

PSYCHE

VOL. XVIII.

JUNE, 1911.

No. 3.

TWO FUNGUS-GROWING ANTS FROM ARIZONA.¹

By WILLIAM MORTON WHEELER.

In a recent paper on the North American fungus-growing ants² I based a new species of *Trachymyrmex* (*T. arizonensis*) on some male and female specimens taken by Mr. Charles Schaeffer at Palmerlee in the Huachuca Mts. of Arizona. Owing to the absence of worker specimens, the status of this species has remained somewhat problematical. At any rate, there was a possibility that it might be merely a sub-species or variety of *T. saussurei* described by Forel many years ago from Orizaba, Mexico³ and subsequently taken as far north as Tepic by Eisen and Vaslit.⁴ I was pleased therefore to find during the past November in the type locality a number of colonies of *T. arizonensis* and to be able to learn something of its habits. Both these and the characters of the worker show that the species is valid and sufficiently distinct from our other North American *Trachymyrmex* (*saussurei* Forel, *septentrionalis* McCook, *turrifex* Wheeler and *jamaicensis* Ern. André).

Somewhat later in November 1910, I came upon a few colonies of a small undescribed *Trachymyrmex* in the desert near Tucson, Arizona. Descriptions of the workers of this and of *T. arizonensis*, together with some notes on their habits are contained in the following paragraphs:

1. *Atta* (*Trachymyrmex*) *arizonensis* Wheeler (Fig. 1.)

Worker. Length 3.5-5 mm.

Head, without the mandibles, as broad as long, broader behind than in front, with feebly concave posterior and feebly convex lateral borders and bluntly angular posterior corners. Eyes hemispherical, in front of the middle of the head. Man-

¹ Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University. No. 37.

² The Fungus-Growing Ants of North America. Bull. Amer. Mus. Nat. Hist. XXIII, 1907, pp. 669-807, 5 pls. 31 text-figs.

³ Études Myrmécologiques en 1884, Bull. Soc. Vaud. Sci. Nat. XX, 91, 1884, pp. 1-65, 1 pl.

⁴ See Pergande, Mexican Formicidæ. Proc. Cala. Acad. Nat. Sci. 3 ser. Vol. V, 1895, p. 896.

dibles with two large apical and numerous smaller basal teeth. Clypeus flattened, its anterior border slightly reflected and in the middle sinuately excised. Frontal area triangular, rather indistinct. Frontal carinae large, with rounded external borders, their surface scarcely concave in the middle, continued behind as a pair of straight, diverging ridges to the posterior corners of the head. Vertex with two shorter, parallel ridges. There is also a short oblique ridge running mesially along each inner orbit half way to the ridge continued back from the frontal carina. Antennae long; scapes reaching somewhat more than $\frac{1}{3}$ their length beyond the posterior corners of the head, slender at the base, thickened distally and again more attenuate at the apex. Pronotum with a slender, lapped-shaped inferior and a stout, pointed superior spine on each side, without an anteromedian paired or unpaired tubercle. Mesonotum on each side in front with a stout, blunt protuberance and behind with three small protuberances, two of which are hardly more than tubercles. Mesoepinotal constriction pronounced. Epinotum with subequal

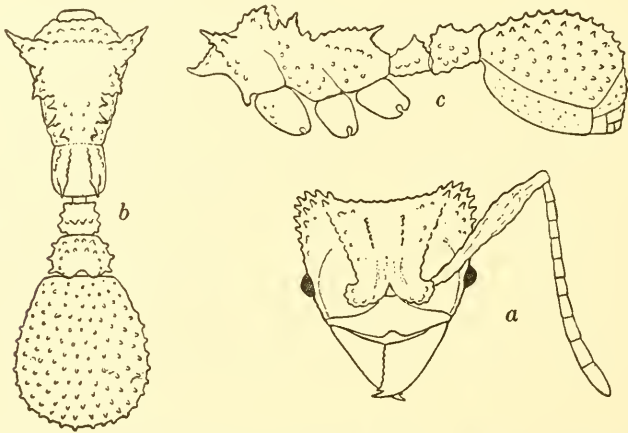


Fig. 1. *Trachymyrmex arizonensis* Wheeler. Worker; a, head; b, thorax and abdomen seen from above; c, same seen in profile.

base and declivity, the latter sloping, the former flattened and bearing a pair of longitudinal ridges which diverge slightly behind and terminate in the spines. These are acute and rather slender, a little longer than broad at their bases, directed outward and backward and but very slightly upward. Petiole with a narrow and very short peduncle; its node with a bitubercular summit, seen from above as long as broad, rounded behind, with parallel sides; in profile it is acutely angular, with straight anterior and posterior declivities, the former a little longer than the latter. Postpetiole nearly twice as broad as the petiole, broader behind than in front; its posterior border with a rounded lobe on each side and a rounded excision in the middle. Its upper surface is distinctly concave behind, so that in profile it is highest in front, with a short, straight anterior and a somewhat longer, concave posterior slope. Gaster oval, slightly broadest behind the middle, its first segment with only

a trace of a median longitudinal impression at the anterior end. Legs long and rather slender.

Mandibles and clypeal border shining, the former finely striated. Remainder of body opaque and finely granular or very finely punctate-rugulose. The various ridges, spines and protuberances, the front, the posterior corners and occiput of the head, the thoracic dorsum and pleuræ (except in the mid-dorsal line between the protuberances), the upper-surface of the petiole, post-petiole (except its concave dorsal surface), and gaster beset with small but prominent and rather acute tubercles. Legs, scapes and cheeks beset with similar but smaller and much less prominent elevations.

