny, and Zoogeography of Beetles and Ants. Ser. Ent. 33. W. Junk publ. Netherlands.
- Barr, T.C., Jr. and J. R. Holsinger. 1985. Speciation in cave faunas. Ann. Rev. Ecol. Syst., v.16: 313-337.
- Barr, T.C. Jr. and S. B. Peck. 1965. Occurrence of a troglobitic *Pseudanoph-thalmus* outside a cave (Coleoptera: Carabidae). Amer. Midl. Nat. 73: 73-74.
- Chandler, D. S. 1990. Insecta: Coleoptera Pselaphidae. pp. 1175-1190. *In* D. L. Dindal (ed.). Soil Biology Guide. John Wiley and Sons, New York.
- Choate, P. M. and T. Rogers. 1976. The occurrence of a troglophilic ground beetle in Florida (Coleoptera: Carabidae). Coleop. Bull. 30: 364.
- Christiansen, K. 1960a. The genus *Pseudosinella* (Collembola, Entomobryidae) in caves of the United States. Psyche 67: 1-25.
- Christiansen, K. 1960b. The genus *Sinella* Brook (Collembola: Entomobryidae) in Nearctic Caves. Ann. Entomol. Soc. Amer. 53: 481-491.

- Christiansen, K. 1960c. The preliminary survey of the knowledge of North American cave Collembola. Amer. Midl. Nat. 64: 39-44.
- Christiansen, K. 1961. Convergence and parallelism in cave Entomobryinae. Evolution 15: 288-301.
- Christiansen, K. 1964. A revision of the Nearctic members of the genus *Tomocerus* (Collembola, Entomobryidae). Rev. Ecologie et Biologie du Sol 1(4): 639-678.
- Christiansen, K. 1965. Behavior and form in the evolution of cave Collembola. Evolution 19: 529-537.
- Christiansen, K. 1966. The genus Arrhopalites (Collembola: Sminthuridae) in the United States and Canada. Int. J. Speleol. 2(1&2): 43-73.
- Christiansen, K. 1982. Zoogeography of cave Collembola east of the Great Plains. NSS Bull. 44: 32-41.
- Christiansen, K. 1985. Regressive evolution in Collembola. NSS Bull. 47: 89-100.
- Christiansen, K.A. 1990. Insect: Collembola. pp. 965-995. In D. L. Dindal (ed.). Soil Biology Guide. John Wiley and Sons, New York.
- Christiansen, K. A. 1992. Cave life in the light of modern evolutionary theory. pp. 453-478. In A. I. Camacho (ed.). The natural history of biospeleology, Monographias del Museo Nacional Ciencias Naturales, Madrid, Spain.
- Christiansen, K. A. and P. Bellinger. 1980. The Collembola of North America, north of the Rio Grande. Crinnell College, Grinnell, IA.
- Christiansen, K. and D. C. Culver. 1968. Geographical variation and evolution in *Pseudosinella hirsuta*. Evolution 22: 237-255.
- Christiansen, K. and D. C. Culver. 1987. Biogeography and the distribution of cave Collembola. J. Biogeog. 14: 459-477.
- Conde, B. 1949. Campodeides cavernicoles de la region des Appalaches. Notes Biospeleol. 4: 125-137.
- Cooper, J. E. and T. L. Poulson. 1968. A guide for biological collecting in caves. NSS News 26: 127-138.
- Culver, D. C. 1982. Cave life: evolution and ecology. Harvard Univ. Press. 189 pp.
- Delamare-Deboutteville, C. 1949. Collemboles cavernicoles du Tennessee et de l'Alabama, Mus, Nat, Hist, Paris, Notes Biospel, 12(4): 117-124.
- Ferguson, L. W. 1981. Cave diplura of the United States. Proc. 8th Int. Cong. Speleol. (Bowling Green, KY, 1981) 1: 11-12.
- Ferguson, L. M. 1990a. Insecta: Diplura. pp. 951-963. In D. L. Dindal (ed.). Soil Biology Guide. John Wiley and Sons, New York.
- Ferguson, L. M. 1990b. Insecta: Microcoryphia and Thysonura. pp. 935-949. In D. L. Dindal (ed.). Soil Biology Guide. John Wiley and Sons, New York.
- Folsom, J. W. 1913. North American springtails of the subfamily Tomocerinae. Proc. U.S. Nat. Mus. 46: 451-472.
