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NORTH AMERICAN SPECIES  
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GENUS MYRMECOPHILA  
(ORTHOPTERA; GRILLIDAE; MYRMECOPHILINAE)

by

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## A REVISION OF THE NORTH AMERICAN SPECIES OF THE GENUS MYRMECOPHILA

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BY MORGAN HEBARD

In recent years we have had frequent requests to determine North American material of the minute crickets which live in ants' nests, all of which belong to the cosmopolitan genus *Myrmecophila*. Much difficulty has been experienced in distinguishing the nominal species and a complete revision was clearly imperative, as soon as sufficient material could be assembled.

General collectors, and even Orthopterists, rarely encounter these strange little creatures, owing to their small size and concealed habitat, even in regions where they are known to be abundant. The Hymenopterists, particularly those specializing on ants, however, discover these insects much more frequently, and it is to two of these, Professor W. M. Wheeler, of the Bussey Institution, and Mr. W. M. Mann, of the Department of Agriculture, that we are deeply indebted for the loan of a large portion of the material forming the basis of the present study. In addition, Professor Wheeler has furnished invaluable aid in determining all of the numerous species of ants recorded in the present paper. All of the material in the Hebard Collection, the United States National Museum and the Academy of Natural Sciences of Philadelphia furnished practically the entire remainder. We grasp the present opportunity to thank most heartily Mr. W. T. Davis for submitting this portion of his collection, and both Mr. A. N. Caudell, of the National Museum, and Mr. James A. G. Rehn, of the Philadelphia Academy, for the privilege of studying this portion of the collections entrusted to their care.

### MYRMECOPHILA Latreille

1829. *Myrmecophila* Latreille, Règne Anim., (ed. 2), v, p. 183.

At the time of original description the genus was considered monotypic.

*Genotype*.—*Myrmecophila acervorum* [*Blatta acervorum*] (Panzer).

The number and proportionate length of the spines and spurs of the caudal tibia, and spines and spinulae of the caudal meta-

tarsus, are of great specific diagnostic value. It is surprising to find that the otherwise careful and exhaustive work of Schimmer is faulty in this respect.<sup>1</sup> It is not surprising, considering the clearly superficial character of the work, that Scudder, in his paper on the species found in the United States, the two new species proposed in which are both found to be synonyms, has completely overlooked the most important of the features exhibited by this armament.

For the genus, the armament of the caudal tibia and metatarsus may be described as follows: Caudal tibia with dorsal margins supplied distad with one external and three or four internal spines; distal extremity armed with three pairs of spurs, the ventral pair being minute and of equal length, in some species so small that they are discernible only under relatively high magnification. Caudal metatarsus supplied dorsad with two or three (in some species individually varying to four) spinulae, distal extremity armed with one pair of spurs.

#### *Specimens Examined, Methods and Conclusions*

In the present paper three hundred and sixteen specimens have been studied, distributed as follows: one hundred and one in the Wheeler Collection, one hundred and three in the Hebard Collection, fifty-three in the United States National Museum, twenty-seven in the Mann Collection, seventeen in the Davis Collection, fourteen in the Academy of Natural Sciences of Philadelphia, and one in the Brooklyn Institute of Arts and Sciences.

The measurements have all been taken under the microscope at a magnification of twenty-three diameters; study of the material required a much higher magnification.

The color terms used are taken from Ridgway's "Color Standards and Nomenclature," as is our custom.

It is evident that of the six described North American species but four are valid. These are *pergandei*, *oregonensis*, *manni* and *nebrascensis*. All are very closely related and may eventually prove to be geographic races of one species. After carefully

<sup>1</sup> That author overlooks the pair of minute ventro-distal tibial spurs and treats the large dorsal pair as part of the series of spines of the dorsal margins. It is true that, in *acervorum*, the pair of ventro-distal tibial spurs are reduced to the minimum size encountered in the genus.

weighing all the evidence, however, we believe that they should be given full specific status. Typical *nebrascensis* might be supposed to represent the most distinct entity, but in Arizona the convergence of this species and *manni* is very decided.

### *Specific Diagnostic Characters*

The species of *Myrmecophila* do not show the number of specific diagnostic characters usually found in the Orthoptera. We have found little or nothing of such value in the North American species, in size, form of segments, width of interocular space, size of eyes,<sup>2</sup> length in proportion to width, form of caudal femora, form of external male genitalia<sup>3</sup> or form of ovipositor.

In coloration certain factors appear to have decided value. The species *pergandei* and *oregonensis* are dark, very rarely, in specimens showing the maximum of recessive coloration, as pale as darker individuals of *manni* and *nebrascensis*. Moreover, *pergandei* normally differs from *formicarum* in having the paired generic pronotal spots faintly outlined in a paler shade of brown. The species *manni* and *nebrascensis* are pale, both developing a weakly barred color phase, this appearing frequently in *nebrascensis* in the eastern portion of its distribution, rarely in *manni* and only in the southeastern portion of its distribution.

In the spination of the caudal limbs, *nebrascensis* shows a decided difference from the other species, in having normally one less spine on the dorso-internal margin of the tibia and always one less spinula on the dorsal surface of the metatarsus.<sup>4</sup> The in the proportions of some of the spines of the caudal limbs, as other three species show slight, but apparently useful, differences

<sup>2</sup> The eye facets may show a different numerical range in the various species. We have not used this feature, as in the majority of specimens the eyes are partially hidden by the pronotum, while in many drying has affected these minute areas to such a degree that the number can not be accurately obtained.

<sup>3</sup> Insufficient alcoholic material is at hand to compare the concealed male genitalia of the species studied. These parts are, however, very simple for the one species examined and probably show no differential characters. In an alcoholic specimen of *nebrascensis* examined, the large opening to the seminal area below the anus was found to have its convex margins narrowly chitinous on each side.

<sup>4</sup> We find that *pergandei*, *oregonensis* and *manni* have normally three, rarely four, such spinulae; *nebrascensis* has two, lacking the median spinula.

noted in the present key to the species. The extremes of individual variation in each cause so close an approach to the normal for the others, however, that these features are not as distinctive as would be desired.

#### *Variation in General Size and in Form of Caudal Femora*

Individual size has proven an extremely interesting feature, due to the fact that in all the species studied, not only is there a direct influence generally exerted on the size of the individuals of a colony by the size of their host ants, but also that in colonies of very small ants, each species of these symbiotic crickets develops a depauperate type, found under no other conditions, so small that it would at first seem almost incredible so great a reduction in the size could exist. A specimen of *nebrascensis* representing this type, 1.47 mm. in length, is the smallest adult specimen of the Orthoptera known to us. In *oregonensis* alone is the size influenced by geographic factors.

The form of the caudal femora is found to vary in all of the species. These members are ovate when short, thus of this type in almost all of the smaller examples and normal in *nebrascensis*, the smallest of the species studied. When the caudal femora are longer, however, they assume a pyriform shape, this due to the flattening of the dorsal margin. As a result, the species which average larger, *pergandei*, *oregonensis* and *manni*, show more frequently the pyriform type.

