



Formicidae of the Bearpaw Mountains of Montana
by Horace Frederick Borchert

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of
DOCTOR OF PHILOSOPHY in Zoology
Montana State University
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Abstract:

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Thirty-nine species and subspecies of ants were found. The twenty-eight species from the subfamily Formicinae constituted the largest taxonomic category. Myrmicinae was represented by ten species. Dolichoderinae was represented by only one species.

Over half, 55%, of the ant species from the Bearpaw Mountains have distributions that are primarily from western United States. Eighteen percent have distribution ranges that cover most of the United States and southern Canada. Thirteen percent have centers of distribution primarily from northeast United States. Boreal and Holarctic ants each form 5% of the population.

New records on the distribution range for eight taxa were made.

These were: *Myrmica lobicornis lobifrons*, *Manica hunteri*, *Aphaenogaster subterranea Occidentalis*, *Aphaenogaster subterranea Valida*, *Solenopsis molesta validiuscula*, *Lasius biveicovnis microps*, *Formica hewitti*, and *Formica microgyna*.

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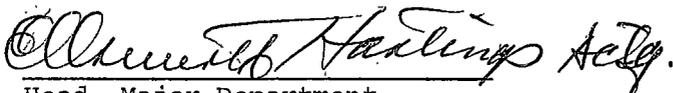
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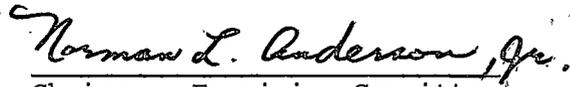
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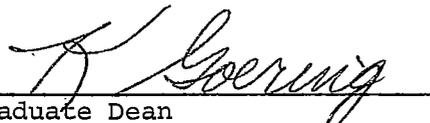
in

Zoology

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Bozeman, Montana

December, 1969

ACKNOWLEDGMENTS

I wish to thank Dr. Norman L. Anderson, my advisor, and the other members of my graduate committee for their constructive criticisms in preparing this thesis.

Thanks to Professor L. W. Hagner of Northern Montana College for the use of his herbarium and for his help in identifying some plants from the Bearpaw Mountains. I also appreciate having had the use of the microscopes from Northern Montana College.

I am grateful to Dr. Robert E. Gregg of the University of Colorado for awakening my interest in myrmecology; for encouragement during the research for this project; and for his opinions involving the identifications of some ant specimens found during this study.

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ABSTRACT

Collections from 450 colonies of ants in the Bearpaw Mountains of north central Montana were made during the summers of 1965 through 1969. More than half of the samples were taken during the summer of 1968. The usual methods of the myrmecologist were employed.

An approximate transect was established on the north-south axis of the mountains by collecting along Beaver, Eagle, and Big Sandy Creeks. These three creeks have their headwaters in the higher elevations of the Bearpaw Mountains. Secondary transects were made by collecting from the sides of the valleys as well as from the valley bottoms. The collecting areas were selected to include various vegetation types.

Thirty-nine species and subspecies of ants were found. The twenty-eight species from the subfamily Formicinae constituted the largest taxonomic category. Myrmicinae was represented by ten species. Dolichoderinae was represented by only one species.

Over half, 55%, of the ant species from the Bearpaw Mountains have distributions that are primarily from western United States. Eighteen percent have distribution ranges that cover most of the United States and southern Canada. Thirteen percent have centers of distribution primarily from northeast United States. Boreal and Holarctic ants each form 5% of the population.

New records on the distribution range for eight taxa were made. These were: *Myrmica lobicornis lobifrons*, *Manica hunteri*, *Aphaenogaster subterranea occidentalis*, *Aphaenogaster subterranea valida*, *Solenopsis molesta validiuscula*, *Lasius brevicornis microps*, *Formica hewitti*, and *Formica microgyna*.

INTRODUCTION

Colonization of the Bearpaw Mountains by ants probably occurred during the last 10,000 years, since the retreat of the last continental glacier. This glacier pushed against the north slopes of the mountains and then flowed around the east and west sides. During this ice age, the ants and other life that was previously present would have had to retreat southward or face extermination.

