Brigham Young University Science Bulletin, Biological Series

Volume 7 | Number 3 Article 1

6-1966

Ants of the Nevada Test Site

Arthur Charles Cole Jr.
Department of Zoology and Entomology, University of Tennesse, Knoxville

Brigham Young University
Science Bulletin

ANTS OF THE NEVADA TEST SITE

by
ARTHUR C. COLE, JR.

BIOLOGICAL SERIES — VOLUME VII, NUMBER 3

JUNE 1966

BRIGHAM YOUNG UNIVERSITY SCIENCE BULLETIN
BIOLOGICAL SERIES

The Brigham Young University Science Bulletin, Biological Series, publishes acceptable papers, particularly large manuscripts, on all phases of biology.

Separate numbers and back volumes can be purchased from University Publications, Brigham Young University, Provo, Utah. All remittances should be made payable to Brigham Young University.

Orders and materials for library exchange should be directed to the Division of Gifts and Exchange, Brigham Young University Library, Provo, Utah.

Brigham Young University
Science Bulletin

ANTS OF THE NEVADA TEST SITE

by

ARTHUR C. COLE, JR.

BIOLOGICAL SERIES — VOLUME VII, NUMBER 3

JUNE 1966

TABLE OF CONTENTS

	Page
INTRODUCTION	1
Glossary of Special Terms	1
FAMILY FORMICIDAE	1
Myrmica emeryana tahoensis	3
Pogonomyrmex californicus	4
Pogonomyrmex occidentalis	5
Pogonomyrmex rugosus	5
Pogonomyrmex salinus	6
Pogonomyrmex imberbiculus	6
Stenamma smithi	7
Aphaenogaster boulderensis	9
Aphaenogaster megommatus	9
Veromessor lariversi	12
Veromessor lobognathus	12
Veromessor pergandei	13
Veromessor smithi	14
Pheidole bicarinata paiute	15
Pheidole desertorum	15
Pheidole inquilina	15
Pheidole pilifera coloradensis	15
Crematogaster coarctata vermiculata	16
Crematogaster depilis	16
Monomorium minimum	16
Solenopsis aurea	17
Solenopsis molesta validiuscula	17
Solenopsis salina	17
Solenopsis xyloni	17
Leptothorax andrei	17
Leptothorax nevadensis rudis	17
Dorymyrmex bicolor	18
Dorymyrmex pyramicus	18
Liometopum occidentale luctuosum	18
Iridomyrmex pruinosum analis	18
Camponotus hyatti	19
Camponotus maccooki	19
Camponotus ocreatus	20
Camponotus vicinus	20
Lasius crypticus	20
Lasius sitiens	20
Acanthomyops latipes	20
Myrmecocystus comatus	21
Myrmecocystus lugubris	21
Myrmecocystus mexicanus	21
Myrmecocystus mimicus	22
Myrmecocystus mojave	22
Formica fusca	23
Formica integroides planipilis	23
Formica lasioides	23
Formica limata	24
Formica microgyna	24
Formica moki	24
Formica neogagates	26
Formica neorufibarbis	26
Formica obtusopilosa	26

Formica subpolita - camponoticeps 26
Novomyrmex minor 26
LITERATURE CITED 27

LIST OF FIGURES

Figure Page
1. Disturbed Pinyon-Juniper community on Rainier Mesa 2
2. Crater nest of *Pogonomyrmex californicus* in mixed community 5
3. Conical gravel mound of *Pogonomyrmex occidentalis* in an Artemisia community 5
4. Flat gravel disc of *Pogonomyrmex rugosus* in the Grayia-Lycium community 6
5. Low gravel mound of *Pogonomyrmex salinus* in a Pinyon-Juniper community 7
6. Contour, in profile, of thoracic dorsum and of petiole and postpetiole of *Stenamma smithi*, n. sp., holotype 7
7. Contours, viewed from above, of petiolar and postpetiolar nodes of *Stenamma smithi*, n. sp., holotype 8
8. Contours, in profile view, of petiole and postpetiole of a male *Aphaenogaster megommatus* 9
9. Contour of paramere of a male *Aphaenogaster megommatus* 9
10. Volsella of a male *Aphaenogaster megommatus* 9
11. Aedeagus of a male *Aphaenogaster megommatus* 9
12. Abdominal sternite IX of a male *Aphaenogaster megommatus* 10
13. Contour in profile, of thoracic dorsum and of petiole and postpetiole of a female *Aphaenogaster megommatus* 10
14. Contours, viewed from above, of petiole and postpetiole of a female *Aphaenogaster megommatus* 10
15. Mound of *Veromessor lariversi* in a mixed plant community 12
16. Contour of thoracic dorsum and of petiole and postpetiole, A *Veromessor smithi*; B *V. lariversi*, C *V. lobognathus*, Worker caste 13
17. Mound of *Veromessor pergandei* in a Larrea community 13
18. Mound of *Veromessor smithi* in a Coleogyne community 14
19. Mound of *Myrmecocystus mexicanus* in a mixed community 22
20. Thatched mound of *Formica integroides planipilis* in a Pinyon-Juniper community 24
21. Paramere of a male *Formica moki* 25
22. Volsella of a male *Formica moki* 25
23. Aedeagus of a male *Formica moki* 25
24. Abdominal sternite IX of a male *Formica moki* 25

LIST OF TAXONOMIC KEYS

Page
Subfamilies of Formicidae 2
Genera of Myrmicinae 3
Species of *Pogonomyrmex* 4
Species of *Aphaenogaster* 8
Species of *Veromessor* 11
Species of *Pheidole* 14
Species of *Crematogaster* 16
Species of *Solenopsis* 16
Species of *Leptothorax* 17
Genera of Dolichoderinae 17
Species of *Dorymyrmex* 18
Genera of Formicinae 19
Species of *Camponotus* 19
Species of *Lasius* 20
Species of *Myrmecocystus* 21
Species of *Formica* 22

ANTS OF THE NEVADA TEST SITE[1]

by

Arthur C. Cole, Jr.[2]

INTRODUCTION

During the summer of 1962 I had the privilege of being stationed at the Nevada Test Site, as a part of Brigham Young University's research team, to make a study of the ants of the site. Previously I had identified extensive samples of ant populations that had been taken from can traps imbedded in the soil. The can traps served admirably in supplying me with nearly a complete list of the taxa occupying the site, and my field collections provided only a very few forms that had not appeared in the can samples. Thus, before I went to the site I had learned not only what taxa were there, but also which geographic areas and plant communities were involved.

Daily collections in the field provided many important data about the ants of the site and disclosed the presence of some taxa that were either new records for the state or species new to science. Three new species were represented; one of these (*Aphaenogaster megommatus* M. R. Smith) was described recently (Smith, 1963), one (*Veromessor smithi* Cole) was described subsequent to my studies on location at the site (Cole, 1963), and the other (*Stenamma* n. sp.) is described in this paper. Males of *Formica moki* Wheeler, which were found in a nest with associated workers, are described herein for the first time, as are also both sexual castes of *Aphaenogaster megommatus* M. R. Smith.

Although ants were represented to some extent in all plant communities of the test site, the disturbed Pinyon-Juniper community on Rainier Mesa supported the greatest number of taxa. Of the total of 52 taxa discovered at the test site, 28 were inhabitants of that community and 19 were found only there. Two conditions probably account for this distribution: (1) the natural condition of the habitat and plant community, and (2) the altered situation produced by the atomic detonations. The undisturbed Pinyon-Juniper community provides some degree of shade, a different type of soil texture, more soil moisture, and cooler diel temperatures than do the other communities of the test site. As a result of atomic detonations, the natural environment was considerably altered, apparently favorably so for many ant species. Most of the trees were killed by the atomic detonations, and surface rocks were disturbed considerably (Fig. 1). Unless otherwise stated, a disturbed community is one which has been affected by one or more atomic detonations.

For excellent accounts of the plant communities of the test site, the reader is referred to the publications in this series by Allred, *et al.* (1963) and Barnum (1964).

I am indebted especially to Dr. Dorald M. Allred and Dr. D Elden Beck, project supervisors, who invited me to participate in the project and were very helpful in providing excellent facilities for my use. I should like to express my appreciation to Merlin Killpack for his interest in my studies at the site and for his patience during our joint trips to collecting stations.

Glossary of Special Terms[3]

Cephalic index (CI). Head width X 100/head length.

Epinotum. The first abdominal segment fused with the thorax; the propodeum.

Eye length (EL). Maximum length of compound eye.

Eye width (EW). Maximum width of compound eye.

Funiculus. Portion of antenna distal to the scape.

Head length (HL). Length of head, in full face view, from anterior border of lateral clypeal lobes to the extreme posterior limits.

Head width (HW). Maximum width of head, excluding the eyes, in full face view.

Ocular index (OI). Eye length X 100/head length.

[1]B.Y.U.-A.E.C. Publication No. COO-1355-15. This work was supported under research contracts AT(11-1)-786 and AT(11-1)-1355 between the U.S. Atomic Energy Commission and Brigham Young University.

[2]Department of Zoology and Entomology, University of Tennessee, Knoxville

[3]For glossaries of common ant terminology the reader is referred to publications by Smith (*Amer. Midland Nat.*, 37:626-91), Wheeler and Wheeler (*Ants of North Dakota*, 1963:305-8), and Cole (J. Tennessee Acad. Sci., 24:86-8).

Petiolar node length (PNL). Length of only the node of the petiole as measured in profile or dorsal view.

Petiolar node width (PNW). Maximum width of the petiolar node in dorsal view.

Postpetiolar length (PPL). Total length of the postpetiole in profile or dorsal view.

Scape. Basalmost segment of an antenna.

Scape index (SI). Scape length X 100 head width.

Scape length (SL). Length of the scape excluding the bulb at the base.

Thorax length (TL). Length of thorax, in profile view, from anterior margin of pronotum (excluding the collar) to the tip of the metasternal lobe.

Fig. 1. Disturbed Pinyon-Juniper community on Rainier Mesa.

FAMILY FORMICIDAE

A Key to the Subfamilies of FORMICIDAE for Identification of the Workers[1]

1. Abdominal pedicel consisting of two segments ..... Myrmicinae
   Abdominal pedicel consisting of one segment 2

2. Cloacal orifice distinctly circular and surrounded by a fringe of hairs ..... Formicinae
   Cloacal orifice slit-shaped, the hairs, when present, not forming an encircling fringe ..... Dolichoderinae

[1]Adapted from Creighton, Bull. Mus. Comp. Zool., 104:29, 1950.