#### *Life History*

The extremely interesting life histories of a number of the species of *Myrmecophila* already have been carefully studied. As we have not had an opportunity for such observations, we refer to the following important papers bearing on the subject.

1819. Savi. Osservazioni sopra la *Blatta acervorum* di Panzer, *Gryllus myrmecophilus nobis*. Biblio. ital., xv, pp. 217 to 219.

1877. H. de Saussure. *Mélanges Orth.*, ii, pp. 457 to 461, pl. 15, figs. xxvi, 1 to 5.

1900. W. M. Wheeler. The Habits of *Myrmecophila nebrascensis* Bruner. *Psyche*, ix, pp. 111 to 115, text figure.

1901. Wasmann. Zur Lebensweise der Ameisengryllen (*Myrmecophila*). *Natur und Offenbarung*, xlvii, pp. 1 to 24.

1903. F. Silvestri. Contribuzioni alla conoscenza dei Mirmecophili. I. Osservazioni su alcuni Mirmecofili dei dintorni de Portici. Ann. Mus. Zool. R. Univ. Napoli, (Nuova Ser.), i, no. 13, pp. 4 and 5.

1909. F. Schimmer. Beitrag zu einer Monographie der Gryllodeengattung *Myrmecophila* Latr. Zeitschr. für Wissensch. Zool., cxiii, pp. 409 to 534, pls. xxii to xxiv, 26 text figures.

We would observe that it has been ascertained, that different European species differ somewhat in their relations with their hosts. It would appear probable that the North American species all agree in being unwelcome inhabitants of the ants' nests, doing little or no harm to their hosts and wholly dependent upon them for the type of nourishment required.<sup>5</sup>

Each species is apparently symbiotic with a large number of species of ants. It has been shown, however, that certain species of ants are greatly preferred.

The following list shows the species of host ants with which the four North American species of *Myrmecophila* have been found to occur.

*Myrmecophila pergandei* Bruner

<i>Crematogaster lineolata</i>	<i>Formica pallidefulva</i>
<i>Aphaenogaster treatae</i>	<i>Formica truncicola</i>
<i>Lasius umbratus</i>	<i>Camponotus herculeanus</i>
<i>Formica fusca</i>	<i>Camponotus castaneus</i>

*Myrmecophila oregonensis* Bruner

<i>Pheidole hyatti</i>	<i>Prenolepis obscura</i>
<i>Veramessor andrei</i>	<i>Formica cinerea</i>
<i>Pogonomyrmex californicus</i>	<i>Formica camponoticeps</i>
<i>Myrmica bradleyi</i>	<i>Formica rufibarbis</i>
<i>Tapinoma sessile</i>	<i>Formica fusca</i>
<i>Prenolepis imparis</i>	<i>Camponotus herculeanus</i>
	<i>Camponotus maculatus</i>

*Myrmecophila manni* Schimmer

<i>Crematogaster lineolata</i>	<i>Formica rufibarbis</i>
<i>Myrmica mutica</i>	<i>Formica fusca</i>
<i>Liometopum apiculatum</i>	<i>Formica neogagates</i>
<i>Tapinoma sessile</i>	<i>Formica rufa</i>
<i>Lasius niger</i>	<i>Camponotus maculatus</i>
	<i>Camponotus acutirostris</i>

<sup>5</sup> Observations made by various authors indicate that the food of these crickets is largely the secretions which lubricate the ants bodies and which are left on the walls of their passage-ways, partly the food of the ants.

*Myrmecophila nebrascensis* Lugger

<i>Pachycondyla harpax</i>	<i>Pogonomyrmex barbatus</i>
<i>Pheidole vas'iti</i>	<i>Liometopum apiculatum</i>
<i>Pheidole desertorum</i>	<i>Dorymyrmex pyramicus</i>
<i>Crematogaster lineolata</i>	<i>Iridomyrmex pruinosus</i>
	<i>Formica rufibarbis</i>

*Key for the North American Species of Myrmecophila*

- A. Dorso-internal margin of caudal tibia armed (normally, rarely in *manni* is one spine missing) with four spines, alternating in length. Dorsal surface of caudal metatarsus armed along the median line with three minute spinulae.
- B. General coloration dark brown, in recessive examples yellowish brown. Abdominal segments never appearing banded. Dorso-external spine of caudal tibia as long as or longer than half the length of the tarsal joints.
- C. Generic pronotal spots faintly outlined in a paler coloration. Caudal metatarsal spurs usually as long as terminal tarsal joint. Distribution: Atlantic Coast from Maryland southward, westward to Nebraska. . . . . **pergandei** Bruner
- CC. Generic pronotal spots of general coloration. Caudal metatarsal spurs usually slightly longer than terminal tarsal joint. Distribution: Pacific Coast from Vancouver Island to the Mexican Border, eastward throughout the Cascades, Sierras and mountains of southern California, but not east of them. . . . . **oregonensis** Bruner
- BB. General coloration pale yellowish brown. Abdominal segments sometimes margined caudad with a slightly darker shade, giving such individuals a banded appearance. Dorso-external spine of caudal tibia often distinctly less than half the length of the tarsal joints. (Generic pronotal spots of general coloration. Caudal metatarsal spurs usually slightly longer than terminal tarsal joint.) Distribution: Southeastern Washington to Mexican Border in Arizona and California, confined to arid or semi-arid country, not extending west of the eastern base of the Cascades, Sierras, and mountains of southern California, except in the San Diego region. . . . . **manni** Schimmer
- AA. Dorso-internal margin of caudal tibia armed normally with three spines, increasing in length distad. Dorsal surface of caudal metatarsus armed along the median line with two minute spinulae. (General coloration yellowish brown. Generic pronotal spots of general coloration. Abdominal segments margined caudad with a slightly darker shade than the general coloration in frequent individuals, giving them a banded appearance.) Distribution: Eastern Nebraska southward to northern Texas and New Mexico and southwestward to the Mexican Border in eastern Arizona. . . . . **nebrascensis** Lugger