- Gurney, A. B. 1943. A synopsis of the poscids of the tribe Psyllipsocini, including the description of an unusual new genus from Arizona. Ann. Entomol. Soc. Amer. 36: 195-220.
- Holsinger, J.R. 1988. Troglobites: the evolution of cave-dwelling organisms. Amer. Sci., v.76: 147-153.
- Holsinger, J. R. and D. C. Culver. 1988. The invertebrate cave fauna of Virginia and a part of eastern Tennessee: zoogeography and ecology. Brimleyana, v.14: 1-162.
- Holsinger, J. R. and S. B. Peck. 1971. The invertebrate cave fauna of Georgia. NSS Bull., v.33: 23-44.
- Howarth, F. C. 1983. Ecology of cave arthropods. Ann. Rev. Entomol., v.28: 365-389.
- Hubbell, T. H. 1936. A monographic revision of the genus *Ceuthophilus* (Orthoptera, Gryllacrididae, Rhaphidophorinae). Univ. Florida Biol. Sci. Ser. 2: 1-551 and 38 plates.
- Hubbell, T.H. and R.M. Norton. 1978. Systematics and biology of the cave crickets of the North American tribe Hadenecini (Orthoptera Saltatoria: Ensifera: Rhaphidophoridae: Dolichopodinae). Misc. Publ. Mus. Zool. Univ. Michigan 156: 1-124.
- Jeannel, R. 1933. Trois *Adelops* nouveaux de l'Amerique du nord (Col., Catopidae). Bull. Soc. Ent. Fr. 38: 251-253.

- Jeannel, R. 1936. Monographie des Catopidae. Mem. Mus. Natl. Hist. Natur, Paris n.s. 1: 1-433.
- Jeannel, R. 1949. Etude systematique. 7-116. In R. Jeannel and H. Henrot, Lt Coleopteres cavernicoles de la region des appalaches. Notes Biospeleo, Fasc 4 Publ. Mus. Natl. Hist. Natur. Paris no. 12.
- Jeannel, R. 1963. Supplement a la monographie des Anillini. (1). Sur quelques especes nouvelles de l'Amerique du Nord. Rev. Fran. Entomol. 30: 145-152
- Jefferson, G. T. 1981. Diptera in British caves. In Proc. 8th Int. Congr. Speleol, Bowling Green, KY. B. Bec, (ed.) 1: 106-107.
- Johnson, W. D. 1930. Physical divisions of northern Alabama. Geol. Surv. Al. abama Bull. 38. 48 pp.
- Jones, W. B. and W. W. Varnedoe, Jr. 1968. Caves of Madison County, Alabama. Geol. Surv. Alab. Circular 52, University, Alabama. 177 pp.
- Jones, W. B. and W. W. Varnedoe, Jr. 1980. Caves of Morgan County, Alabama. Geol. Surv. Alab. Bull. 112, University, Alabama. 205 pp.
- Klimaszewski, J. 1984. A revision of the genus Aleochara Gravenhorst of America north of Mexico (Coleoptera: Staphylinidae, Aleocharinae). Mem. Em Soc. Canada 129: 1-211.
- Klimaszewski, J. and S. B. Peck. 1986. A review of the cavernicolous Staphylinidae (Coleoptera) of eastern North America: part 1: Aleocharinae. Quaest Ent. 22: 51-113.
- Lindroth, Carl H. 1966. The ground beetles of Canada and Alaska. Opuscula Entomologica Supplementum XXIX, Entomologiska Sallskapet, Lund. 1192 pp.
- Loding, H. P. 1945. Catalogue of the beetles of Alabama. Geolo. Sur. Alabama Mono 11, 172 pp.
- Marshall, S. A. and S. B. Peck. 1984. Distribution of cave-dwelling Sphaero ceridae (Diptera) of eastern North America. Proc. Ent. Soc. Ontario 115: 37-41.
- Marshall, S. A. and S. B. Peck. 1985. The origin and relationships of *Spelobic tenebraerum* (Aldrich), a troglobitic, eastern North American, Sphaerocerid fly. Can. Entomol. 117: 1013-1015.
- Marshall, S. A. and J. Rohacek. 1984. A revision of the genus *Telomerina* Rohacek (Diptera, Sphaeroceridae). Syst. Entomol. 9: 127-163.