Subfamily MYRMICINAE

A Key to the Genera of the Subfamily MYRMICINAE for the Identification of the Workers[4]

1. Postpetiole attached to dorsal surface of first gastric segment, the gaster flattened dorsally but much more convex vertically, acutely pointed behind ..... *Crematogaster*

   Postpetiole attached to anterior end of first gastric segment, the gaster about equally convex above and below and not notably pointed behind 2

2. Antennae with 10 segments, the last two forming a distinct club ..... *Solenopsis*

   Antennae with more than 10 segments, the club, if present, with more than two segments 3

3. Spurs on middle and hind tibiae distinctly pectinate 4

   Spurs on middle and hind tibiae not pectinate 5

4. Thoracic dorsum not impressed between the mesonotum and epinotum; psammophore present, but sometimes weak ..... *Pogonomyrmex*

   Thoracic dorsum impressed between the mesonotum and epinotum; psammophore absent ..... *Myrmica*

5. Epinotum unarmed, the basal face at the same level as the dorsum of the mesonotum ..... *Monomorium*

   Epinotum armed with spines or teeth 6

6. Workers dimorphic, with the head of the major disproportionally large ..... *Pheidole*

   Workers monomorphic 7

7. Thoracic dorsum with the mesoepinotal suture absent or very faint, epinotum not depressed well below level of mesonotum ..... *Leptothorax*

   Thoracic dorsum with the mesoepinotal suture prominent, epinotum depressed well below level of mesonotum 8

8. Clypeus with a pair of prominent, parallel, longitudinal carinae; eyes minute, set very low on sides of head ..... *Stenamma*

   Clypeus without a pair of prominent, parallel, longitudinal carinae; eyes notably larger, set higher on sides of head 9

9. Head quadrate, not notably narrower behind the eyes than in front of them; psammophore present ..... *Veromessor*

   Head longer than broad, much narrower behind the eyes than in front of them, the occipital corners more broadly rounded; psammophore absent ..... *Aphaenogaster*

Genus *Myrmica* Latreille

Myrmica emeryana tahoensis Wheeler

Colonies of *tahoensis*, the only member of its genus known from the test site, were restricted to the Pinyon-Juniper community and chiefly to that of Rainier Mesa. They were few and small, and were found under stones in the more shaded areas. The workers, docile and sluggish, can be distinguished from their close relatives elsewhere by the epinotal spines, which are distinctly bent downward, and by the reddish yellow thorax and blackish head and gaster.

Genus *Pogonomyrmex* Mayr

A Key to Species of the Genus *Pogonomyrmex* for Identification of the Workers

1. Mandible with six teeth; eyes placed decidedly below center of sides of head; clypeus with a prominent tooth-like projection in front of each antennal fossa; head, thorax, and petiolar node strongly rugo-reticulose; metasternal flanges strongly developed and prominently acute; psammophore weakly developed; small ants, length of largest workers less than 5.0 mm. *imberbiculus* Wheeler

   Mandible with seven teeth; eyes placed at approximately the center of the sides of the head, clypeus without prominent tooth-like projections; head, thorax, and petiolar node not strongly rugo-reticulose; metasternal flanges less well developed and more rounded; psammophore strongly developed; larger ants, length of largest workers notably greater than 5.0 mm. 2

2. Ventral surface of petiolar peduncle with a few, long, erect, downward-directed hairs; eyes small, weakly convex, not extending beyond sides of head with head in full-face view, the head length between the occipital corner and the mandibular insertion more than three times the greatest eye diameter *rugosus* Emery

   Ventral surface of petiolar peduncle without hairs; eyes notably larger, more strongly convex, extending well beyond sides of head with head in full-face view, the head length between the occipital corner and the mandibular insertion distinctly less than three times the greatest eye diameter 3

3. Interrugal spaces on head and thorax shining, free of sculpture or with fine punctures that do not obscure the shining surface; base of antennal scape weakly developed; epinotum without armature *californicus* (Buckley)

   Interrugal spaces on head and thorax opaque, densely and strongly punctate, the punctures (especially on the head) giving a beaded appearance; base of antennal scape strongly developed; epinotum with a pair of short to long spines 4

4. Basal-most mandibular tooth offset, meeting the basal mandibular margin at a pronounced angle; superior lobe of base of antennal scape truncate, the extreme base with a distinct carina extending to the apex of the superior lobe; interrugal punctures of sides of the pronotum not tending to obscure the rugae; dorsum of petiolar node irregularly rugose; base of dorsum of first segment of gaster strongly shining, at most only shagreened *occidentalis* (Cresson)

   Basal-most mandibular tooth not offset, meeting the basal mandibular margin evenly at a straight angle; superior lobe of base of antennal scape broadly rounded, the extreme base without a carina; interrugal punctures of sides of pronotum tending to obscure the rugae; dorsum of petiolar node with a number of rugae that are generally transverse and subparallel; base of dorsum of first segment of gaster usually densely and finely punctate, the surface subopaque or opaque *salinus* (Olsen)

Pogonomyrmex (*Pogonomyrmex*) *californicus* (Buckley)

I include, as a portion of this overall species population, the ant which has been known as *californicus estebanius*, for reasons that have been stated in my generic revision (Cole, 1965b). The latter has been distinguished from the typical, concolorous, ferrugineous red *californicus* by its bicolored body—the head and thorax being ferrugineous red and the gaster (as well as generally the petiole and postpetiole) black, wholly or in part. Both forms occur at the test site, often at the same stations and in the same nests.

Colonies were found abundantly in Grayia-Lycium and Salsola communities. They were less numerous in Larrea-Franseria, and rather sparse in Atriplex-Kochia, mixed, and Coleogyne communities. The nest of *californicus* is surmounted by a circular or semicircular crater of loose sand bearing a single, central entrance (Fig. 2). The worker may be distinguished from that of all

[3]Adapted from Cole (1965b). Validation of the names of the species is explained fully in the revision.

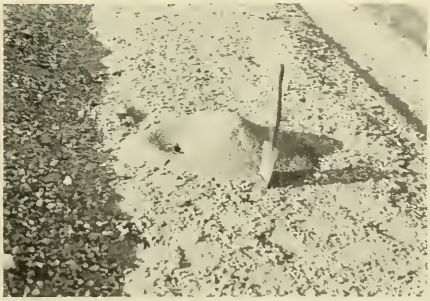

Fig. 2. Crater nest of *Pogonomyrmex californicus* in mixed community.

other species of *Pogonomyrmex* at the test site by a lack of epinotal armature. The sexual castes were found in nests in early and middle July.

Pogonomyrmex (*Pogonomyrmex*) *occidentalis* (Cresson)

Colonies of this species are characteristic of sagebrush (*Artemisia*) areas below the zone of Pinyon-Juniper. They contact the range of *P. salinus* in Pinyon-Juniper, but do not enter it. The characteristic gravel cones, or domes, surrounded by cleared areas and with basal entrances, predominate the landscape (Fig. 3).

The worker, which bears a close superficial resemblance to that of *salinus*, has the basalmost mandibular tooth offset from the margin, the superior lobe of the antennal scape base truncate, the petiolar and postpetiolar nodes without transverse rugae, and the dorsum of the base of the first gastric segment shining and without punctures. Far from being docile, the workers attack the intruder vigorously when a nest is disturbed and can inflict very painful stings.

Pogonomyrmex (*Pogonomyrmex*) *rugosus* Emery

This is the taxon that, together with certain of its variants, has been known as *barbatus rugosus* and which I have elevated to full species status in my unpublished revision of the genus *Pogonomyrmex* in North America (Cole, 1965b). Although colonies were most numerous in the Grayia-Lycium community, they occurred also

Fig. 3. Conical gravel mound of *Pogonomyrmex occidentalis* in an Artemisia community. Ruler is one foot in length.

in Atriplex-Kochia, Coleogyne, Larrea-Franseria, Salsola, and mixed communities. The nest superstructure consists of a very low gravel mound or disc with a large irregular central entrance (Fig. 4). The workers, which defend their nests with pugnacity, are the largest in the genus as represented at the test site. They are black, reddish black, or reddish brown in color, and can be distinguished from all other *Pogonomyrmex* of the site by the presence of a few erect hairs on the venter of the petiolar peduncle.

Pogonomyrmex (*Pogonomyrmex*) *salinus* Olsen

This species of harvester is one of the dominant ants of the Pinyon-Juniper community. In fact, it is pretty much of an "indicator species," for it is restricted to that community and therein replaces *P. occidentalis* at higher elevations. The nest is constructed in an open area between shrubs and is surrounded by a rather flat gravel bed which bears one or more saucer-like depressions with a central entrance (Fig. 5). It is surrounded by an area which has been cleared of plants by the ants.

The worker, which is rather closely allied to *P. occidentalis*, is characterized by its mandible, the basal-most tooth of which is not offset from the mandibular margin, the convex superior lobe of the base of the antennal scape, the generally transversely rugose dorsum of the petiole and postpetiole, and the usually strongly punctate and subopaque dorsal base of the first gastric segment. Unlike those of *occidentalis*, the workers are very docile ants and retreat to cover rather than attacking.

Pogonomyrmex (*Ephebomyrmex*) *imberbiculus* Wheeler

The diminutive, sluggish workers of this species form small, obscure colonies beneath stones. At the test site they were found in the Grayia-Lycium community. The only member of its subgenus known from the site, *imberbiculus* is distinctive in its small size (length 4-5 mm.), the pair of projections in front of the antennal fossae, the rugo-reticulose sculpture of head and thorax, and the very thick postpetiole. It is totally inoffensive in its behavior and retreats readily when disturbed.

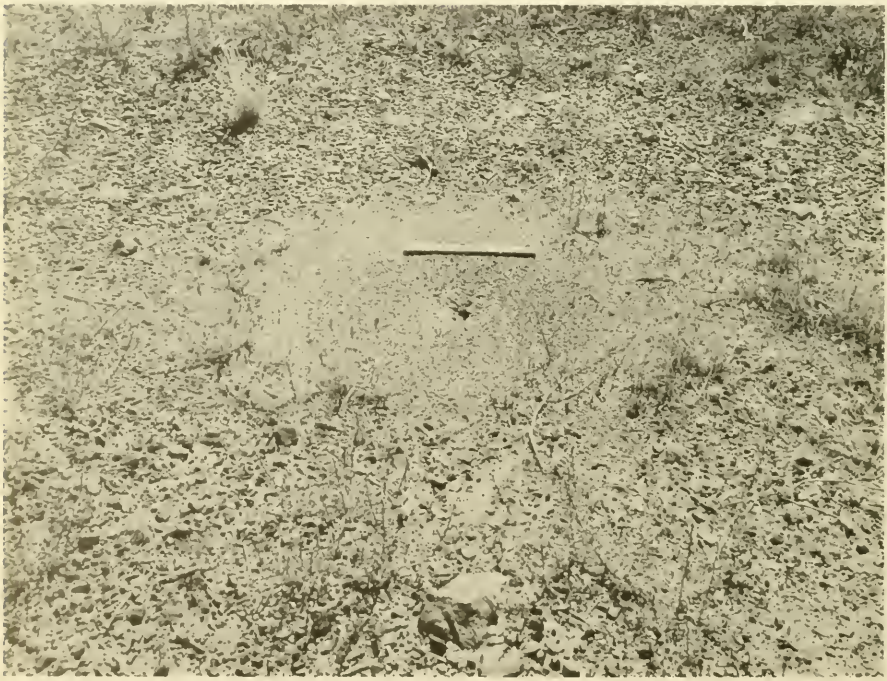

Fig. 4. Flat gravel disc of *Pogonomyrmex rugosus* in the Grayia-Lycium community. Ruler is one foot in length.