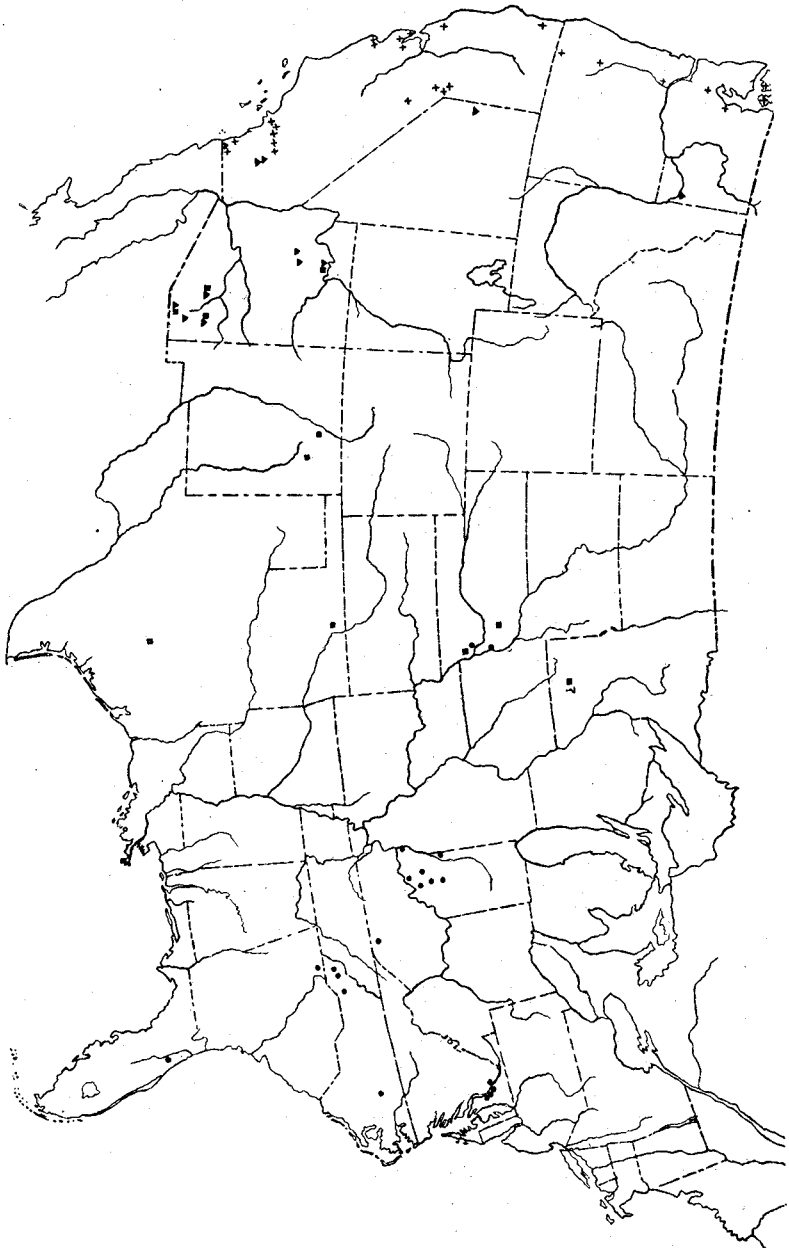


FIG. 1.—The known distribution of *Myrmecophila pergandei* is indicated by dots, that of *nebrascensis* by squares, that of *miami* by triangles and that of *oregensis* by crosses. Due to the secretive habits of these insects, the definite limits of distribution in some directions will probably not be known for some time to come. As the Crescent City, Florida, record of *pergandei* is the only one for the genus in the Sabalian Zone of the southeastern United States, we do not at the present time feel full satisfaction as to its authenticity.



**Myrmecophila pergandei** Bruner

1884. *Myrmecophila pergandei* Bruner, Can. Ent., xvi, p. 42, figs. 4a and 4b. [♂, ♀; Atlantic States from Maryland southward.]

1912. *Myrmecophila pergandei* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1912, p. 128. (Single type fixation.) [♀; Washington, District of Columbia. Host = *Camponotus herculeanus pennsylvanicus* DeGeer.]

The type is in the Hebard Collection, type number 202.

The present species develops the largest size of the species found in North America. Very close affinity to this insect is shown by *M. oregonensis* Bruner and *M. manni* Schimmer. It is indeed possible that these may eventually prove to be races of *pergandei*. Nearest agreement is shown by *oregonensis*, which occurs on the Pacific Coast, that insect distinguishable by its normally concolorous pronotal spots and slightly longer caudal metatarsal spurs.

*Measurements (in millimeters)*

♂	Length of body	Width of body <sup>6</sup>	Length of caudal femur	Width of caudal femur <sup>7</sup>	Length of caudal metatarsus
Washington, District of Columbia, <i>paratype</i> .....	2.18	1.29	1.36	.88 (×1.56+)	.68
Balsam, North Carolina.....	4.76	2.52	2.65	1.63 (×1.63—)	—
Hendersonville, North Carolina	2.92	1.56	1.43	1.02 (×1.42—)	.75
Corbin, Kentucky.....	3.6	2.11	2.31	1.43 (×1.61+)	1.34
South Bend, Nebraska.....	3.54	2.04	1.84	1.29 (×1.43—)	1.09
South Bend, Nebraska <sup>8</sup> .....	4.35	2.52	2.38	1.56 (×1.52+)	1.43
♀					Length of ovi-positor
Washington, District of Columbia, <i>type</i> .....	4.15	2.58	—	—	2.11
Washington, District of Columbia, <i>paratype</i> .....	3.87	2.52	2.31	1.52 (×1.52—)	2.04
Clayton, Georgia.....	2.52	1.56	1.36	.88 (×1.54+)	1.29
Posey County, Indiana.....	2.52	1.56	1.36	1.02	1.29
Posey County, Indiana.....	3.4	2.24	2	1.26 (×1.6 —)	1.56
South Bend, Nebraska.....	3.54	2.24	2.04	1.36 (×1.5 )	1.9
South Bend, Nebraska <sup>9</sup> .....	4.69	2.72	2.52	1.5 (×1.68)	2.24

<sup>6</sup> Taken across second dorsal abdominal segment. This is slightly greater than the pronotal width in males, much greater than that dimension in females.

<sup>7</sup> Number of times width of caudal femur is contained in its length.

<sup>8</sup> Largest and smallest males measured, of twenty from this locality.

<sup>9</sup> Largest and smallest females measured, of eleven from this locality.

In the material before us, the series of largest examples of this species were taken with the largest ants, *Camponotus herculeanus* Linnaeus; the smallest examples with small ants, *Crematogaster lineolata* Say. We believe that, in *pergandei*, geographic influences have little or nothing to do with the considerable size variation shown by this species. It does appear, however, that the size of the ants in a nest has a decided effect on the individuals of this cricket living in the same. The differences in size among adults from the same colony of *pergandei* is ascribable to individual variation.

In general coloration individuals of this species are as follows: Dorsal surface dark chestnut brown, shading to chestnut brown on all but margins of pronotum and proximal portions of proximal abdominal segments, well supplied with microscopic golden scales. Paired generic pronotal markings faintly outlined in a slightly paler shade, this rarely noticeable to the naked eye and sometimes subobsolete. Ventral surface, limbs and antennae buckthorn brown, except caudal tibiae and caudal femora dorso-proximad, which are slightly darker. Cerci ochraceous-tawny. In recessive examples of the present species the dorsal surface is russet, with paler areas tawny. The maximum recessive condition in the series is shown by the specimens from Raleigh, North Carolina, which are almost entirely pale ochraceous-tawny.

*Specimens Examined.*—73; 32 males, 23 females and 18 immature individuals.

MARYLAND: Gray's Farm, Linden, Montgomery County, (W. V. Warner), 1 large ♀, (host = *Formica truncicola obscuriventris* Mayr), [U. S. N. M.]. Plummer's Island, XI, 20, 1903, (A. N. Caudell), 1 small juv., (host = *Crematogaster lineolata* Say); X, 13, 1911, (J. D. Hood), 1 large ♀, (host = *Camponotus herculeanus ligniperda* var. *noveboracensis* Fitch), [both U. S. N. M.].