The ant species now present in the Bearpaw Mountains and their affinities can be in part inferred from the literature. Creighton (1950) lists the distributions for 585 recognized valid taxonomic entities in North America north of Mexico. He also reports the range of certain taxa as "through Montana" or "to Montana" or "coast to coast in northern United States and southern Canada". The "type localities" for a few species or subspecies has been recorded as "in Montana". The Wheelers (1967) have collected ants in eastern Montana and noted the presence of *Veromessor lobognathus* as a new record for the state. There is no indication from the literature that the ant fauna in the island mountain ranges of the eastern portion of the state has been sampled. It likely was mountains of this type that Creighton (1950) had in mind when he wrote: "Many of the species of *Formica* range widely and have produced numerous geographical races. There are also 'insular' species which occur in isolated mountains of the west." The Bearpaw Mountains south of Havre, Montana, are geologically isolated from the mountainous area to the west and south even though they may not be isolated biologically. Gregg (personal

communication) states that he possesses "specimens only from the mountains in western Montana, and some from the vicinity of Billings".

Since there was no indication in the literature of intensive ant collecting from the mountains of eastern Montana, this investigation was undertaken to:

1. Collect and identify the ant species of the Bearpaw Mountains.
2. Relate the ant species of the area to their overall distribution.
3. Correlate the different ant species with vegetation types.

GENERAL DESCRIPTION OF THE BEARPAW MOUNTAINS

Geology

The Bearpaw Mountains (Fig. 1), one of several isolated mountain uplifts of the Tertiary age in the northern Great Plains of Montana, are about forty miles long on an east-west axis and about thirty-three miles on the north-south axis. Most of the peaks are from 4,000 to 5,000 feet above sea level and several are above 6,000 feet. The highest peak is Old Baldy at an elevation of 6,916 feet. The deformed sedimentary rocks are intruded by dikes, sills, plugs and stocks with volcanic formations on the north and south flanks. A continental ice sheet advanced across the northern portion of the mountains during the late Pleistocene, abutted against the high terrain and covered all the existing valleys below 4200 feet with glacial till. After the retreat of the ice sheet, a drainage system developed on the ground moraine. Locally, parts of the preglacial valleys have been resurrected (Pecora, 1957).

Climate

The climate of the Bearpaws is continental with cold winters and warm summers that are typical of the northern prairies. The nearest official station of the U. S. Weather Bureau is in Havre, about thirty miles north of the Bearpaws. From 1931-1967, the mean temperature for January was 13.9 F. The coldest temperature recorded in Havre was -57°F. in January of 1916. During this thirty-six year period, the month of July shows the highest temperatures with a mean average of 69.6°F. and the highest recorded temperature was 111°F. in August of 1961. The mean annual

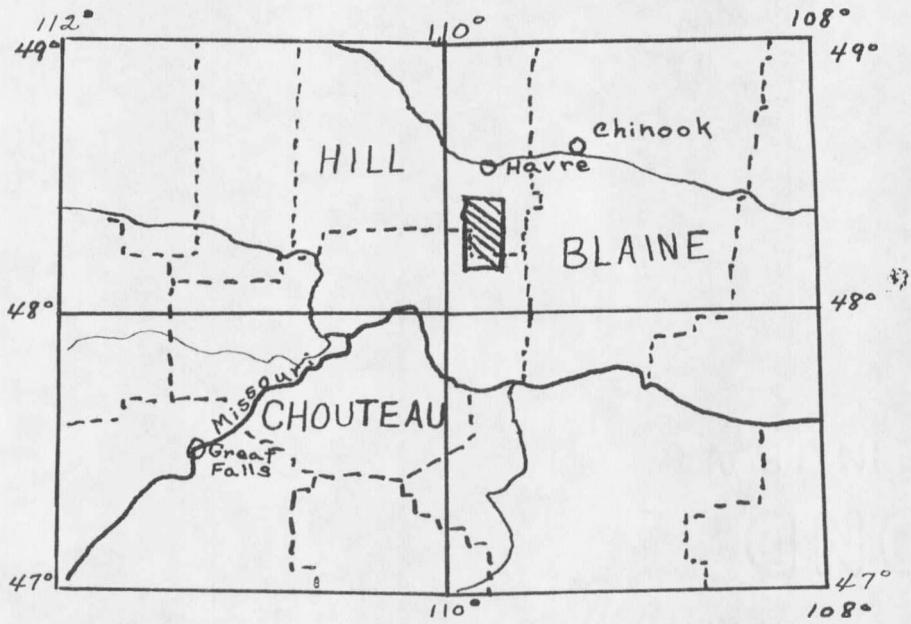


Figure 1. The study area, Bearpaw Mountains, north central Montana.
1" = 50 miles.

precipitation for the 1931-1967 period was 12.78 inches with about half occurring during the months of April through June (U. S. Weather Bureau, 1967).