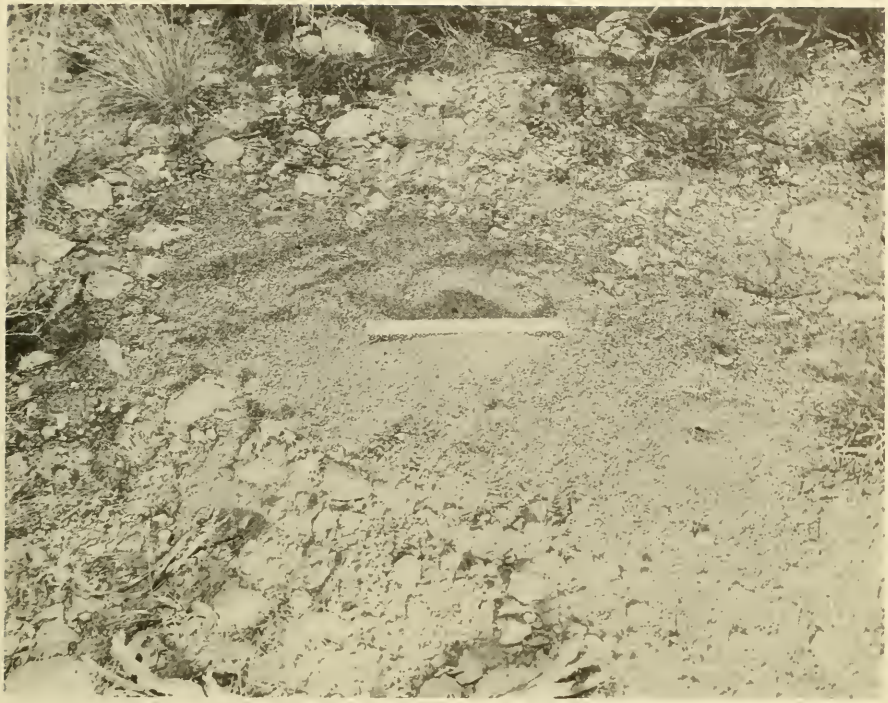

Fig. 5. Low gravel mound of *Pogonomyrmex salinus* in a Pinyon-Juniper community. Note the two saucer-shaped depressions and their central entrances. Ruler is one foot in length.

Genus *Stenamma* Westwood

Stenamma smithi, new species

Holotype, worker. HL 1.02 mm, HW 0.85 mm, CI 83.3, SL 0.08 mm, SI 94.1, EL 0.22 mm, EW 0.15 mm, OI 21.5, WL 1.22 mm, PNL 0.17 mm, PNW 0.22 mm, PPL 0.29 mm, PPW 0.31 mm.

Funicular segments two through six distinctly broader than long, last segment only slightly longer than combined lengths of the two preceding segments. Eye large, oval, with 12 ommatidia across its greatest diameter which is nearly equivalent to distance from lower eye margin to the mandibular insertion.

Contour of thoracic dorsum and of petiole and postpetiole as shown in Fig. 6; mesoepinotal impression pronounced, its greatest length 0.22 mm, its greatest depth 0.05 mm, bearing a distinct, transverse, median welt; declivity of epinotum long and steep; epinotal spines short but pronounced, acute apically and broad basally, directed rather strongly upward; petiolar peduncle rather short, its venter with a small, distinct, blunt process. Contour of petiolar and postpetiolar nodes, viewed from above, as shown in Fig. 7; petiolar node with a broad, blunt apex; postpetiolar node subspherical.

Sculpturing of head pronounced, the rugae rather coarse and wavy, especially laterally where they tend to form weak reticulations; front with subparallel, longitudinal striae; inter-

Fig. 6. Contour, in profile, of thoracic dorsum and of petiole and postpetiole of *Stenamma smithi*, n. sp. holotype.

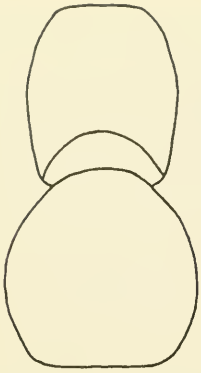

Fig. 7. Contours, viewed from above, of petiolar and postpetiolar nodes of *Stenamma smithi*, n. sp., holotype.

rugal spaces densely and finely punctate and subopaque. Pronotal rugae longitudinal, chiefly moderately coarse, somewhat wavy, widely and unevenly spaced; those of anterior border finer and transverse; interspaces shining, very finely and sparsely punctate. Base and sides of epinotum moderately rugose, the rugae longitudinal and unevenly spaced, the interspaces subopaque. Base of gaster with prominent, short, longitudinal rugulae with a maximum length of 0.086 mm. Gaster smooth, strongly shining.

Body with abundant, suberect to erect, golden hairs, those on the head notably shorter and denser than elsewhere. Hairs on legs mostly subappressed and reclinate, except on femora where they are distinctly suberect and erect.

Antennae, clypeus, genae, mandibles, thorax, legs, petiole, and postpetiole uniformly, medium ferrugineous red; frons, vertex, and occiput deeply and uniformly infuscated; dorsum of gaster a very deep, uniform, blackish brown.

Type locality. The holotype and 11 paratype workers were extracted from can samples taken on January 3, 5, 8, and 10, 1962, in B.Y.U. Study Area ECH of the test site. The nest was not found. I am pleased to name this interesting new species for Dr. M. R. Smith, my good friend and colleague, who recently revised the genus *Stenamma* in North America north of Mexico (Smith, 1957). I had sent the specimens to Dr. Smith for his inspection, and when he informed me that they appeared to represent a new species, I invited him to describe and name the population. However, inasmuch as he retired from his position at the U. S. National Museum before he could accomplish this, Dr. Smith kindly arranged for the return of the specimens to me.

Variation in paratype series. Variation among the specimens is remarkably slight. In a few of the workers the epinotal spines deviate somewhat in shape and size from those of the holotype. In some they are a little longer and less robust; in others they are a little shorter and more angular. The pronotal rugae in three specimens are rather arcuate and somewhat coarser. The number of ommatidia across the maximum diameter of the eye varies from 10 to 13. The pronotal width varies from 0.53 to 0.59 mm. Variations in other parts are as follows: HL 0.88 to 0.97 mm, HW 0.75 to 0.80 mm, CI 82.5 to 87.5, SL 0.73 to 0.77 mm, SI 93.7 to 96.3, EL 0.19 to 0.22 mm, EW 0.12 to 0.14 mm, OI 20.0 to 21.6, TL 1.07 to 1.09 mm, PNL 0.08 to 0.12 mm, PNW 0.17 to 0.21 mm, PPL 0.22 to 0.26 mm, PPW 0.27 to 0.31 mm.

Location of types. The holotype and one paratype will be deposited in the U. S. National Museum; other paratypes will be deposited in the Museum of Comparative Zoology and in the author's collection.

Affinities. In Smith's (1957, p. 142) revision of the genus the species keys to *brevicorne* (Mayr), an eastern species which ranges westward to Nebraska and Minnesota. It differs markedly from that species, however, especially in its greater body size and larger eyes, the differing dorsal contour of the thorax, the long declivity of the epinotum, and the conformation of the petiolar and postpetiolar nodes.

Genus *Aphaenogaster* Mayr

A Key to Species of the Genus *Aphaenogaster* for Identification of the Workers

1. Eye very large, strongly protuberant, with 18 to 20 facets in its greatest diameter, its lower border approximately the greatest ocular diameter from the mandibular articulation; body a sordid, pale, yellowish tan ..... *megommatus* M. R. Smith

   Eye notably smaller, with about 15 facets in its greatest diameter, its lower border about 1½ times the greatest ocular diameter from the mandibular articulation; body ferrugineous red ..... *boulderensis* M. R. Smith

Aphaenogaster boulderensis
M. R. Smith

This species was first described from workers collected on Horseshoe Island, Lake Mead, Boulder Dam (now Hoover Dam), Nevada. The distinctive worker is rather small (length 4.5 to 5.5 mm), very slender, and with strongly rounded posterior corners of the head and a rounded occipital border. The epinotal armature consists of faint tubercles. The body is a rather uniform, pale, ferrugineous red, with the gaster sometimes slightly darker.

No nest was found at the test site. Two workers were taken from soil cans in mixed vegetation in October. The ants probably nest beneath stones and form small colonies. Apparently *boulderensis* is poorly represented at the test site. It may indeed be a rare ant anywhere.

Aphaenogaster megommatus
M. R. Smith

This species was described recently (Smith, 1963) from workers collected in Nevada, Arizona, California, and Oregon. Although no nest was found at the test site, the ants rather commonly appeared in can traps from areas of Larrea, Larrea-Franseria, and Grayia-Lycium.

A. megommatus is a crepuscular and nocturnal forager. The worker is readily recognizable by its pale color, extraordinarily large, black eyes, and long, slender antennal scapes. Body length varies from 4.0 to 5.5 mm.

The previously undescribed sexual castes are described as follows:

Male. HL 0.71 to 0.88 mm, HW 0.63 to 0.70 mm, CI 112.7 to 125.7, SL 0.31 to 0.34 mm, SI 48.5 to 48.9, EL 0.48 to 0.68 mm, EW 0.37 to 0.43 mm, OI 60.1 to 77.3, TL 1.99 to 2.14 mm, PNL 0.14 to 0.19 mm, PNW 0.22 to 0.24 mm, PPL 0.26 to 0.31 mm, PPW 0.34 to 0.41 mm.

Head distinctly longer than broad; eyes very large; maximum width of head across the eyes 0.82 to 0.88 mm; antennal scape short, its length less than the combined lengths of first two funicular segments; anterior border of median lobe of clypeus with a shallow but distinct notch. Epinotal armature consisting of a pair of short, blunt, tubercles; petiolar and postpetiolar contours as illustrated in Fig. 8; petiolar node not pronounced, its apex broadly convex. Contour of paramere of genitalia as shown in Fig. 9, of volsella as in Fig. 10, and of aedeagus as in Fig. 11; abdominal sternite IX as shown in Fig. 12.

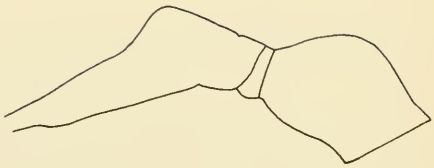

Fig. 8. Contours, in profile view, of petiole and postpetiole of a male *Aphaenogaster megommatus*.

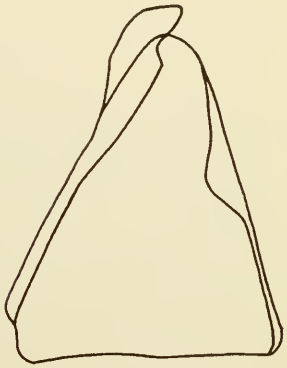

Fig. 9. Contour of paramere of a male *Aphaenogaster megommatus*.

Fig. 10. Volsella of a male *Aphaenogaster megommatus*.

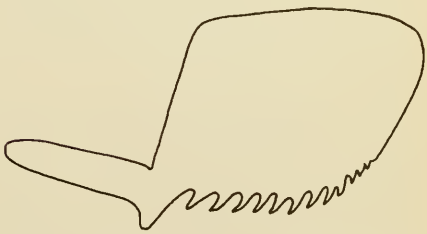

Fig. 11. Aedeagus of a male *Aphaenogaster megommatus*.

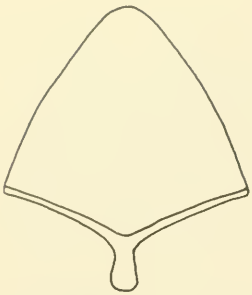

Fig. 12. Abdominal sternite IX of a male *Aphaenogaster megommatus.*

Head very densely and finely punctate, subopaque; thorax faintly and finely punctate, the punctures extremely delicate, the integument translucent and somewhat shining; gaster prominently, densely, and finely shagreened, the surface highly polished.