DISTRICT OF COLUMBIA: Washington, IV, 22 to VI, 1885, (L. Bruner), 5 ♂, 4 ♀, 4 juv., *type, allotype* and 8 *paratypes*, (hosts = *Camponotus herculeanus pennsylvanicus* DeGeer, *Formica pallidefulva* Latreille and (one immature with) *Crematogaster lineolata* Say), [Hebard Cln.]; VI, 19, 1911, (Wm. T. Davis; under bark of log), 1 juv. ♂, 1 juv. ♀, (host = *Crematogaster lineolata* Say), [Davis Cln.]. Mulligan Hill, Washington, IV, 2, 1916, (H. S. Barber), 1 small ♂, (host = *Camponotus castaneus* Latreille), [U. S. N. M.].

VIRGINIA: XI, 1883, 1 small juv., (host = *Crematogaster lineolata* Say), [Hebard Cln.]. Great Falls, VI, 11, 1910, (Wm. T. Davis), 2 large ♀, 1 juv. ♀, (host = *Formica pallidefulva* Latreille), [Davis Cln.]. Hot Springs,

VIII, 3, 1916, (M. Hebard; under bark of pine log), 1 large juv. ♀, (host = *Formica fusca* var. *subsericea*), [Hebard Cln.].

NORTH CAROLINA: Raleigh, I, 22, 1906, (C. S. Brimley), 1 small and very pale ♂, (host = *Lasius umbratus mixtus* var. *aphidicola* Walsh), [U. S. N. M.]; X, 1 very pale ♂, [Davis Cln.]. Retreat, VIII, 6, (H. G. Hubbard), 1 small ♂, (host = *Aphaenogaster treatae* Forel), [U. S. N. M.]. Hendersonville, VI, 1907, (F. Sherman), 1 small ♂, [U. S. N. M.]. Balsam, 4500 to 5700 feet, VII, 24, 1903, (A. P. Morse), 1 large ♂, (host = *Camponotus herculeanus pennsylvanicus* DeGeer), [Hebard Cln.].

GEORGIA: Clayton, 2000 to 3700 feet, VI, 1909, (W. T. Davis), 1 small ♀, 4 juv., (host = *Crematogaster lineolata* var. near *pilosa* Pergande), [Wheeler and Davis Clns.].

KENTUCKY: Corbin, VIII, 24, 1904, (H. S. Barber), 1 large ♂, (host = *Camponotus herculeanus pennsylvanicus* var. *ferrugineus* Fabricius), [U. S. N. M.].

FLORIDA: Crescent City, 1 juv. ♂, [Hebard Cln.].

INDIANA: Crawford County, IX, 6, 1902, (W. S. Blatchley), 1 large ♀, [Hebard Cln.]. New Harmony, IV, 27, 1901 to V, 6, 1902, (W. S. Blatchley), 1 large ♀, 1 small ♀, 1 juv. ♀, [Hebard Cln.].

NEBRASKA: South Bend, 1050 feet, (in rotten log, low ground on island), 20 ♂, 11 ♀, 2 juv. ♂, 5 juv. ♀, (host = *Camponotus herculeanus ligniperda* var. *noveboracensis* Fitch), [Hebard Cln.].

In addition to the localities listed above, the species has been recorded by Blatchley from Orange, Dubois, Perry and Knox Counties and Mitchell, Lawrence County, Indiana, and by Bruner, with a query, but probably correctly, from Omaha, Nebraska.<sup>10</sup>

### **Myrmecophila oregonensis** Bruner

1884. *Myrmecophila oregonensis* Bruner, Can. Ent., xvi, p. 43. [♀, juv.; Portland, Oregon.]

1899. *Myrmecophila formicarum* Scudder, Psyche, viii, p. 426. [♂, ♀; Sisson, El Dorado County, Placer County and Coronado, California.]

The adult female described has been selected as single type of *oregonensis*.<sup>11</sup> We here select the unique male, taken by A. P. Morse, at Sisson, California, on September 3, 1897, and now in the Museum of Comparative Zoology, as single type of *M. formicarum* Scudder.

<sup>10</sup> Smith, in his "Insects of New Jersey," 1900, states that this species "occurs in ant nests from Massachusetts to Maryland; but not yet actually taken, because not sought for, in New Jersey." This is not the case, as the northernmost locality at which the species has been found on the Atlantic Coast is in Maryland near the District of Columbia. It is possible that the species may eventually be found in extreme southern New Jersey, but it is practically certain that it does not occur over by far the greater portion of that state.

<sup>11</sup> Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1912, p. 128, (1912).

Study of the types and the material now at hand shows conclusively that *formicarum* is a synonym of *oregonensis*, as indicated above.

Very close affinity to *M. pergandei* Bruner is shown by the present species. Under the former species a comparison is made on page 98. Considering the variation shown and the weakness of the degree of differentiation which has taken place, we would not be surprised should further investigation, particularly breeding experiments, show *oregonensis* to be synonymic with *pergandei*, or at best a geographic race. To *oregonensis* close relationship is shown by *M. manni* Schimmer, under which species the two are compared on page 105.

For the present, however, we believe it best to recognize the four species, *pergandei* of the eastern United States, *manni* of the western arid and semi-arid regions of the western United States, *oregonensis* of the Pacific Coast and *nebrascensis* of the central western and southwestern United States.

Bruner, when he described *oregonensis*, had but one adult example. His original description is correct as to the diagnostic differences in color, when compared with *pergandei*, but incorrect in stating that *oregonensis* is more slender. Scudder correctly gives the uniform character of coloration for his synonymic *formicarum* and for *oregonensis*. That author is, however, in error in giving as differential characters the stouter form and flatter body of "*formicarum*," when compared with *pergandei*, and its lighter coloration, when compared with *oregonensis*, as well as the difference in caudal tibial spurs between "*formicarum*" and *oregonensis*. These features are all valueless, as is clearly shown by the present series, being wholly attributable to individual variation.

The following table of measurements shows *oregonensis* to be of an average smaller size than *pergandei*, and to be subject to an even greater degree of size variation than that species.