The climate within the Bearpaws is somewhat milder than that of Havre with the mean average temperature for July of 60°F. The unofficial weather reports from the Bearpaw Ski Bowl gave the winter temperatures near freezing when the temperature in Havre was near 0°F. The annual precipitation in the higher elevations is about seven inches more than that recorded in Havre (Windecker, 1967).

Vegetation

Martinka (1968) recognized seven habitat types in his study of the deer in the Bearpaw Mountains. Walcheck (1969) in his study of the birds along Beaver Creek showed four community types. The ants appear to be primarily limited in distribution by soil conditions and cover, such as rocks or wood for nesting sites, rather than by specific plant groups. Gregg (1963) states, "It is evident that ants are more sensitive to the composite of environmental conditions (climate and biotic) to which they are subjected and to which they must be adapted, and are controlled less by relations with particular plant species or groups of species, than many other groups of insects." In this study four plant complexes which also reflect soil conditions are recognized.

The coniferous forests (Plate VIII) are found on the north-facing slopes at the higher elevations and are dominated by lodgepole pine (*Pinus contorta*), some Douglas fir (*Pseudotsuga taxifolia*) and a few

alpine fir (*Abies lasiocarpa*). The forest floor is covered by a thick mat of leaf litter with very few rocks exposed; consequently, the nesting sites for the ants are primarily associated with wood.

The deciduous trees and shrubs are found along the flood plains of the streams, along the sheltered cuts and on some east slopes. The dominant trees along the flood plains (Plate V) are: willow (*Salix spp.*), thinleaf alder (*Alnus tenuifolia*) and black cottonwood (*Populus trichocarpa*). In a few places in the higher elevations, as along Eagle Creek (Plate IV), some ponderosa pine (*Pinus ponderosa*) and Douglas fir are found. The understory of shrubs is composed of roses (*Rosa spp.*), dogwood (*Cornus stolonifera*), western snowberry (*Symphoricarpos occidentalis*), chokecherry (*Prunus virginiana*), and western serviceberry (*Amelanchier alnifolia*) on the flood plains. The shrubs extend into the protected watershed cuts and along the east slopes (Plate VIII) of intermediate elevations. Aspen (*Populus tremuloides*) clumps are interspersed throughout the forested areas where there are favorable growing conditions.

The bottom meadows found along the flood plains (Plate VI) as clearings in the forests are the more mesic grasslands. The most common grasses are bluegrass (*Poa spp.*) and timothy (*Phleum pratense*) with some bluebunch wheatgrass (*Agropyron spicatum*) and smooth brome grass (*Bromus inermis*). Dandelions (*Taraxacum officinale*), clover (*Trifolium spp.*), asters (*Aster spp.*), horse mint (*Monarda fistulosa*), and stinging nettles (*Urtica dioica*) are typical forbs. The soil is usually moist since it receives the run-off water from the higher areas and the subsurface water moves into the valleys and comes to the surface as seeps and/or springs.

The upland grasses or bunchgrasses are found on the exposed south and west slopes and on the upland areas. The most common grasses are bluebunch wheatgrass, Idaho fescue (*Festuca idahoensis*), blue grama (*Bouteloua gracilis*), bluegrass and cheat grass (*Bromus tectorum*). The most abundant forbs are vetches (*Astragalus spp.*), arrow-leaf balsamroot (*Balsamorhiza sagittata*), fringed sage (*Artemisia frigida*) and western yarrow (*Achillea millefolium*). The club mosses (*Selaginella spp.*) also form an important part of the soil cover. The topsoil is variable from almost bare parent materials to a few inches in depth and it is dry at least part of the summer. Ponderosa pine stands are found on some of the ridge tops.

METHODS AND MATERIALS

To obtain a representative sample of the ants of the Bearpaw Mountains, collecting was done along three drainage systems whose headwaters are in the higher elevation of the range: (1) Beaver Creek draining northward, (2) Big Sandy Creek draining to the west, and (3) Eagle Creek which drains some of the southern portion of the formation. A transect through the higher portions of the Bearpaws was established by following these creek valleys (Fig. 2). A secondary transect was established for each of the collecting areas selected along each of the creek valleys. This was done by walking a relatively straight line across the valley and collecting from most of the spots in which ants are usually found. The seven collecting areas were selected so that representatives of all the various vegetation types would be sampled. Additional collections were made from areas selected at random through the Bearpaws.