Hairs on head, thorax, petiole, and postpetiole sparse, rather long, erect and suberect, of unequal length, pointed, slender, and golden, especially delicate on scutum; a few suberect hairs on occipital corners of head; numerous on gular region; on the thorax most abundant on tuberculate areas of epinotum; unusually long and sparse on petiolar and postpetiolar nodes; rather long, scattered, delicate, pointed, erect, and suberect on gaster.

Thorax, appendages, petiole, postpetiole, gaster, and anterior half of head a rather uniform, dusky yellow; posterior half of head strongly infuscated, especially deeply within the ocellar triangle; mandibular teeth deep reddish brown; eyes black.

Female. HL 1.37 to 1.52 mm, HW 1.25 to 1.29 mm, CI 82.2 to 91.5, SL 1.56 to 1.60 mm, SI 124.0 to 124.8, EL 0.49 to 0.53 mm, EW 0.38 to 0.46 mm, OI 34.9 to 37.6, TL 2.67 to 2.81 mm, PNL 0.27 to 0.34 mm, PNW 0.38 to 0.42 mm, PPL 0.38 to 0.46 mm, PPW 0.53 to 0.65 mm.

Head notably longer than wide, occipital corners rather broadly and evenly rounded; extreme occipital margin with a low, narrow, transverse carina; eyes subovate, very large, their greatest diameter approximately one-third more than distance from lower eye margin to mandibular articulation, with 20 to 23 facets in their greatest diameter; maximum head width across the eyes 1.41 to 1.52 mm; antennal scapes

Fig. 13. Contour, in profile, of thoracic dorsum and of petiole and postpetiole of a female *Aphaenogaster megommatus.*

long, in repose extending well beyond posterior corners of head.

Contours of thorax, petiole, and postpetiole as shown in Fig. 13; epinotal declivity short and very steep; epinotal spines robust, broad, finger-like, bluntly rounded apically, flattened laterally, directed strongly backward; petiolar peduncle with a rather well-developed, longitudinal keel; petiolar node broadly and evenly rounded apically; postpetiole with a small, prominent, sharp, anteroventral, downwardly directed spine, the node with a long anterior declivity and a short posterior declivity. Contours of petiolar and postpetiolar nodes, viewed from above, as shown in Fig. 14; apex of petiolar node broadly truncate, notably narrower than the base; postpetiolar node considerably broader than long, the sides rather strongly convex.

Head prominently, unevenly, longitudinally rugulose, the interspaces somewhat shining and with dense and very delicate punctures; mandibles finely, longitudinally striate, densely and finely punctulate, and subopaque; frontal area

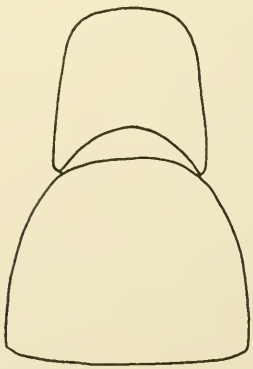

Fig. 14. Contours, viewed from above, of petiole and postpetiole of a female *Aphaenogaster megommatus.*

with three or four longitudinal carinae. Pronotum, scutum, and scutellum mostly smooth and strongly shining; epinotum transversely, unevenly rugulose, the interspaces finely and densely punctulate and subopaque; petiolar and postpetiolar nodes subopaque, finely and densely punctulate, and with sparse, irregular rugulae. Gaster moderately shining, densely and finely shagreened.

Hairs yellow, moderately abundant, and scattered; shorter, less delicate, and more blunt on scutum than on head and scutellum; sparse, rather long, and robust on epinotum, petiole, and postpetiole.

Body and appendages mostly a rather uniform, sordid light brown; scutum sometimes notably infuscated; eyes jet black; mandibular teeth deep reddish brown.

These descriptions are based upon the following specimens: Last Chance Canyon, El Paso Mts., Kern Co., Calif., July 10, 1964, R. R. Snelling leg (6♂, 4♀); 7 miles S. of Benton, Mono Co., Calif., August 9, 1962, R. R. Snelling leg (2♂, 4♀); Las Vegas, Nev., July 22, 1963, collector unknown (1♂); Nevada Test Site, can traps, July 28, 1961 (1 nest queen), July 1, 1962 (1♂), August 12, 1962 (1 nest queen), August 19, 1963 (1♀), August 25, 1963 (1 nest queen).

Genus *Veromessor* Forel

A Key to Species of the Genus *Veromessor* for Identification of the Workers[6]

1. Middle of anterior border of clypeus with a prominent projection; eye with a distinct anteroventral angle; color piceous brown to black; strongly polymorphic; forage in files ..... *pergandei* Emery

   Middle of anterior border of clypeus without a projection; eye without a distinct anteroventral angle; color pale brownish yellow to deep ferrugineous brown; not strongly polymorphic; forage singly 2

2. Head strongly, longitudinally, and rather evenly rugose, the rugae extending into the occipital region; eye small (OI 22), the distance from its posterior margin to the occipital margin greater than 1½ times its maximum diameter; epinotal spines very long, about 1½ times the distance between their bases; nests generally beneath stones in compact gravelly soil; diurnal; length 6.29 to 6.87 mm; thoracic profile as shown in Fig. 16C; base of antennal scape flattened, broader than apex; color a rather uniform, deep, ferrugineous brown ..... *lobognathus* (Andrews)

   Head not strongly rugose, the rugae not extending into the occipital region; eye large (OI 30 to 31), the distance from its posterior margin to the occipital margin no greater than or notably less than 1½ times its maximum diameter; epinotal spines shorter, no longer than the distance between their bases; nests in open and surmounted by craters; crepuscular or nocturnal; length 3.61 to 5.86 mm 3

3. Occipital region of head shining and faintly shagreened; rugae around antennal fossae concentric; maximum diameter of eye subequal to distance from posterior margin of eye to occipital margin; SI 87; base of scape narrower than apex and not flattened, the dilation reduced, involving only the extreme base, and meeting the shaft at strong angles; thoracic contour as shown in Fig. 16B; epinotal spines notably shorter than distance between their bases; apex of petiolar node acute; head, thorax, petiole, and postpetiole brownish yellow; gaster darker; length 3.61 to 5.86 mm; nocturnal ..... *lariversi* M. R. Smith

   Occipital region of head subopaque, densely and finely punctate; rugae around antennal fossae not concentric; distance from posterior margin of eye to occipital margin of head about 1 1/6 times maximum diameter of eye; SI 96; base of scape flattened, broader than apex, the dilation involving more of the shaft and meeting it at weaker angles; thoracic contour as shown in Fig. 16A; length of epinotal spines and their interbasal distance subequal; apex of petiolar node broadly convex; head, thorax, petiole, and postpetiole medium reddish brown, gaster slightly darker; length 5.70 to 5.86 mm; crepuscular ..... *smithi* Cole

[6]Adapted from Cole (1963, pp. 681-2).

Veromessor lariversi M. R. Smith

Although generally sympatric with *V. smithi* and occupying the same stations, *lariversi* was relatively uncommon. Most colonies were in sandy areas with mixed vegetation. Nests occurred very sparsely, however, in Grayia-Lycium, Salsola, and Coleogyne communities. Each nest was surmounted by one or two circular craters of sand, three inches or less in diameter, and marked by a rather large, irregular entrance (Fig. 15). Maximum depth of a nest was two feet, well above the hardpan layer. The workers are nocturnal foragers, as their pale color and large eyes would seem to indicate. Winged males and females, few in number, were in some of the nests between July 4 and 27.

Workers of *lariversi* can be distinguished easily from other species of *Veromessor* at the test site by their brownish yellow head, thorax, petiole, postpetiole, and their rather contrastingly darker gaster; and by the shining occipital region of the head, the large eyes, the very short epinotal spines, and the acute apex of the petiolar node. The dorsal contours of the thorax, petiole, and postpetiole are shown in Fig. 16B. For further information on this species the reader is referred to papers by Smith (1951) and Cole (1955, 1963).

Veromessor lobognathus (Andrews)

Probably more colonies of this species have been found at the test site than at all other localities combined. Although *lobognathus* had been considered to be a rare ant, it has become evident that it can be a common occupant of certain stations such as that on Rainier Mesa in disturbed Pinyon-Juniper. First described from Colorado (Andrews, 1916), it was rediscovered there by Gregg (1955) and near Ely, Nevada, by Cole (Gregg, *loc. cit.*), and subsequently in North Dakota and South Dakota by Wheeler and Wheeler (1956, 1959, 1965). At the test site the nests were largely confined to Rainier Mesa and were restricted to Pinyon-Juniper areas where they were sympatric with *Pogonomyrmex salinus* Olsen—a species whose workers remarkably resemble superficially those of *lobognathus*. On the mesa I excavated and

Fig. 15. Mound of *Veromessor lariversi* in a mixed plant community. Ruler is six inches in length.

studied 47 nests of *lobognathus* and located 11 others which were not disturbed. The colonies were very populous and lived beneath large rocks, some of which were deeply and strongly embedded in the soil and banked peripherally with a light coating of gravel. One nest opened into a gravel crater beside the covering rock.

The workers moved rapidly and agilely when a nest was opened. They did not attack the intruder. Distinct and perpetual stridulation was heard. During late June and early July numerous males and females were in the nests. *V. lobognathus* seems to be one of the most abundant and successful components of the ant fauna on Rainier Mesa.

The worker can be identified easily by its strong, superficial resemblance to *Pogonomyrmex occidentalis* and *salinus;* its deep, ferruginous brown color; its small eyes; and its very long epinotal spines. The contours of the thorax, petiole, and postpetiole, in profile, are illustrated in Fig. 16C.

Veromessor pergandei Emery

Probably by far the glossiest black ant of the low desert, *pergandei* is the dominant species of the Larrea community where it is able to flourish under extremely xeric conditions. It is a diurnal forager which can remain active during periods of intense heat. The long trails of streaming, black workers represent a characteristic pattern of extranidal activity. The nests, which are in exposed soil, are surmounted by low, semicircular or circular craters (sometimes multiple) of sand (Fig. 17) and are often cov-

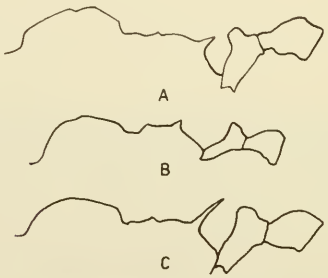

Fig. 16. Contour of thoracic dorsum and of petiole and postpetiole. A. *Veromessor smithi;* B. *V. lariversi;* C. *V. lobognathus.* Worker caste.