Measurements (in millimeters)

♂	Length of body	Width of body	Length of caudal femur	Width of caudal femur <sup>12</sup>	Length of caudal metatarsus
Victoria, British Columbia. . . .	3.2	1.9	1.97	1.29 (×1.53—)	1.15
San Juan Island, Washington. . .	3.33	2.11	1.9	1.22 (×1.56—)	1.15

♂	Length of body	Width of body	Length of caudal femur	Width of caudal femur <sup>12</sup>	Length of caudal meta- tarsus
Lake Tahoe, California.....	3.13	2.11	2.11	1.16 (×1.82—)	2.12
Palo Alto, California.....	2	1.3	1.22	.85 (×1.44+)	.75
Pasadena, California.....	3.13	2.04	—	—	—
San Ysidro, California.....	2.88	1.97	1.77	1.19 (×1.5 —)	—
♀					Length of ovi- positor
Victoria, British Columbia....	3.26	2.27	1.9	1.22 (×1.56—)	1.56
Seattle, Washington.....	3.54	2.04	1.84	1.16 (×1.59—)	1.5
Divide, Oregon.....	2.86	2	1.77	1.22 (×1.45)	1.43
Lake Tahoe, California.....	3.26	2	1.77	1.16 (×1.53—)	1.46
Placer County, California....	3.67	2.72	2.54	1.5 (×1.69—)	1.97
El Dorado County, California.	2.79	1.74	1.63	1.04 (×1.58+)	1.36
San Francisco, California.....	2.52	1.63	1.54	1.02 (×1.51—)	1.29
Alameda County, California...	1.5	1.02	1.02	.64 (×1.59+)	.82
Palo Alto, California.....	2	1.43	1.22	.81 (×1.51—)	1.09
Los Angeles County, California	3.06	2.15	2.11	1.23 (×1.71+)	1.41
Los Angeles County, California	1.9	1.29	1.15	.73 (×1.58+)	.95
Sierra Madre, California.....	2.86	1.5	1.32	.9 (×1.47—)	1.04
San Ysidro, California.....	2.79	1.56	1.52	1.02 (×1.49+)	1.29
San Ysidro, California.....	1.6	1.02	.88	.6 (×1.47+)	.72

In the series of females measured, the length of the caudal metatarsus ranges from .4 in the smallest example to 1.29 mm. in the largest specimen.

The extreme variation in size of *oregonensis* is most interesting. Geographic distribution here is clearly a size factor. The material from British Columbia southward to northern California, and as far as King's River in the Sierras, averages large; that from the region about San Francisco, south to the Mexican border, averages small. The size of the host ants is, however, in some cases a much more powerful factor in the size development of these symbiotic crickets. An extremely depauperate condition is seen to occur in nests of the small ant *Tapinoma sessile* Say. Specimens taken in nests of that ant, in Alameda County and at San Ysidro, are very much smaller than any other adults before us. That this is not a fixed rule for all material occurring with that species of ant is shown by a medium sized adult cricket, taken

<sup>12</sup> The number of times the width of the caudal femur is contained in its length is also given.

under the same conditions at San Ysidro, but on a different date. In the six other cases before us of material from nests of small sized ants, however, the crickets are either small immatures, small or very small adults.

That immature and adult crickets inhabit the same ants' nest is shown by a number of cases in the present series.

The normal general coloration for *oregonensis* is as follows: Pronotum and proximal abdominal segments cinnamon brown, rapidly becoming darker caudad, so that the major portion of the dorsal surface of the abdomen is mummy brown. Head mummy brown. Palpi, underparts and limbs paler, buckthorn brown with an ochraceous-tawny tinge. Antennae of the limb coloration proximad, darkening to cinnamon brown. Cerci of the limb coloration, often more strongly tinged with ochraceous-tawny. As in *pergandei*, the dorsal surface and appendages are rather thickly supplied with minutely microscopic golden scales. These are easily rubbed off and have completely disappeared in some of the alcoholic material at hand.

Individuals of recessive coloration have the dorsal surface ochraceous-tawny, becoming darker only distad on the abdomen. The immature individual from Humboldt County, California, is exceptionally pale, as pale as is normal for *manni*.

*Specimens Examined.*—93; 21 males, 51 females and 21 immature individuals.

BRITISH COLUMBIA: (G. W. Taylor), 1 ♂, 1 ♀, [Hebard Cln.]. Wellington, Vancouver Island, III, 18 to IX, 24, 1900 to 1904, (G. W. Taylor), 1 small ♂, 2 small ♀, 1 large ♀, 1 juv.; VIII, 8, 1906, (A. N. Caudell), 1 juv., [all U. S. N. M.]. Nanaimo, Vancouver Island, VIII, 7, 1906, (A. N. Caudell), 2 small juv., [U. S. N. M.].

WASHINGTON: San Juan Island, VII, 1 to 7, 1909, (W. M. Mann), 1 large ♂, (host = *Camponotus herculeanus modoc* Wheeler), [Hebard Cln.], 2 large juv., (host = *Formica fusca* var. *neorufibarbis* Emery), [Mann Cln.]. Seattle, (T. Kincaid), 1 large ♂, 3 large ♀, 1 large juv., [U. S. N. M. and Hebard Cln.]. Tenino, (H. G. Hubbard), 1 medium ♂, (host = *Formica fusca* var. *argentea* Wheeler), [U. S. N. M.].

OREGON: Divide, IX, 12, 1897, (A. P. Morse), 2 large ♀, [U. S. N. M. and Hebard Cln.].

CALIFORNIA: Bair's Ranch, Redwood Creek, Humboldt County, VI, 12, (H. S. Barber), 1 small pale juv., [U. S. N. M.]. Placer County, IX, 1 large ♀, *paratype* of *M. formicarum* Sc., [Hebard Cln.]. El Dorado County, II, 2 medium ♀, 1 *paratype* of *M. formicarum* Sc., [both Hebard Cln.]. Lake Tahoe, VII, 1915, (for W. M. Wheeler), 1 medium large ♂, 1 medium large ♀,

1 juv., (host = *Myrmica bradleyi* Wheeler), 1 large ♀, 1 medium large ♀, 1 juv., (host = *Formica fusca* var. *neorufibarbis* Emery), 1 juv., (host = *Camponotus maculatus vicinus* Mayr), [all Wheeler Cln.]. King's River, (H. Heath), 2 large ♀, [Wheeler Cln.]. Sonoma County, VIII, 1 small juv., [Brooklyn Institute of Arts and Sciences]. Land's End, San Francisco, X, 17, 1909, (F. X. Williams), 1 medium small ♀, 1 juv., [U. S. N. M.]. Alameda County, III, 2 very small ♀, 2 very small juv.?, (host = *Tapinoma sessile* Say), [U. S. N. M.]. Palo Alto, I, 1911, (W. M. Wheeler), 1 small ♀, (host = *Camponotus maculatus mccoocki* Forel), [Wheeler Cln.]; (Isabel McCracken), 1 small ♂, 4 small ♀, 2 juv., (host = *Veramessor andrei* Mayr), [Wheeler Cln.]; XI, 11, 1913, 2 small ♂, 4 small ♀, [Mann Cln.]. Stanford University, Palo Alto, I, 23 to III, 9, 1910 and 1915, 3 small ♂, 9 small ♀, 1 juv., (hosts = *Formica rufibarbis* var. *occidua* Wheeler; *Prenolepis imparis* Say; *Formica camponoticeps* Wheeler; *Prenolepis* near *obscura* Mayr; *Veramessor andrei* Mayr), [Mann, Hebard and Wheeler Cln.]; II, 1, 1900, 1 small ♀, (host = *Camponotus maculatus maccooki* Forel, [Davis Cln.]. Pacific Grove, II, 20, 1910, (W. M. Mann), 1 large ♀, (host = *Camponotus maculatus vicinus* var. *maritimus* Wheeler [Mann Cln.]. Los Angeles County, (D. W. Coquillett), 2 medium ♂, 1 small ♂, 1 very small ♂, 1 medium ♀, 1 very small ♀, [U. S. N. M. and Hebard Cln.]. Pasadena, IV, 6, 1916, 1 small ♂, 1 medium small ♀, (hosts = *Pogonomyrmex californicus* Buckley, *Formica cinerea pilicornis* Emery), [Davis Cln.]; XII, 7, 1910, (W. M. Wheeler), 1 large ♂, (host = *Formica cinerea pilicornis* Emery), 1 very small juv., (host = *Pheidole hyatti* Emery), [both Wheeler Cln.]. Sierra Madre, XII, 2, 1910, (W. M. Wheeler), 1 medium small ♀, (host = *Formica rufibarbis* var. *occidua* Wheeler), [Wheeler Cln.]. San Gabriel Mountains, near Claremont, XII, 9, 1910, (W. M. Wheeler), 1 very small juv., (host = *Tapinoma sessile* Say), [Wheeler Cln.]. Santa Ana Canyon, San Bernardino Mountains, (H. Wickham), 1 juv. ♀, [U. S. N. M.]. La Jolla, XII, 20, 1910, (W. M. Wheeler), 1 small ♀, (host = *Veramessor andrei* Mayr var. [Wheeler Cln.]. San Ysidro, XII, 24, 1910 to I, 10, 1911, (W. M. Wheeler), 3 small ♂, 4 small ♀, (host = *Formica rufibarbis* var. *occidua* Wheeler), 1 medium ♀, 1 very small ♀, (host = *Tapinoma sessile*), [all Wheeler Cln.].