The bulk of the 450 collections were made during the summers of 1968 and 1969; however, about 100 colonies were sampled during previous summers starting with 1965.

The usual collecting procedure involved the removal of the nest cover by turning rocks or chopping logs apart and then picking up the ants with curved forceps and placing them in two-dram vials of 85% ethanol. With some of the small subterranean forms it was necessary to remove a shovel-ful of soil, place it on a piece of cloth such as an old sheet, and to wait for the ants to expose themselves when they left the soil.

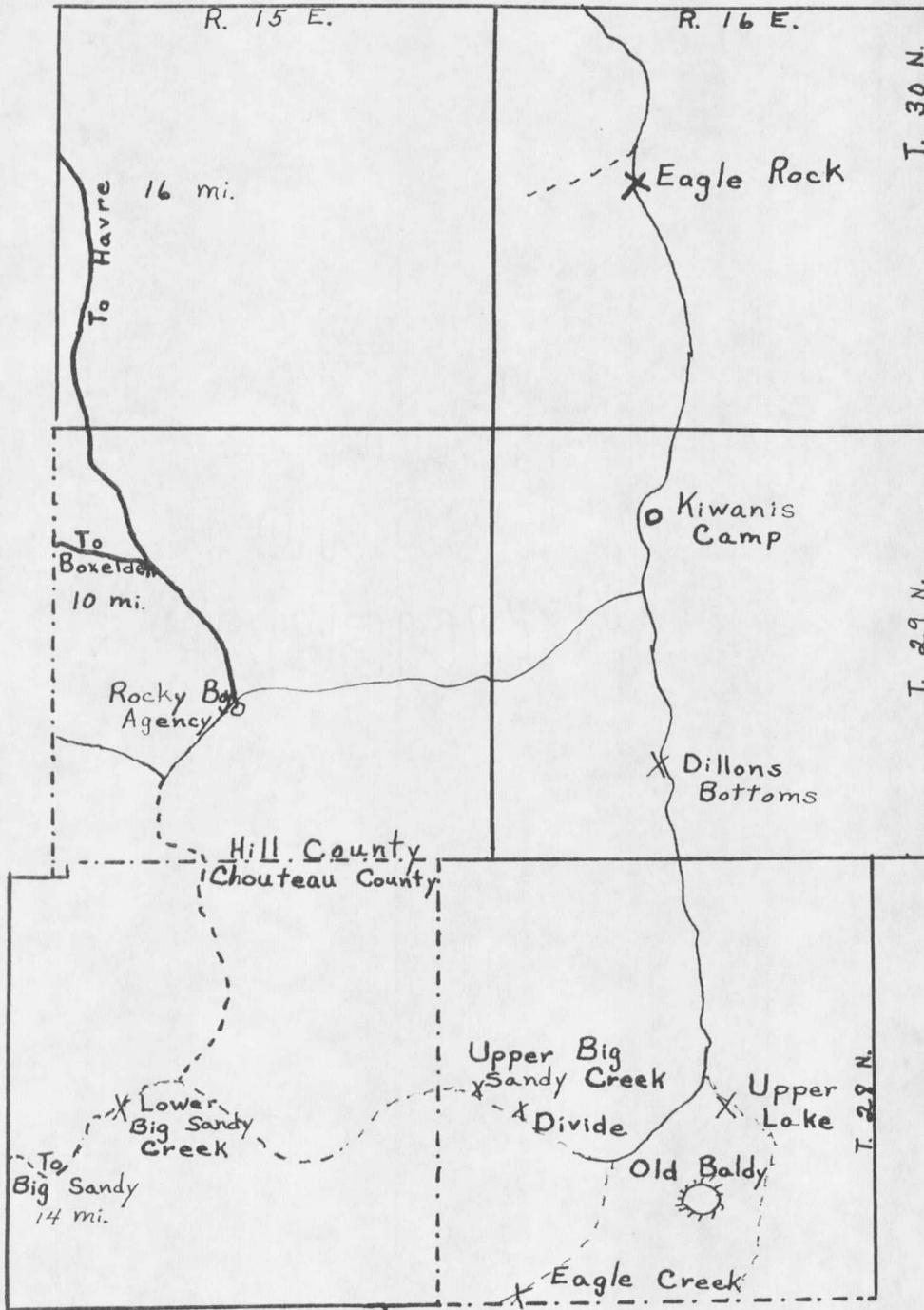


Figure 2. Location of Collecting Sites. 1 cm = 1 mile

-  Black top road
-  Improved road
-  Dirt road

After representatives of a colony were collected, the vial was numbered by placing a slip of paper into it. A corresponding number was written in a field notebook and an entry was made as to the microhabitat, collecting area, date, type of vegetation, and any other notation that was thought to be pertinent.

Upon returning to the laboratory, the soil and other extraneous material that was inadvertently put into the vials was removed and the 'cleaned' ants were placed in vials with fresh 85% ethanol with about 3% glycerol added. Each vial of ants was labeled with the most pertinent collection data and the scientific name of the species.

The ants are social insects and compose the family Formicidae of the order Hymenoptera. The workers are apterous, possess geniculate antennae and an abdominal pedicel of one or two segments. The structure of the abdominal pedicel distinguishes the family as well as the subfamilies. A small hand lens, 10X, is usually a sufficient aid in identification of the genera. Magnification of 100X is needed to see the pectinate spur used in the identification of some genera of Myrmicinae such as *Myrmica*, *Manica* and *Pogonomyrmex*. Most of the identifications were made with the aid of a dissection microscope with 2X and 4X objective lenses and a 10X ocular.

A collection ordinarily consists of the representatives of one species from a single nest; however, a collection could be a single 'stray' that was gathered at a site from which no nests for that species were found. An ideal collection would consist of a number of workers, some of the brood, males, alate females, and dealate females. Most of the collections for this study consist of workers plus any of the other castes found in the

nest. From very populous nests, such as *Formica obscuripes*, it was possible to collect a large number of workers. The number of specimens collected from each nest depended upon the population of the colony and/or the speed with which they escaped into the inner sanctuary of the nest. An attempt was made to get at least ten workers from each nest sampled.