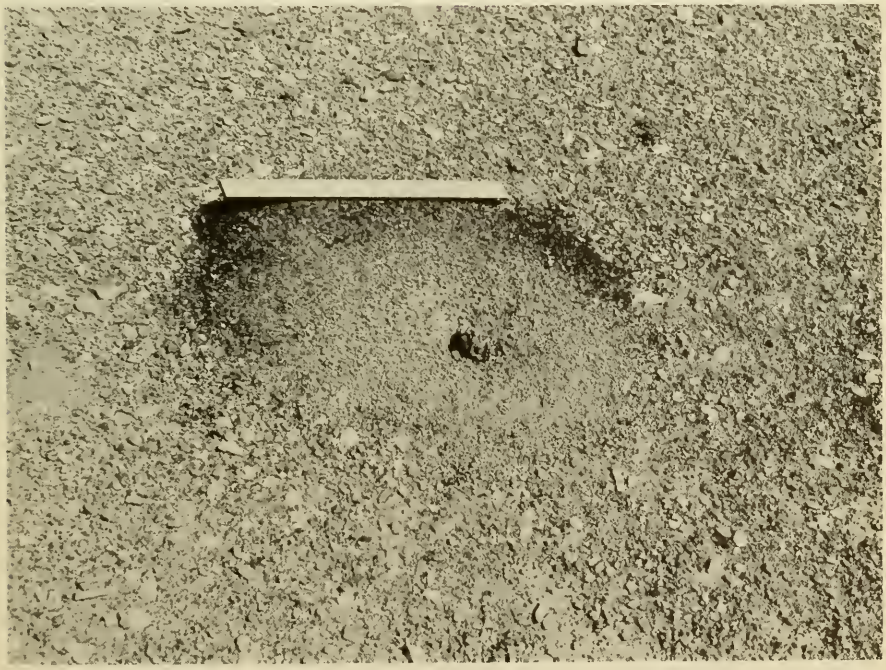

Fig. 17. Mound of *Veromessor pergandei* in a Larrea community. Ruler is one foot in length.

ered with a dense layer of chaff from harvested seeds. The workers are strongly polymorphic. This characteristic, the concolorous black body, and the presence of a prominent projection on the middle of the anterior border of the clypeus will serve to separate the species from all others in the genus at the test site and elsewhere.

Veromessor smithi Cole

This species was described from numerous specimens of all castes collected at the test site (Cole, 1963). Most nests were in the *Coleogyne* area at the foot of Rainier Mesa, where they were numerous, but one nest was observed in open, sandy desert with mixed vegetation. They occurred in fully exposed areas between plants, and each was marked by a small, circular crater of soil about five inches in diameter (Fig. 18). The timid, sluggish workers appear to be crepuscular foragers. They can be recognized by the medium, reddish brown body color, the large eyes, the punctate and subopaque occiput, the epinotal spines of medium length, and the distinctive thoracic contour and broadly subtruncate petiolar node (Fig. 16A).

Winged castes appeared abundantly in the nests between July 4 and 27. Mating flights were not observed.

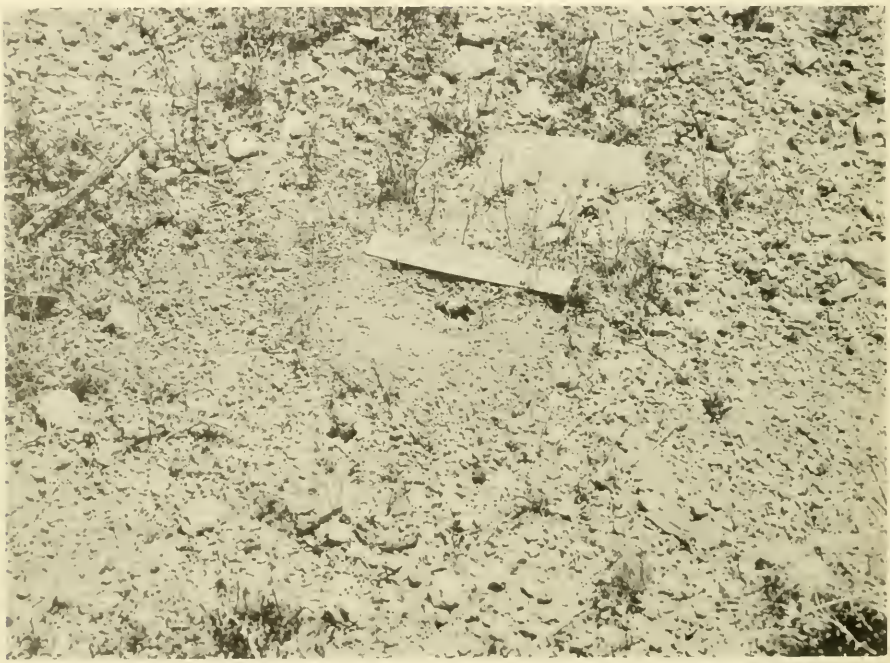

Fig. 18. Mound of *Veromessor smithi* in a Coleogyne community. Ruler is six inches in length.

Genus *Pheidole* Westwood

A Key to Species of the Genus *Pheidole* for Identification of the Workers

1. Antennal scape of major surpassing the occipital corner; large ants, length of major 4.5 to 5.0 mm, of minor 3.0 to 3.5 mm ..... *desertorum* Wheeler

   Antennal scape of major not reaching the occipital corner; smaller ants, length of major less than 4.5 mm, of minor less than 2.5 mm 2

2. Major with transverse occipital striae which are confined chiefly to the top of the occiput ..... *pilifera coloradensis* Emery

Occiput of major without transverse striae or rugae 3

3. Epinotum of the minor bearing a pair of thick, bluntly rounded spines of approximately the same diameter throughout; promesonotal suture of the major and minor distinct; inquilines in nests of *P. pilifera coloradensis* . . . . . *inquilina* (Wheeler)

Epinotal spines of the minor sharp, tapered, and more slender; promesonotal suture of the major and minor faint or absent; not inquilines 4

4. Anterior clypeal margin of the major sinuate; pronotum smooth and shining; basal face of epinotum somewhat shining . . . . . *bicarinata paiute* Gregg

Anterior clypeal margin of the major bluntly bidentate; pronotum punctate and usually with transverse striae or rugae; basal face of epinotum opaque . . . . *bicarinata vinelandica* Forel[7]

Pheidole bicarinata paiute Gregg

The types of this recently described subspecies (Gregg, 1958) came from Goldfield, Nevada, at an elevation of 5,800 feet. Colonies were numerous at the test site in areas of Grayia-Lycium, Larrea-Franseria, Coleogyne, and Atriplex-Kochia. The nests were beneath stones. Majors were numerous in a colony, and the ratio between them and the minors seems to be unusually great for a *Pheidole*. The docile, small, brown majors, with a body length of 4.0 to 4.5 mm, are readily distinguishable by the broadly sinuate anterior margin of the clypeus, the apunctate and strongly shining pronotum, and the strong rugae enclosing laterally the rather shining but distinctly punctate basal surface of the epinotum.

Pheidole desertorum Wheeler

A common occupant of our southwestern deserts, *desertorum* was most prevalent at the test site in Grayia-Lycium and mixed plant communities. It occurred to a decidely more limited extent in Coleogyne, Larrea-Franseria, and Salsola areas. Nests were beneath the larger stones. Colonies were generally large and the occupants very active and pugnacious. The majors, which attain a body length of about 4.5 to 5.0 mm, can be identified easily by their long antennal scapes and by their reddish yellow color.

Pheidole inquilina (Wheeler)

At the test site this especially interesting species is an inquiline in nests of *Pheidole pilifera coloradensis* Emery. Described as the type species of the monotypic genus *Epipheidole* by Wheeler (1903, p. 664), this species was recently transferred to the genus *Pheidole* by Cole (1965a) who, at the test site, discovered the unknown soldier caste and rediscovered the worker, and subsequently showed that they are representative of *Pheidole*, not a genus of their own.

Nests of the host ants, which were confined to disturbed Pinyon-Juniper on Rainier Mesa, were under loose stones. A total of only one soldier and two workers of *inquilina* was found, indicating the rarity of these castes, but several alate males and both alate and dealate females of the inquiline were in the nests. The sexes, as well as the small workers, can be recognized by their finger-shaped epinotal spines. The soldier (major worker) shows close affinities to that of *coloradensis*, the host ant, but it is of notably smaller stature, the occiput is smooth and shining and lacks the transverse rugae or striae that are characteristic of the host soldier, the dorsal contours of the thorax, petiole, and postpetiole are distinctively different, and the body color is much lighter. Cole (*ibid.*, p. 174, figs. 1, 2) has compared the contours, in profile, of the thorax, petiole, and postpetiole of the soldiers in the two taxa.

The discovery of *inquilina* at the test site has extended considerably westward its range which included previously only Nebraska and Colorado.

Pheidole pilifera coloradensis Emery

Nests of this taxon were found only beneath rather large stones in disturbed Pinyon-Juniper on Rainier Mesa. Colonies were rather numerous. Winged forms were in some of the nests between June 22 and July 4, 1962.

The timid, dark reddish brown soldiers can be recognized easily by their transversely rugulose or striate occiput and the presence of well-developed lateral connules on the postpetiole.

[7]Although this ant has not been taken at the test site, I have included it in the key because it has been collected from adjoining areas and will probably be found eventually at the site

Genus *Crematogaster* Lund

A Key to Species of the Genus *Crematogaster* for Identification of the Workers

1. Dorsum of thorax without erect hairs; promesonotum densely punctate, the punctures largely replacing the rugae ..... *depilis* Wheeler

   Dorsum of thorax with one, long, erect hair at each humeral angle; rugae on dorsum of promesonotum coarse and vermiculate, the interrugal punctures prominent, the surface opaque ..... *coarctata vermiculata* Emery

Crematogaster coarctata vermiculata Emery

Although I have assigned all pertinent collections to *vermiculata*, the test site appears to be in a region of transition between *vermiculata* and *coarctata*, inasmuch as some of the workers seem to represent intergrades of the two populations. Problems of this kind will have to be resolved by a generic revision following an inspection of large series of ants from all parts of their range.

Nests at the test site were chiefly in open soil, but in Pinyon-Juniper on Rainier Mesa they were found sparsely under stones. Although being most numerous in the Larrea-Franseria community, they occurred also in considerable numbers in Atriplex-Kochia and less abundantly in both mixed and Grayia-Lycium communities. The characters used in the key will serve adequately to separate the two species of *Crematogaster* known from the test site. Males and females were found in nests on Rainier Mesa on July 28.

Crematogaster depilis Wheeler

Strangely and apparently absent from the Pinyon-Juniper community, colonies of *depilis* were most numerous in the Larrea-Franseria and mixed communities. The nests were in open areas between shrubs or at the bases of the plants. Colonies appeared not to be so populous as those of *vermiculata*. The workers can be recognized by the lack of hairs on the pronotum and by their generally brown color.

Genus *Monomorium* Mayr

Monomorium minimum (Buckley)

This minute, black species nests beneath stones chiefly in the Coleogyne and mixed communities, although a few scattered colonies were found in the Pinyon-Juniper community of Rainier Mesa. The worker is readily recognizable by its small size, black color, smooth and highly polished body, and the unarmed epinotum. The populous colonies contained very active workers and multiple queens. The sexual castes were not found.

Genus *Solenopsis* Westwood

A Key to Species of the Genus *Solenopsis* for Identification of the Workers[3]

1. Second and usually the third funicular segment of antennae at least 1½ times as long as broad; workers polymorphic 2

   Second and third funicular segment of antennae at most only slightly longer than broad, usually broader than long; workers very small, not polymorphic, their nests frequently in those of other ants 3

2. Eyes of major with no more than 50 facets, those of minor with about 20 facets; front of head of major with only a few widely scattered punctures; dorsum of epinotum of minor, in lateral view, rather strongly convex; body a concolorous golden yellow ..... *aurea* Wheeler

   Eyes of major with 70 to 80 facets, those of minor with about 50 facets; front of head of major with numerous punctures; dorsum of epinotum of minor, in lateral view, weakly and broadly convex; head and thorax yellow to red, gaster usually notably darker. ..... *xyloni* McCook

[3]Adapted from Creighton (*Ibid.*, pp. 228-30) and Snelling, California Dep. Agr. Occasional Papers No. 3, 1963, 3-5.