In addition to the localities given above, this species has been recorded by Scudder from Victoria, Vancouver Island, British Columbia, Portland and Siskiyou, Oregon, and as the synonymous *formicarum* from Coronado, California.

### **Myrmecophila manni** Schimmer

1911. *Myrmecophila manni* Schimmer, Deutsch. Ent. Zeitschr., 1911, p. 443, text fig. 1. [♂, ♀; Wawawai, Washington.]

The cotypes of this species are apparently in the collection of F. Schimmer, at Meerane, Saxony.

The present insect is an inhabitant of the semi-arid and arid regions of the western United States, ranging from southern Washington to the Mexican border. The species' western limit

of distribution is the foot of the mountain boundaries formed by the Cascade, Sierra, Tehachapi, San Gabriel, San Bernardino and San Jacinto Mountains, but near the Mexican border, in the vicinity of San Diego, it invades the coastal region through the Cuyamacas and other lower mountains. In that semi-arid region only, the ranges of *M. oregonensis* Bruner and *manni* overlap.

It is noteworthy that, though *manni* is probably widely distributed through the plateaus and mountains of Arizona and adjacent regions, it apparently does not occur anywhere in the mountains forming the western boundary of its distribution, those mountains being the habitat of *oregonensis*, as are the coastal regions westward of them.

We find that *manni* is distinctive, when compared with *oregonensis*, in being very pale in general coloration.<sup>13</sup> Schimmer was incorrect in supposing *manni* to be a very distinct species, recognizable particularly by the lack of minute scales. The alcoholic material which he had before him had been shorn of scales, due probably to washing about in the preservative. A large number of the present series, similarly preserved, are before us and exhibit the same condition, the series, however, showing plainly the reason. The caudal tibial spines are usually proportionately somewhat shorter than in *oregonensis*. This weak feature and the pale coloration are the only specific diagnostic characters we can find to separate *manni* from that species.

Though fully aware of the weakness of general coloration as a specific diagnostic character, the large series of these two species before us are each so generally constant. *oregonensis* dark, *manni* pale, that we believe it best to recognize *manni* as a valid species, rather than consider it a geographic race of *oregonensis* or an absolute synonym of that species.

We would note that in Arizona the distribution of *manni* coincides with the westernmost known distribution of *M. nebrascensis* Lugger.

<sup>13</sup> The light coloration is evidently not governed by the usually pale surroundings of the desert or semi-arid environment of the species. This is shown by the character of the environment in which we found *manni* and the pale condition of *nebrascensis* at Grand Canyon Station and Ash Fork, Arizona. See remarks under material recorded.



The convergence shown by *manni* and *nebrascensis* in Arizona causes material from that region to be separated with considerable difficulty. We find that occasional individuals of the present species from Arizona, particularly among the smaller examples, have the third spine of the dorso-internal margins of the caudal tibiae greatly reduced, rarely missing on one or both limbs. As Arizonan specimens of *nebrascensis* are almost always very pale and uniform in coloration, not showing the barred type which is more usual in material of that species from Nebraska and Texas, the only difference which can be determined, in such specimens as described above, is that of the caudal metatarsal armament, showing dorsad three spines in *manni*, two in *nebrascensis*.

The present species shows decided size variation, but by no means as great as is shown by the larger series of *oregonensis* before us.

*Measurements (in millimeters)*

♂	Length of body	Width of body	Length of caudal femur	Width of caudal femur <sup>14</sup>	Length of caudal meta- tarsus
Wawawai, Washington, <i>topotype</i>	2.4	1.5	1.41	.88 (×1.64—)	.748
Wawawai, Washington, <i>topotype</i>	2.5	1.7	1.57	.95 (×1.64—)	.884
Pyramid Lake, Nevada.....	2.38	1.3	—	—	—
San Ysidro, California.....	2.86	1.84	1.72	1.16 (×1.48+)	—
Oracle, Arizona.....	2.58	1.97	1.7	1.09 (×1.56—)	1.02
Santa Rita Mts., Arizona.....	2.86	1.84	—	—	1.02
Huachuca Mts., Arizona.....	3.06	1.77	1.5	.95 (×1.58—)	.85
♀					Length of ovi- positor
Wawawai, Washington, <i>topotype</i>	2.58	1.56	1.36	.88 (×1.55—)	1.09
Pyramid Lake, Nevada.....	2.52	1.5	—	—	1.36
Palm Springs, California.....	1.97	1.25	1.09	.76 (×1.43+)	1
San Ysidro, California.....	2.52	1.77	1.52	.99 (×1.54—)	1.22
Williams, Arizona.....	2.58	1.43	—	.88	1.04
Oracle, Arizona.....	2.72	1.84	1.6	1 (×1.6)	.88
Santa Rita Mts., Arizona.....	3.33	2.31	1.8	1.09 (×1.65+)	1.5
Huachuca Mts., Arizona.....	2.86	1.97	1.73	1.16 (×1.49+)	1.3

It would appear that geographic factors have little or no influence on the size in *manni*, the variation shown being attributable to individual variation and some correlation with the size of the ants forming the host colony.

<sup>14</sup> Number of times width of caudal femur is contained in its length.