- Mockford, E. L. 1950. Psocoptera of Indiana. Proc. Ind. Acad. Sci. 60: 192-204 Papp, L. and H. Plachter. 1976. On cave dwelling Sphaeroceridae from Hungary
- and Germany (Diptera). Ann. Hist. Natur. Mus. Nat. Hungary 68: 195-207.
- Park, O. 1947. Observations on *Batrisodes* (Coleoptera: Pselaphidae) with particular reference to the American species east of the Rocky Mountains Chicago, Acad, Sci. Bull 8: 45-132.
- Park, O. 1951. Cavernicolous Pselaphid beetles of Alabama and Tennessee, with observations on the taxonomy of the family. Geol. Surv. Alabama, Mus. Pap. 31: 107 pp.
- Park, O. 1953. New or little known Pselaphid beetles of the United States, with observations on taxonomy and evolution of the family Pselaphidae. Bull Chicago Acad. Sci. 9: 249-293.
- Park, O. 1956. New or little known species of Pselaphid beetles from southeast ern United States. J. Tenn. Acad. Sci. 31: 54-100.
- Park, O. 1958. New or little known species of Pselaphid beetles chiefly from southeastern United States. J. Tenn. Acad. Sci. 33: 39-74.
- Park, O. 1960. Cavernicolous Pselaphid beetles of the United States. Amer. Mid. Nat. 64: 66-104.
- Park, O. 1965. Revision of the genus Batriasymmodes (Coleoptera: Pselaphluae). Trans. Amer. Micros. Soc. 84: 184-201.
- Peck, S. B. 1970. The terrestrial arthropod fauna of Florida caves. Fla. Entomol., v.53: 203-207.
- Peck, S. B. 1973. A systematic revision and the evolutionary biology of the *Ptomaphagus (Adelops)* beetles of North America (Coleoptera; Leiodidae: Catopinae) with emphasis on cave inhabiting species. Bull. Mus. Comp. Zool. (Harvard Univ.) 145: 29-162.
- Peck, S. B. 1974a. The eyeless *Catopocerus* beetles (Leiodidae) of eastern North America. Psyche 81: 377-397.

- Peck, S. B. 1974b. The food of the salamanders *Eurveea lucifuga* and *Plethodon glutinosus* in caves. NSS Bull. 36: 7-10.
- Peck, S. B. 1975a. A review of the distribution and habitats of North American Brathinus (Coleoptera: Staphylinidae: Omaliinae). Psyche 82: 59-66.
- Peck, S. B. 1975b. Cantharid beetle larvae in American caves. NSS Bull. 37: 77-78
- Peck, S. B. 1975c. A population study of the cave beetle *Ptomaphagus loedingi* (Colcoptera; Leiodidae; Catopinae). Int. J. Speleol. 7: 19-32.
- Peck, S. B 1976. The effect of cave entrances on the distribution of cave inhabiting terrestrial arthropods. Int. J. Speleol. 8: 309-321.
- Peck, S. B. 1977. A review of the distribution and biology of the small carrien beetle *Prionochaeta opaca* of North America (Coleoptera; Leiodidae; Catopinae). Psyche 83: 299-307.
- Peck, S. B. 1978. Systematics and evolution of forest litter Adelopsis in the 54 southern Appalachians (Coleoptera; Leiodidae; Catopinae). Psyche 85: 355-382.
- Peck, S. B. 1981. Distribution and biology of the flightless carrion beetle *Necrophilus pettitii* in castern North America (Coleoptera; Silphidae). Ent. News 92: 181-185.
- Peck, S. B. 1982. Occurrence of *Ptomaphagus cavernicola* in forests in Florida and Georgia (Coleoptera; Leiodidae; Cholevinae). Fla. Ent. 65: 378-379.
- Peck, S. B. 1983. Experimental hybridizations between populations of cavernicolous *Ptomaphaqus* beetles (Coleoptera; Leiodidae; Cholevinae). Can. Ent. 115: 445-452.
- Peck, S. B. 1984. The distribution and evolution of cavernicolous *Ptomaphaqus* beetles in the southeastern United States with new species and records. Can. J. Zool. 62: 730-740.
- Peck, S. B. 1986. Evolution of adult morphology and life-history characters in cavernicolous *Ptomaphagus* beetles. Evolution 40: 1021-1030.