3. Punctures on head dense, small, distinct, clearly greater in diameter than the hairs which arise from them ..... *salina* Wheeler

   Punctures on head sparser, smaller, often visible only under high magnification, only a little larger than the hairs which arise from them ..... *molesta validiuscula* (Emery)

Solenopsis aurea Wheeler

Nests of this species were in open soil of the Coleogyne and Grayia-Lycium communities, and were more representative of the former. The colonies were small and few. The key characters will suffice for recognition of this ant. The uniformly golden yellow color of the body in all workers is a characteristic feature.

Solenopsis molesta validiuscula (Emery)

This minute (length 1.8 to 2.0 mm), brownish yellow species nests independently or in colonies of other ants. Most colonies were found in Pinyon-Juniper, and especially in nests of *Pheidole pilifera coloradensis*, but the species occupied also, to a very limited degree, the Grayia-Lycium and Larrea-Franseria communities.

Solenopsis salina Wheeler

Three colonies of what probably represents this species were found beneath stones in the disturbed Pinyon-Juniper community of Rainier Mesa. A species difficult to separate from *molesta validiuscula*, *salina* has numerous cephalic punctures that are of greater diameter than the hairs which rise from them, and a distinct ventral tooth on the venter of the petiolar peduncle.

Solenopsis xyloni McCook

The strongly polymorphic workers of *xyloni* were found infrequently in the Larrea-Franseria community where they nest at the base of shrubs. The minor workers are considerably darker than the larger workers.

Genus *Leptothorax* Mayr

A Key to Species of the Genus *Leptothorax* for Identification of the Workers

1. Antennal scape in repose failing to reach the occipital margin by an amount twice as great as its greatest thickness; epinotal spines reduced to short, broad angles; thoracic dorsum densely and finely punctate ..... *andrei* Emery

   Antennal scape in repose failing to reach the occipital margin by an amount no greater than its greatest thickness; epinotal spines well-developed; thoracic dorsum coarsely, longitudinally rugose ..... *nevadensis rudis* Wheeler

Leptothorax andrei Emery

A few workers, assignable to this species, were taken in disturbed Pinyon-Juniper on Rainier Mesa. The nest was not found. This small species can be recognized by its yellow color, its feebly shining head, its very short, angulate epinotal armature, and the broad petiolar node which, viewed in profile, is nearly as wide apically as basally. The ants generally construct small nests beneath stones. For additional information on *andrei* and its allies, the reader is referred to a paper by Cole (1958).

Leptothorax nevadensis rudis Wheeler

Sparse and small colonies were found in the disturbed Pinyon-Juniper community on Rainier Mesa. The workers were sluggish and docile.

The worker of this subspecies is a small, brownish black ant. The thoracic dorsum is completely covered with coarse, longitudinal rugae except for a punctate area on the mesonotum. The epinotal spines are rather well developed, and the postpetiole is a little less than twice the width of the petiole.

Subfamily Dolichoderinae

A Key to the Genera of the Subfamily Dolichoderinae for Identification of the Workers

1. Epinotum with a prominent tooth-like protuberance directed upward from the junction of the basal and declivious faces; third segment of the maxillary palp very long, as long as or longer than the three succeeding segments combined ..... *Dorymyrmex*

Epinotum without such a protuberance, unarmed, the junction of the two faces rounded or angular, third segment of the maxillary palp not usually long, shorter than the three succeeding segments combined 2

2. Dorsum of the thorax without a conspicuous impression at the mesoepinotal suture; hairs on the thorax abundant, gastric pubescense dense, workers somewhat polymorphic *Liometopum*

Dorsum of the thorax with a conspicuous impression at the mesoepinotal suture; hairs on the thorax very sparse; gastric pubescence dilute *Iridomyrmex*

Genus *Dorymyrmex* Forel

A Key to Species of the Genus *Dorymyrmex* for Identification of the Workers

1. Clypeus broadly and evenly rounded, without a trace of a median angle or carina; head and thorax deep red or reddish yellow, gaster brownish black or black *bicolor* Wheeler

Clypeus distinctly angular or subcarinate medially; body not contrastingly bicolored *pyramicus* (Roger)

Dorymyrmex bicolor Wheeler

Rapidly moving, foraging workers of this species were encountered repeatedly in the Larrea-Franseria community to which the nests were restricted. This common, typically desert species constructed, in unshaded areas, nests marked by exquisite, semicircular or circular craters of fine loose sand. The worker can be distinguished from that of its nearest relative, *pyramicus*, by its bicolored body, a feature that appears to be genetically fixed.

Dorymyrmex pyramicus (Roger)

Very closely allied to *bicolor*, *pyramicus* was also found nesting, and in its greatest numbers, in the Larrea-Franseria community, where it was often sympatric with *bicolor* at the same stations. It occurred also, but to a much more limited extent, in the Coleogyne and mixed communities.

Genus *Liometopum* Mayr

Liometopum occidentale luctuosum Wheeler

A single small colony of this species was found in disturbed Pinyon-Juniper on Rainier Mesa. The nest was in soil beneath light detritus at the base of a juniper.

The worker caste shows a considerable variation in size (2.5 to 5 mm in length), has very sparse pilosity, and is rather uniformly deep brown in color and rather strongly shining. As is true of other members of its genus, *luctuosum* possesses the characteristic and unpleasant "*Liometopum* odor."

Genus *Iridomyrmex* Mayr

Iridomyrmex pruinosum analis (F. André)

Present in all plant communities studied at the test site, this common ant constructs its nests beneath stones, at the base of plants, and in fully exposed areas where it makes a small, irregular or circular mound of soil. The small workers run about very rapidly and apparently erratically. They can withstand very high soil surface temperatures, and were observed foraging on trails during hot summer days.

The pale yellow and yellow and brown workers are characterized by their long, sparse, erect body hairs and the dilute pubescence on the head and thorax which does not obscure the shining surface. The worker is virtually identical to that of *bicolor*, except for its concolorous brown body. Nest location and construction of the two species are the same.

Subfamily Formicinae

A Key to the Genera of the Subfamily Formicinae for the Identification of the Workers

1. Thoracic dorsum, in lateral view, evenly convex, the epinotum not depressed below the level of the promesonotum, the mesoepinotal suture slightly or not at all impressed; antennal scapes inserted well behind the posterior edge of the clypeus . . . . . *Camponotus*

   Thoracic dorsum, in lateral view, with the epinotum distinctly depressed below the level of the promesonotum, the mesoepinotal suture well impressed; antennal scapes inserted at or near the posterior border of the clypeus 2

2. Maxillary palps very short, 3-segmented . . . . . *Acanthomyops*

   Maxillary palps notably longer, 6-segmented 3

3. Maxillary palps longer than the head, the third and fourth segments very long and as long as or longer than the two terminal segments combined; psammophore present . . . . . *Myrmecocystus*

   Maxillary palps shorter or no longer than the head, the third and fourth segments shorter than the two terminal segments combined; psammophore absent 4

4. Frontal carinae prominent, their lateral margins slightly reflected upward; ocelli very distinct . . . . . *Formica*

   Frontal carinae less well marked, their lateral margins flattened; ocelli indistinct or absent . . . . . *Lasius*

Genus *Camponotus* Mayr

A Key to Species of the Genus *Camponotus* for Identification of the Workers

1. Middle of anterior clypeal border depressed, bearing a narrow, median notch; length of major less than 8 mm . . . . . *hyatti* Emery

   Middle of anterior clypeal border not bearing a narrow, median notch; length of major notably greater than 8 mm 2

2. Antennal scape of the major distinctly flattened at the base, the flattened portion forming a small lateral lobule . . . . . *maccooki* Forel

   Antennal scape of the major not flattened at the base or, if flattened, without a lateral lobule 3

3. Cheeks strongly shining, with minute inconspicuous punctures; antennal scape not flattened at the base; head black; thorax and gaster yellow, often suffused with brown; tibiae and tarsi strongly infuscated . . . . . *ocreatus* Emery

   Cheeks feebly shining, the punctures coarser and conspicuous; antennal scape flattened at the base; body medium to very deep red . . . . . *vicinus* Mayr

Camponotus hyatti Emery

A single small colony of *hyatti* was found nesting in the soil beneath a dead juniper limb in a mixed community. The species is a member of the subgenus *Myrmentoma*, which is characterized by having a narrow, median notch in the depressed middle of the anterior clypeal border, and is the only member of that subgenus known from the test site. The highly polished, jet black gaster contrasts sharply with the shining, bright red head and thorax.

Camponotus maccooki Forel

This species was limited largely to the Grayia-Lycium community, but it occurred spottedly in Pinyon-Juniper also. Nests were beneath

stones. The major workers are rather large ants of a rather uniform yellowish brown or reddish brown color. They are readily identifiable by their antennal scapes which are distinctly flattened basally and bear a lateral lobule.

Camponotus vicinus Mayr

Nests of *vicinus* were found frequently in the Pinyon-Juniper community, of which they are a characteristic element, but were seen nowhere else at the test site. The workers are very large ants with a deeply ferrugineous red thorax and a black head and gaster. Colonies were beneath the larger rocks in partly shaded areas.

Camponotus ocreatus Emery

Except for two workers found in the Larrea-Franseria community, all members of this species occurred in the mixed community. A single nest was located beneath a small stone. The black head and appendages contrasting with the yellow thorax and gaster give the worker a striking appearance.

Genus *Lasius* Fabricius

A Key to Species of the Genus *Lasius* for Identification of the Workers

1. Very small ants (width of pronotum usually less than 0.54 mm.); eyes minute, typically with 11 ommatidia in a line along the long axis of the eye; color yellowish brown ..... *siticus* Wilson

   Larger ants (width of pronotum usually more than 0.54 mm.); eyes larger, typically with 14 or 15 ommatidia in a line along the long axis of the eye; color consistently darker, usually dark brown ..... *crypticus* Wilson

Lasius siticus Wilson

Colonies of this species were found only in disturbed Pinyon-Juniper, where they were considerably more common than those of *crypticus*. The nests were beneath stones at the same stations as those occupied by *crypticus*. The sexual castes were in nests between June 23 and July 10.

The workers are of a pale brown color and are notably smaller than those of *crypticus*. The eyes are small, having only 10 to 12 ommatidia across the maximum diameter of the eye rather than the usual 14 or 15 of *crypticus*.

This is a new Nevada record for this species.

Lasius crypticus Wilson

A few nests of *crypticus* were found in disturbed Pinyon-Juniper on Rainier Mesa. All were in the soil beneath stones in open areas.

The dark brown workers have a sparse pilosity, and erect hairs are absent from the antennal scapes and tibiae.