The normal general coloration in the present species is entirely cinnamon buff, except the eyes which are blackish brown and the distal portion of the ovipositor which, as in the other species, is shining, dark reddish brown. In extremes of recession individuals are slightly paler, ochraceous-buff. Some material is ochraceous-tawny, while in a few specimens from southern Arizona the dorsal segments, except the pronotum, are broadly margined caudad with a very slightly darker shade, thus showing close resemblance in general appearance to the banded type developed in *M. nebrascensis* Lugger.

A number of specimens among those in a poor state of preservation are as dark as pale material of *oregonensis*. It is clear that, in so delicate and pale a species as the present, discoloration readily occurs and is in our opinion responsible for this. As color is important in distinguishing *oregonensis* and *manni*, the possibility of discoloration in material of the latter species should always be remembered.

*Specimens Examined.*—68; 16 males, 36 females and 16 immature individuals.

WASHINGTON: Wawawai, Whitman County, III, 20 to IV, 24, 1909, (W. M. Mann), 3 ♂, 5 ♀, (hosts = *Formica rufa obscuripes* Forel, *Formica neogagates* Emery, *Formica rufibarbis* var. *occidentalis* Wheeler, *Formica fusca* var. *argentea* Wheeler, *Formica fusca* var. *marcida* Wheeler), [A. N. S. P., U. S. N. M., Hebard and Wheeler Clns.].

NEVADA: Pyramid Lake, 2 ♂, 1 ♀, 2 juv. ♀, (hosts = *Myrmica mutica* Emery and *Formica neogagates* var. *vetula* Wheeler), [Mann Cln.].

CALIFORNIA: Chino Canyon, five miles northwest of Palm Springs, IV, 5, 1917, 4 small ♀, (host = *Tapinoma sessile* Say), [Davis Cln.]. Palm Springs, II, 15, (H. G. Hubbard), 1 small ♀, 2 small juv., [U. S. N. M.]. San Ysidro, Cal., I, 6 and 7, 1911, (W. M. Wheeler), 1 ♂, 3 ♀, (hosts = *Camponotus maculatus vicinus* var. *luteangulus* Wheeler, *Camponotus maculatus nitidiventris* Emery), [Wheeler Cln.].

ARIZONA: Grand Canyon Station, Coconino Plateau, 6800 feet, X, 6, 1919, (M. Hebard; under dark lava boulder in passages of ants' nest in dark soil), 1 ♂, [Hebard Cln.]. Williams, Coconino Plateau, 6900 feet, I, 28, 1911, (W. M. Wheeler), 1 juv., (host = *Formica fusca* var. *argentea* Wheeler), [Wheeler Cln.]; V, 26 to VI, 3, (H. S. Barber), 1 ♂, 2 ♀, 4 juv., (hosts = *Formica fusca* Linnaeus and *Lasius niger* var. *sitkaensis* Pergande), [U. S. N. M.]. Ash Fork, VIII, 1, 1919, 5300 feet, (Rehn and Hebard; in ants nest, *Crematogaster lineolata* Say var., under volcanic fragment at summit of hill<sup>15</sup>), 2 ♀, [A. N. S. P. and Hebard Cln.]. Oracle, I, 8, 1914, (E. A.

<sup>15</sup> In the field notes for the specimens taken at Ash Fork we note, "Their paleness made them very conspicuous on the dark stone among the still darker ants." This was true also for the material taken at Grand Canyon Station.

Schwarz), 1 ♂, (host = *Camponotus acutirostris* Wheeler), [U. S. N. M.]; 4500 feet, III, 13 and 14, 1919, (W. M. Wheeler), 7 ♀, (host = *Camponotus acutirostris* Wheeler), [Wheeler Cln.]; 5000 feet, III, 11, 1919, (W. M. Wheeler), 1 ♀, 6 juv., (host = *Liometopum apiculatum* Mayr), [Wheeler Cln.]; 4500 feet, III, 16, 1919, (W. M. Wheeler), 1 juv., (host = *Crematogaster lineolata* Say var.), [Wheeler Cln.]. Post Canon, Pinaleño Mountains, VII, 18, 1917, (W. M. Wheeler), 2 ♀, (host = *Formica rufibarbis* var. *gnava* Buckley), [Wheeler Cln.]. Santa Rita Mountains, VI, 17, (Hubbard and Schwarz), 1 ♂, 1 ♀, (host = *Camponotus* sp.), [U. S. N. M.]. Huachuca Mountains, XI, 10 to 13, 1910, (W. M. Wheeler), 2 ♂, 2 ♀, (host = *Camponotus maculatus bulimosus* Wheeler), [Wheeler Cln.]. Ramsey Canon, Huachuca Mountains, (W. H. Mann), 4 ♂, 5 ♀, (host = *Liometopum apiculatum* Mayr.), [Mann Cln.].

This species was previously known only from the type locality, Wawawai, Washington.

### **Myrmecophila nebrascensis** Lugger

1898. *Myrmecophila nebrascensis* Lugger, Orth. of Minnesota, p. 260, fig.

169. [No locality given, figured type from Bruner's series taken at West Point, Nebraska.]

1899. *Myrmecophila nehawkae* Scudder, Psyche, viii, p. 428. [♂, ♀; Weeping Water, Nebraska.<sup>16</sup>]

The type of this species is the female from West Point, Nebraska, taken by Bruner on May 6, 1891, which was loaned to Lugger by Bruner and figured by the former author as *Myrmecophila nebrascensis* Bruner. Lugger was at that time in ignorance of the fact that the species had not been described. This specimen was located in the collections of the Division of Economic Zoology of the University of Minnesota. As this specimen belongs to the Bruner Collection, it has been most kindly returned by the University of Minnesota. The Bruner North American Collection having been incorporated in the Hebard Collection, this type now bears the type number 529 of the latter collection.

The collections now before us prove conclusively the synonymy indicated above. The name *nehawkae* was based on material of *nebrascensis* of very small size, taken from nests of the small ant *Crematogaster lineolata* Say. Other material of *nebrascensis* now at hand, from nests of small sized ants, is even smaller than the

<sup>16</sup> We here select as single type of *M. nehawkae* Scudder, a female, taken at Weeping Water, Nebraska, in nest of *Tapinoma sessile* Say. Hebard Collection, Type no. 396.

material on which Scudder based *nehawkae*. Thus we find great depauperation governed by the small size of the host ant in all of the North American species of *Myrmecophila*.

The different armament of the caudal tibiae and metatarsi readily distinguishes *nebrascensis* from the other forms found in the United States, excepting as to the tibiae of occasional Arizonan individuals of *manni*, as discussed under that species. In coloration close agreement with *M. manni* Schimmer is found, though a banded condition is apparently more frequently encountered in the present species. For this reason material from Arizona must be carefully examined in regard to the spine formulae, particularly of the caudal metatarsi, as in that geographic area the distributions of *manni* and *nebrascensis* overlap.