Ants can be collected from spring through autumn. The colonies sampled in the spring were generally smaller than those sampled later in the season. The winter mortality rate could explain this. Brood was found in many of the nests during the latter part of the collecting season, starting with early summer. Late summer and early fall are the best seasons to collect when the winged forms are desired. It was the easiest to collect ants after a rain when the soil was damp and cool for then the ants were in their chambers near the surface and their movements were somewhat sluggish.

Classification of the ants was based upon the keys in The Ants of North America (Creighton, 1950) and The Ants of Colorado (Gregg, 1963) with references to The Ants of North Dakota (Wheeler, 1963).

Dr. Gregg identified and/or verified classifications of specimens that were unfamiliar to me.

SITE DESCRIPTIONS AND RESULTS

Eagle Rock Area

The Eagle Rock collecting area (Plate I) is located in Beaver Creek Park of Hill County in section 16, R. 16 E., T. 30 N. at approximately 3360 feet above sea level. The east bank of the creek continues as a cliff forming the east side of the valley. On the west side of the creek there is a small flood plain that is covered with shrubs, primarily willow and thinleaf alder. A steep bank about ten to fifteen feet high marked the edge of the flood plain. A large number of loose rocks along the bank made an excellent habitat for ants. The remainder of the valley and the east-facing slope was a drier grassland area. An upland grassland about two miles to the west at 3900 feet near the Eagle Rock School was searched for ants.

The parent material of the soil in the Eagle Rock area is variable with alluvium along the stream flood plains and glacial ground moraine in the upland area built upon mafic volcanic rock which outcrops at Eagle Rock (Kerr, 1957). The topsoil is also variable in both depth and texture. Generally, though, the soil is a well drained, dark colored loam with excellent moisture storing capacity (SCS, 1962). The topsoil on the hill-sides appears to be shallow with numerous boulders of glacial origin and outcroppings of bedrock.

The ants found in the bottom flood plain area (Table I) were:

Solenopsis molesta validiuscula, *Formica lasioides*, *F. sanguinea subnuda*, and *F. fusca*. The members of *subnuda* were very numerous and very conspicuous in the area. *F. fusca* individuals were observed on the ground and