Genus *Acanthomyops* Mayr

Acanthomyops latipes (Walsh)

Colonies of *latipes* were found only in disturbed Pinyon-Juniper on Rainier Mesa. The nests were located rather deeply in the soil beneath stones in partially shaded areas. Queens of both alpha and beta types were taken. The latter is an especially interesting ant. The body is extremely hairy, the femora and tibiae are greatly compressed and enlarged, so that they contrast strongly with the slender tarsi, and the antennal scapes are gradually much incrassated from base to apex.

The worker's body, including the gula, is densely hairy and of a rather concolorous brownish yellow. The antennal scape, in repose, does not surpass the occipital border. Viewed in profile, the scale of the petiole has a blunt apex; seen from behind, the scale is somewhat flattened and entire. The worker possesses the "citronella odor" that is characteristic of all members of its genus.

Genus *Myrmecocystus* Wesmael

A Key to Species of the Genus *Myrmecocystus* for Identification of the Workers

1. Eyes large, their greatest diameter notably longer than the length of the first funicular segment; ocelli small and obscure or absent; mandibles with eight teeth . . . 2

   Eyes small, their greatest diameter about equal to the length of the first funicular segment; ocelli large and prominent; mandibles with seven teeth . . . 3

2. Petiolar scale thick from front to back; erect hairs on crest and sides of petiolar scale numerous and conspicuous; length range 4.0 to 9.5 mm . . . *mexicanus* Wesmael

   Petiolar scale thin from front to back; erect hairs on crest and sides of petiolar scale very sparse or absent; length range 2.5 to 5.5 mm . . . *mojave* Wheeler

3. Erect hairs delicate, sparse or absent on the cheeks; pubescense short and sparse, not notably obscuring the ground surface; body rather shining . . . 4

   Erect hairs coarse and numerous, abundant on cheeks; pubescence longer and dense, mostly obscuring the ground surface; body often silvery but not shining . . . *comatus* Wheeler

4. Erect hairs sparse or absent on the femora and tibiae, confined chiefly to the flexor surfaces; small ants, length 2.0 to 3.5 mm; body a concolorous dark brown . . . *lugubris* Wheeler

   Erect hairs abundant on all surfaces of the femora and tibiae; larger ants, length 3.0 to 6.5 mm; body bicolored, the head and thorax notably lighter than the gaster, and generally red or reddish brown . . . *mimicus* Wheeler

Myrmecocystus comatus Wheeler

M. comatus was well represented in the Grayia-Lycium, Larrea-Franseria, Atriplex-Kochia, and mixed communities; scarce in the Coleogyne and Salsola communities; and rare in Pinyon-Juniper areas. It nests in open areas between shrubs. Each nest is marked either by only a hole in the soil or by a crude soil crater. Most colonies were very populous.

By far the hairiest member of its genus and accordingly well named, *comatus* is best, but not easily, distinguished from its close relatives, by that trait. The dull red head, the darker infuscated thorax, and the silvery, densely pubescert, black gaster are unique features. The workers vary in length from 3.5 to 6.5 mm.

Myrmecocystus lugubris Wheeler

This species was found only in the Atriplex-Kochia community where it was a minor component of the ant fauna. The small colonies occupied exposed areas, and their nests were marked by an entrance around which soil was loosely and irregularly dispersed. The workers were active during the intense heat of the summer day. They appeared to be most numerous on the shrubs over which they moved swiftly.

The very dark brown or black, polymorphic workers are of rather small stature, with a body length of 2.5 to 3.5 mm. Erect hairs on the body, and especially on the appendages, are rather sparse. The entire body is somewhat shining.

Myrmecocystus mexicanus Wesmael

Nests of this common desert species were found most abundantly in the Grayia-Lycium community, but they were rather numerous in the mixed, Salsola, and Coleogyne communities, and were scarce in the Larrea-Franseria community. All colonies were in unshaded soil between plants, and were marked with a broad, circular entrance of coarse, tightly packed sand (Fig. 19). The ants are nocturnal foragers.

This species has strongly polymorphic workers (4.5 to 9.5 mm in length) which can move with great rapidity and agility. Although most specimens were referable to the typical *mexicanus*, some (even in the same nests) were characteristic of the subspecies *hortideorum* McCook, which supposedly differs from *mexicanus* by its nearly concolorous yellow body. I predict that future revisionary studies of *Myrmecocystus* will show that the two forms are synonymous.

Fig. 19. Mound of *Myrmecocystus mexicanus* in a mixed community.

Myrmecocystus mimicus Wheeler

A common occupant of the Larrea-Franseria community, *mimicus* was well represented in the Grayia-Lycium, but only moderately so in the Atriplex-Kochia, Salsola, and mixed communities, and poorly so in Coleogyne. The nests and nesting sites were like those of *comatus*.

The workers possess erect hairs that are notably more delicate and less abundant than those of *comatus*. The two species are not separable by color differences, but the body of *mimicus* is more shining, and the pubescence on the gaster is not sufficiently dense to obscure the shining surface or produce a silvery luster.

Myrmecocystus mojave Wheeler

At the test site *mojave* is restricted to Pinyon-Juniper areas. Strong colonies were found nesting beneath stones or in soil without cover and marked by a circular crater of small pebbles with a large, irregular, central entrance. The workers are nocturnal and crepuscular foragers. The sexual castes, as well as semirepletes, were in nests on Rainier Mesa from middle to late June.

The workers of *mojave*, like those of *mexicanus*, are polymorphic, but less strongly so. They vary in length from 3 to 5 mm. The scale of the petiole is notably thinner, viewed laterally, than is that of *mexicanus*.

Genus *Formica* Linné

A Key to Species of the Genus *Formica* for Identification of the Workers

1. The combined second and third funicular segments of the antenna not more than 1 1/5 times as long as the first segment and often not that long 2

   The combined second and third funicular segments at least 1¼ times as long as the first segment and usually longer 4

2. Extensor surface of antennal scape with a number of short, delicate, erect, silvery hairs ..... *lasioides* Emery

   Extensor surface of antennal scape without erect hairs, except for a few at the extreme tip 3

3. Thorax with numerous erect hairs; body surface moderately shining ..... *neogagates* Emery

   Thorax without erect hairs or with only one or two erect hairs; body surface strongly shining ..... *limata* Wheeler

4. Erect hairs on the pronotum distinctly clavate or spatulate ..... *microgyna* Wheeler

   Erect hairs on the pronotum simple, not clavate or spatulate 5

5. Antennal scape considerably longer than distance from middle of clypeal border to midoccipital border; base of epinotum notably convex, the angle between it and the declivious surface poorly defined; posterior surface of petiole convex ..... *moki* Wheeler

   Antennal scape not longer than distance from middle of clypeal border to midoccipital border, or if longer, the epinotum distinctly angular; posterior surface of petiole not convex 6

6. Anterior border of clypeus distinctly excised; gaster evenly covered with stout, rather long, blunt, erect, silvery hairs ..... *obtusopilosa* Emery

Anterior border of clypeus not excised; gaster without such pilosity 7

7. Head and thorax of the larger workers ferrugineous red and generally notably lighter than the gaster or, if infuscated, the infuscation not obscuring the ferrugineous ground color; frontal area shining; frontal lobes strongly divergent behind 8

Body concolorous or, if bicolored, the thorax lighter than the head and gaster; frontal area opaque, frontal lobes not strongly divergent behind, often parallel 9

8. Head of the major worker, excluding the mandibles, as broad as long or broader than long; erect hairs on the thorax unequal in length; cephalic hairs nearly as numerous as, and only a little longer than, those on the thorax ..... *obscuripes* Forel[7]

Head of the major worker, excluding the mandibles, longer than broad; erect hairs on the thorax short, subequal in length; cephalic hairs considerably longer and less dense than those on the thorax ..... *integroides planipilis* Creighton

9. Gula with erect hairs; worker caste strongly polymorphic; head of largest workers (mandibles excluded) quadrate, as broad as or broader than long ..... *subpolita camponoticeps* Wheeler

Gula without erect hairs; worker caste not polymorphic; head longer than broad 10

10. Body black; when in full-face view, eyes of largest workers reaching or projecting beyond the head margin ..... *fusca* L.

Thorax more or less red; when in full-face view, eyes of largest workers not reaching the head margin ..... *neorufibarbis* Emery

Formica fusca Linné

This species appeared to be restricted to Pinyon-Juniper areas, where the nests were beneath individual or clusters of stones. Colonies were sparse and also unusually weak for this species. The ants are active scavengers.

The workers are entirely black and of medium size (4 to 7 mm in length), and they have a moderately shining and very sparsely hairy body. The gaster is moderately pubescent and often has a silky luster.

Formica integroides planipilis Creighton

This ant was limited to Pinyon-Juniper areas and was more representative of the undisturbed than the disturbed ones. Each nest was surmounted by a dome-shaped, thatched mound fashioned of assorted, rather tightly packed detritus, and constructed against or around a shrub that was ultimately killed by the ants (Fig. 20). Brood was found in chambers within the mound as well as in those underground. The colonies were very populous. When the mounds were disturbed, workers in large numbers attacked the intruder and ejected their "formic acid" spray.

The workers vary considerably in size, and may be designated as minors, media, and majors. The majors are distinctly bicolored, with dull red head and thorax and brownish black gaster; the red portions of the media are more or less marked with brown; and the minors are strongly and extensively infuscated. The legs are brownish black in all workers. The body is very hairy, the erect hairs of the thorax being short and subequal in length, whereas those of the head are longer and sparser. Erect hairs on the middle and hind tibiae are numerous and generally cover all surfaces. The gaster is opaque and densely pubescent.

Formica lasioides Emery

This species was sparsely represented in the ant fauna of disturbed Pinyon-Juniper on Rainier Mesa. The nests were beneath small stones in open areas. The workers were very timid.

The worker of this comparatively small ant (3.5 to 4.5 mm in length) has a smooth and shining body which is generally of a medium brown color. There are a number of erect, short, delicate hairs along the extensor surface of the antennal scape.

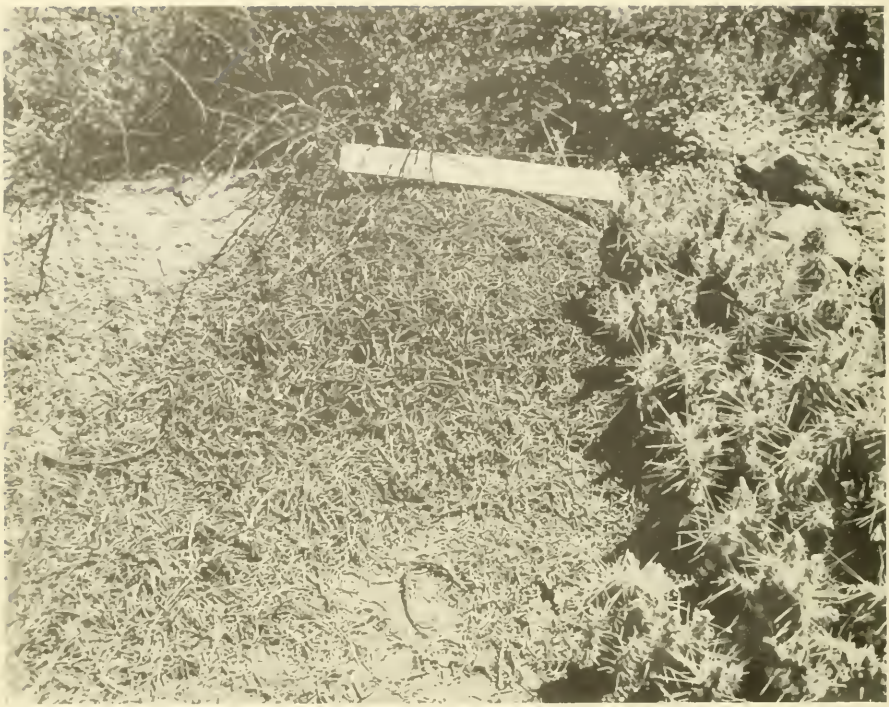

Fig. 20. Thatched mound of *Formica integroides planipilis* in a Pinyon-Juniper community. Ruler is one foot in length.