- Peck, S. B. 1988. The cave fauna of Canada, and the ecology of the cave and mine fauna of Ontario. Can. J. Zool., v.66: 1197-1213.
- Peck, S. B. 1989. The cave fauna of Alabama: Part I. The terrestrial invertebrates (excluding insects). NSS Bull. 51: 11-33.
- Peck, S. B. 1990. Insects: Coleoptera Silphidae and the associated families Agyrtidae and LeSodidae. pp. 1113-1136. In D. L. Dindal (ed.). Soil Biology Guide. John Wiley and Sons, New York.
- Peck, S. B. and K. C. Christiansen. 1990. The evolution and zoogeography of the invertebrate cave faunas of the "Driftless Area" of the upper Mississippi River Valley, Iowa, Minnesota, Wisconsin, and Illinois, U.S.A. Can. J. Zool. 66: 1197-1213.
- Peck, S. B. and B. L. Richardson. 1976. Feeding ecology of the salamander *Eurycea lucifuga* in the entrance, twilight, and dark zones of caves. Ann. Speleol. 31: 175-182.

- Quate, L. W. 1954. A Revision of the Psychodidae (Diptera) in America north of Mexico. Univ. Calif. Pub. Entomol. 10: 103-273.
- Reddell, J. 1966. A checklist of the cave fauna of Texas. II. Insecta. Texas J. Sci. 18: 25-56.
- Reddell, J. 1983. A checklist and bibliography of the Japygoidea (Insecta: Diplura) of North America, Central America, and the West Indies. Pierce-Sellards Ser. (Texas Mem. Mus., Univ. Texas) 37: 1-41.
- Rehn, J. W. H. 1944. The rhaphidiophorid *Trachvcines asynamorus* Adelung in America (Orthoptera, Gryllacrididae, Rhaphidophorinae). Entomol. News 55: 36-39.
- Robinson, G. 1980. Cave-dwelling tineid moths: a taxonomic review of the world species (Lepidoptera: Tineidae). Trans. British Cave Res. Assoc. 7: 83-120.
- Robinson, W. H. 1971. Old and new biologies of *Meqascelia* species (Diptera, Phoridae). Stud. Entomol. 14: 321-348.
- Salmon, J. T. 1964. An index to the Collembola. Roy. Soc. N. Zeal. Bull. 7: 1-651. Smetana, A. 1971. Revision of the tribe Quediini of America north of Mexico (Coleoptera: Staphylinidae). Mem. Ent. Soc. Canada 79, 303 pp.
- Smetana, A. 1971. Revision of the tribe Quediini of Ameria north of Mexico (Coleoptera: Staphylinidae). Mem. Entomol. Soc. Canada 79.
- Thibaud, J. M. 1975. Description des trois especes nouvelles des genres Bonetogastrura et Typhlogastrura (Insectes Collemboles Hypogastruridae). Ann. Speleol. 30: 343-346.
- Valentine, J. M. 1931. New cavernicole Carabidae of the subfamily Trechinae Jeannel. J. Elisha Mit. Sci. Soc. 46: 247-258.
- Valentine, J. M. 1932. A classification of the genus *Pseudanophthalmus* Jeannel (fam. Carabidae) with descriptions of new species and notes on distribution. J. Elisha Mit. Sci. Soc. 47: 261-280.
- Valentine, J. M. 1945. Speciation and raciation in *Pseudanonhthalmus* (Cavernicolous Carabidae). Trans. Conn. Acad. Arts Sci. 36: 631-672.
- Valentine, J. M. 1948. New anophthalmid beetles (fam. Carabidae) from the Appalachian region. Geol. Surv. Alabama, Mus. Pap. 27. 1-19.
- Varnedoe, W. W. Jr. 1973. Alabama caves and caverns. National Speleological Society. Huntsville, Alabama.
- Varnedoe, W. W. Jr. 1975. Alabama Cave Survey. Interim Report no. 2. Huntsville Grotto, National Speleological Society. Huntsville, Alabama.
- Varnedoe, W. W. Jr. 1981. Alabama caves, 1980. Alabama Cave Survey. Huntsville Grotto. National Speleological Society.

Manuscript received by the Society 8/7/94.

- Revised manuscript received 10/25/94.
- Manuscript accepted for publication 11/13/94.