An extremely interesting account of the habits of this species has been given by Dr. W. M. Wheeler.<sup>17</sup>

*Measurements (in millimeters)*

♂	Length of body	Width of body	Length of caudal femur	Width of caudal femur	Length of caudal metatarsus
West Point, Nebraska, <i>topotype</i> <sup>18</sup> .....	2.04	1.5	1.53	1.08 (×1.41+) <sup>19</sup>	.75
West Point, Nebraska, <i>topotype</i>	1.97	1.4	1.4	1.06 (×1.32+)	.75
Weeping Water, Nebraska <sup>20</sup> ...	1.77	.75	1.04	.71 (×1.47—)	—
Austin, Texas.....	2.38	1.43	1.5	.95 (×1.58—)	.74
Las Vegas, New Mexico.....	2.18	1.47	1.43	.97 (×1.47+)	.74
Oracle, Arizona.....	2.04	1.16	1.22	.73 (×1.67+)	—
Oracle, Arizona.....	1.74	1.02	.95	.62 (×1.53+)	.476
Huachuca Mountains, Arizona.	1.3	.88	—	—	—
Huachuca Mountains, Arizona.	1.5	.95	—	—	—
♀					Length of ovipositor
West Point, Nebraska, <i>topotype</i>	2.31	1.43	1.38	.95 (×1.45+)	.95
West Point, Nebraska, <i>topotype</i>	2.86	1.63	1.53	1.09 (×1.40+)	1.22
Weeping Water, Nebraska <sup>21</sup> ...	2.04	1.09	.97	.66 (×1.47—)	.76
Weeping Water, Nebraska <sup>20</sup> ...	1.5	.95	—	—	.71
Ponca City, Oklahoma.....	1.97	1.16	—	—	.71

<sup>17</sup> Psyche, ix, pp. 111 to 115, text fig., (1900).

<sup>18</sup> See original reference.

<sup>19</sup> Number of times width of caudal femur is contained in its length.

<sup>20</sup> Paratype of the synonymous *M. nehawkae* Scudder.

<sup>21</sup> Type of the synonymous *M. nehawkae* Scudder.

	Length of body	Width of body:	Length of caudal femur	Width of caudal femur!	Length of ovi- positor
Austin, Texas.....	2.58	1.63	1.56	1.02 (×1.53—)	1.02
Las Vegas, New Mexico.....	1.63	1.06	.88	.61 (×1.44+)	.72
Las Vegas, New Mexico.....	2.11	1.63	1.43	.97 (×1.47+)	1.16
Oracle, Arizona.....	2.45	1.54	—	—	.85
Oracle, Arizona.....	1.7	1.02	—	—	.65

It appears that geographic factors have little to do with size variation in this species. In the present series there is a larger percentage of depauperate material, from nests of small sized ants, than in any other of the other species here treated.

The general coloration of this species is clay color on the dorsal surface, cinnamon-buff on the ventral surface. Frequent specimens have the dorsal surface of the abdomen slightly darker at the caudal extremity. The eyes are blackish brown. The minute microscopic scale covering is moderately thick, the scales golden.

Frequent individuals of both the large and depauperate conditions have the caudal margins of the dorsal segments broadly but not strongly darkened. Such material, in consequence, has a banded appearance. This was supposed by Scudder to be peculiar to the depauperate condition, which he described as a distinct species, *nehawkae*. Such is not the case.

Much of the Arizonan material is of a maximum recessive coloration, light ochraceous-buff above and below. No trace of banding is shown by any of this material.

*Specimens Examined*.—82; 25 males, 37 females and 20 immature individuals.

NEBRASKA: West Point, V, 6 and 9, 1891, (L. Bruner), 4 ♂, 8 ♀, large and medium large, *typ*<sup>2</sup>, [Hebard Cln. and U. S. N. M.]. Weeping Water, (L. Bruner), 3 ♂, 11 ♀, 2 juv., small to very small, *typ*<sup>2</sup>, *allotype*, one *paratype* and *topotypes* of *M. nehawkae* Scudder, (host = *Tapinoma sessile* Say), [Hebard Cln., A. N. S. P. and U. S. N. M.].

OKLAHOMA: Ponca City, IX, 21, 1906, (A. C. Burrill), 1 small ♀, (host = *Crematogaster lineolata* Say), [Wheeler Cln.].

TEXAS: Austin, I, 26, 1903, II, 28, 1919, III, 1900, (W. M. Wheeler<sup>22</sup>), 3 ♂, 1 ♀, large, (host = *Formica rufibarbis* var. *gnava* Buckley), 5 ♂, 5 ♀, large to medium large, [A. N. S. P., Wheeler and Hebard Clns.].

<sup>22</sup> Dr. Wheeler states that in the vicinity of Austin, this species "is most abundant in company with *Formica fusca* var. *neorufibarbis* Mayr, less abundant in the nests of the Texan agricultural ant (*Pogonomyrmex barbatus* Sm.)—and rare in nests of *Camponotus castaneus* Latr., the Ponerine *Pachycondyla harpax* Fabr. and a species of *Crematogaster*." That author also states that the males of *nebrascensis* in the vicinity of Austin, bear to the females the ratio of about one to seven or eight.

NEW MEXICO: Las Vegas, VIII, 8 to 13, (H. S. Barber), 1 large ♂, 1 large ♀, 1 small ♀, 1 very small ♀, 2 juv., (host = *Crematogaster lineolata* Say var.), [U. S. N. M. and Hebard Cln.].

ARIZONA: Grand Canyon, Coconino Plateau, 7000 feet, III, 21, 1919, (W. M. Wheeler), 2 juv. or very small ♂, (host = *Crematogaster lineolata* Say var.), [Wheeler Cln.]; 6800 feet, X, 6, 1919, (M. Hebard; under dark lava boulder in passages of ants nest in dark soil), 1 small ♂, [Hebard Cln.]. Oracle, 4000 ft., III, 12, 1919, (W. M. Wheeler), 2 medium ♂, (host = *Pogonomyrmex barbatus* var. *malefaciens* Buckley), 5000 ft., III, 11, 1919, (W. M. Wheeler), 1 medium large ♂, (host = *Liometopum apiculatum* Mayr), 1 very small ♀, (host = *Dorymyrmex pyramicus brunneus* Forel), 1 very small ♂, 1 very small ♀, (host = *Iridomyrmex pruinosus* var.  *analis* André), 1 small ♂, 1 large ♀, 1 very small ♀, 11 small juv., (host = *Crematogaster lineolata* Say var.), [all Wheeler Cln.]. Post Canon, Pinaleno Mountains, VII, 18, 1917, (W. M. Wheeler), 1 ♂, 1 ♀, (host = *Formica rufibarbis* var. *gnava* Buckley), [Wheeler Cln.]. Huachuca Mountains, XI, 10 to 18, 1910, (W. M. Wheeler), 2 very small ♂, 3 very small ♀, 3 juv., (hosts = *Liometopum apiculatum* Mayr, *Pheidole desertorum* Wheeler, *Pheidole vasliti* var. *arizonica* Santschi, *Crematogaster lineolata* Say var.), [all Wheeler Cln.].

In addition to the localities given above, this species has been recorded by Scudder from Santa Fé, New Mexico. Lugger's record of a species of the genus from Minnesota may refer to this species. The specimen figured, which is the type, is, however, from West Point, Nebraska, and no definite data is given by that author for material from Minnesota.