Formica limata Wheeler

Two small colonies of this ant were found under small stones in disturbed Pinyon-Juniper on Rainier Mesa. The species appeared nowhere else at the test site.

The worker resembles that of *lasioides* and *neogagates*. The characters in the key will segregate it readily. Its most striking characteristic is the very strongly shining body.

Formica microgyna Wheeler

A single worker assignable to this species was taken from a can trap in Pinyon-Juniper. No nest was found.

The worker of *microgyna* has a rather light ferruginous head and thorax, and a black, strongly opaque gaster. It is characterized chiefly by the presence of a few clavate hairs on the pronotum and by the pilosity of the femora and tibiae which includes erect hairs in addition to those on the flexor surfaces.

Nests of *microgyna* are generally constructed in open areas under stones which are ultimately banked peripherally with detritus.

Formica moki Wheeler

A single colony of this species was found in a Pinyon-Juniper area near Tippipah Spring. The nest was in open, stony soil beneath a small rock. Numerous workers and a few males were collected, but no females were encountered. The workers are 4.0 to 5.8 mm in length and of a dull ferruginous red color, with the posterodorsal part of the head, and the petiole, gaster, and legs dark brown. The hairs are sparse and erect. The body surface is subopaque and finely and densely granulose. In certain lights the posterodorsal portion of the head and the gaster have a rather bronzy luster.

The male caste is described herewith for the first time.

Male. HL 1.41 to 1.41 mm, HW 1.60 to 1.74 mm, CI 113 to 123, SL 1.67 to 1.71 mm, SI 98 to 104, EL 0.87 to 0.91 mm, EW 0.49 to 0.53 mm, OI 62 to 65, TL 3.50 to 3.80 mm, PNL 0.49 to 0.53 mm, PNW 0.95 to 1.03 mm.

Antennal scape long, its length approximately equal to the combined lengths of funicular segments 2 to 5, inclusive. Median lobe of clypeus strongly and evenly convex, its anterior border entire.

Petiolar node, in profile, notably broader basally than apically, the apex acute but rather thick. Petiolar node, viewed from above and behind, with its apex prominently, broadly, and evenly concave; the corners rather sharply rounded.

Paramere of genitalia as shown in Fig. 21, volsella as in Fig. 22, and aedeagus as in Fig. 23. Sternite IX of abdomen as illustrated in Fig. 24.

Head, thorax, and petiole densely and finely granulose; subopaque. Gaster densely and more finely granulose; the surface somewhat shining.

Cephalic pilosity mostly very sparse, the hairs limited chiefly to the mandibles (where they are long and dense) and the anterior margin of the clypeus; absent from occipital corners of the head. Thorax (except the epinotum) mostly densely pubescent, with a few scattered, short, slender, pointed, golden hairs on scutum and scutellum; epinotum, petiole, and dorsum of base of first segment of gaster covered with a dense pile of very short, erect and suberect, slender hairs forming a rather even, plush-like investiture; each corner of apex of petiolar node with two or three comparatively long, erect hairs. Gaster chiefly without hairs, except for those described on the first segment and for a very few, short, suberect, delicate ones along the posterior border of the segments; pubescence on gaster appressed, widely spaced, not obscuring the surface.

Head deep brown; thorax, and especially the dorsum of the scutum, a little lighter; petiole, legs, and gaster dusky yellow; antennae light brown.

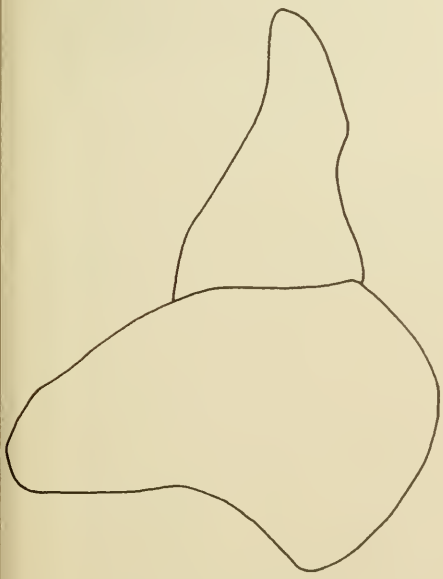

Fig. 21. Paramere of a male *Formica moki.*

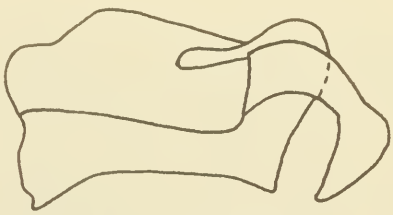

Fig. 22. Volsella of a male *Formica moki.*

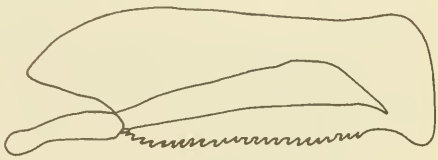

Fig. 23. Aedaegus of a male *Formica moki.*

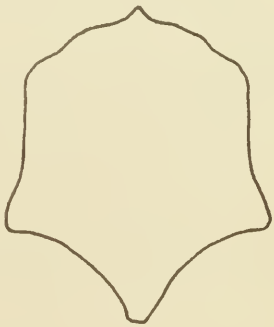

Fig. 24. Abdominal sternite IX of a male *Formica moki.*

Described from six males collected by the writer on July 25, 1962. *F. moki*, heretofore unported from Nevada, is known also from southern Utah and northern Arizona, where it appears to be a very uncommon species.

Formica neogagates Emery

Colonies of *neogagates* were found at the test site only in Pinyon-Juniper areas, but they were considerably better represented than were those of *lasioides* and *limata*. Nests and nesting sites were similar to those of the latter two species.

The worker of *neogagates* resembles closely that of both *lasioides* and *limata* in color and average size. Unlike that of *lasioides*, however, its antennal scapes have no erect hairs. Its body is only moderately shining.

Formica neorufibarbis Emery

A few colonies of this ant were found under stones in partial shade in the Pinyon-Juniper community.

The worker of this medium-sized ant (length 3 to 6 mm) has a brown to black head and gaster, and a light to deep red thorax which is often strongly infuscated, especially on the pronotum. The head and thorax are subopaque; the gaster is rather smooth and shining.

Formica obtusopilosa Emery

A few colonies of this ant were found in a mixed plant community with scattered sparse juniper and *Artemisia*. The nests were in rather coarse, gravelly soil of unshaded areas. They were marked by a rather large, irregular entrance surrounded by a narrow, uneven circlet of small pebbles. Workers were numerous in the colonies. My attempts to find males, which have never been described, were unsuccessful

The large (up to 7 mm in length), handsome workers of *obtusopilosa* have the head and thorax colored a rich, uniform, ferrugineous red, and the gaster an opaque black. The conspicuous, long, robust, blunt, silvery hairs which evenly cover the gaster are definitive of this taxon. As in other closely related taxa, the anterior clypeal margin is distinctly, medially emarginate.

Formica subpolita camponoticeps Wheeler

Restricted to the Pinyon-Juniper community, colonies of this taxon were rather common under stones in sunny areas. The workers are strongly polymorphic and vary in length from 2.5 to 6.0 mm.

The workers have a shining body with castaneous brown head, brownish or reddish yellow thorax, and piceous brown gaster. The head of the larger workers is at least as broad as long, excluding the mandibles, and its gula bears erect hairs. There are a few erect hairs also on the front and occiput as well as on the dorsum of the pronotum.

Subfamily Dorylinae

Genus *Neivamyrmex* Borgmeier

Neivamyrmex minor (Cresson)

A few males of this species were attracted to black light on July 21 in Pinyon-Juniper on Rainier Mesa. The worker caste is unknown.

LITERATURE CITED

Allred, D. M., D E. Beck, and C. D. Jorgensen. 1963. Biotic communities of the Nevada Test Site. Brigham Young Univ. Sci. Bull., Biol. Ser., 2(2):1-52.

Andrews, H. 1916. A new ant of the genus *Messor* from Colorado. Psyche, 23:81-3.

Barnum, A. H. 1964. Orthoptera of the Nevada Test Site. Brigham Young Univ. Sci. Bull., Biol. Ser., 4(3):1-134.

Cole, A. C. 1955. Studies of Nevada ants. I. Notes on *Veromessor laricersi* M. R. Smith and a description of the queen (Hymenoptera: Formicidae). J. Tennessee Acad. Sci., 30:51-2.

Cole, A. C. 1958. North American *Leptothorax* of the *nitens-carinatus* complex (Hymenoptera: Formicidae). Ann. Entomol. Soc. Amer., 51:535-8.

Cole, A. C. 1963. A new species of *Veromessor* from the Nevada Test Site and notes on related species (Hymenoptera: Formicidae). Ann. Entomol. Soc. Amer., 56:678-682.

Cole, A. C. 1965a. Discovery of the worker caste of *Pheidole* (*P.*) *inquilina*, new combination (Hymenoptera: Formicidae). Ann. Entomol. Soc. Amer., 58:173-5.

Cole, A. C. 1965b. A monographic revision of the genus *Pogonomyrmex* Mayr in North America (Hymenoptera: Formicidae). (Unpub. ms.).

Gregg, R. E. 1955. The rediscovery of *Veromessor lobognathus* (Andrews) (Hymenoptera: Formicidae). Psyche, 62:45-52.

Gregg, R. E. 1958. Key to the species of *Pheidole* (Hymenoptera: Formicidae) in the United States. J. New York Entomol. Soc., 66:7-48.

Smith, M. R. 1941. Two new species of *Aphaenogaster* (Hymenoptera: Formicidae). Great Basin Nat., 2:118-21.

Smith, M. R. 1951. Two new ants from western Nevada (Hymenoptera: Formicidae). Great Basin Nat., 11:91-6.

Smith, M. R. 1957. Revision of the genus *Stenamma* Westwood in America north of Mexico (Hymenoptera: Formicidae). Amer. Midland Nat., 57:133-74.

Smith, M. R. 1963. A new species of *Aphaenogaster* (*Attomyrma*) from the western United States (Hymenoptera: Formicidae). J. New York Entomol. Soc., 71:244-6.

Wheeler, G. C. and J. Wheeler. 1956. *Veromessor lobognathus* in North Dakota (Hymenoptera: Formicidae). Psyche, 63:140-5.

Wheeler, G. C. and J. Wheeler. 1959. *Veromessor lobognathus*: second note (Hymenoptera: Formicidae). Ann. Entomol. Soc. Amer., 52:176-9.

Wheeler, G. C. and J. Wheeler. 1965. *Veromessor lobognathus*: third note (Hymenoptera: Formicidae). J. Kansas Entomol. Soc., 38:55-61.