Hairs and pubescence fulvous, the former hooked, erect and rather uniformly distributed over the body, legs and scapes; the pubescence is very short and delicate and present only on the antennal scapes.

Body ferruginous red; legs and antennæ a shade paler; borders of mandibles black; frontal area, vertex and occiput each often with a black or dark brown spot. Old specimens not infrequently have the body covered with a bluish bloom.

Described from numerous specimens taken Nov. 10–16, 1910 from several colonies in Miller and Hunter Canyons, Huachuca Mts., Arizona at elevations varying from 5000 to 6000 ft.

T. arizonensis is most closely related to *T. saussurei* Forel but differs from this species and from *T. septentrionalis* in its larger average size, much deeper color, longer antennal scapes, more numerous and more acute tubercles, especially on the posterior portions of the head and upper surface of the gaster, the less rounded sides of the head, the stouter and more backwardly directed epinotal spines and the erect, instead of reclinate, hairs on the legs and antennal scapes. From *T. turrifex*, *arizonensis* differs in its much larger size, much longer antennal scapes, more backwardly directed epinotal spines and proportionally narrower postpetiole. In *turrifex*, moreover, the mesoëpinotal constriction is more pronounced, the epinotal declivity is not sloping but vertical, the inferior pronotal spines are acute, there is a prominent median pronotal tubercle and the dorsal surface of the postpetiole is beset posteriorly with small tubercles and is flattened but not concave.

The territory in which *T. arizonensis* was observed would seem at first sight to be very unfavorable to an ant addicted to cultivating fungi for food, and is certainly very different from that inhabited by *T. septentrionalis* and *turrifex*. *T. septentrionalis* flourishes only in the sandy oak woods of the Mississippi Valley, Atlantic and Gulf States as far north as southern Illinois and southern New Jersey; while *T. turrifex* prefers the black or argillaceous soil of

the cedar brakes and post-oak woods of central Texas. Both are essentially lowland species. *T. arizonensis*, however, lives in the arid, stony mountain canyons of southern Arizona and undoubtedly also in similar localities in northern Mexico. In the Huachuclas the nests were never seen on ridges or elevations but invariably on the slopes or in the very beds of the small dry arroyos entering from the north the main canyons which run from west to east. These situations are evidently selected because of their greater exposure to the southern sun and the longer retention of moisture in their soil.

The nests can be easily recognized by the portions of exhausted fungus gardens scattered about their main entrances. This refuse is usually of a bright yellow color and quickly arrests the eye of one who is scrutinizing the soil for signs of ants. The largest *arizonensis* nest seen was situated in front of Mr. Joseph Palmerlee's ranch in Miller Canyon at an altitude of 5500 ft. It was in such hard, stony soil that I was unable to reach its lowermost galleries even when Mr. Palmerlee came to my assistance with a large pick and a pair of powerful arms. The nest had three entrances, one on a rude crater sprinkled with yellow fungus-garden refuse and two others about 10-14 inches from the crater opening and about a foot apart at the edge of a boulder some three feet in diameter. On removing this the two openings were seen to lead into converging galleries $\frac{1}{2}$ to $\frac{3}{4}$ of an inch in diameter, which ran along the surface of the soil for several inches, and then united and descended perpendicularly as an irregular passage-way between a couple of large stones to a depth of two feet. Here it joined an obliquely ascending gallery which was traced to the opening on the crater, and the common gallery thus formed at once opened into a chamber 10 inches long by 6 inches in diameter and only 2-3 inches high, the roof of which was formed by the lower surface of one of the two large stones. Although this chamber was apparently a natural cavity and had not been excavated by the ants, it nevertheless contained a large fungus-garden which was suspended from the lower surface of the stone and hung in folds like a series of curtains. In this respect and also in its bluish white color it resembled very closely the gardens of *T. septentrionalis* and *jamaicensis* which I described in my former paper (*loco citato* pp. 750 and 760). From the floor of the chamber

a vertical gallery descended into the soil but was followed only a few inches to where it passed under a boulder that could have been removed only with a charge of dynamite. The soil about the nest was so hard that it had been soaked by a recent heavy rain only to a depth of eighteen inches and the walls of the fungus chamber were very dry and dusty.

The colony inhabiting this nest was very large, comprising several hundred workers and being fully four to six times as populous as the largest *septentrionalis* and *turrifex* colonies I have seen. The workers were also more rapid in their movements and feigned death much less readily than our other species of *Trachymyrmex*. The colony was evidently in a hibernating or subdormant condition and contained neither larvæ nor pupæ. I also failed to find any deälated queens, but these may have escaped into the lowermost galleries as soon as the surface boulder was removed. The breeding season of the species probably does not begin till just after the rains in early July. This is indicated by the late appearance of the males and winged females which were taken, evidently while on their nuptial flight, by Schaeffer, on August 24.

All the other colonies of *T. arizonensis* found in the Huachuca Mts. were examined less thoroughly, but all had essentially the same structure at the surface of the soil. The entrances, usually only one or two in number, were always near or just under the edge of some large stone and when this was removed the galleries could be followed along the surface for several inches before they descended to a lower level. In two instances portions of the surface galleries were packed with fungus-garden refuse in a manner that recalled the conditions I have described for *Cyphomyrmex wheeleri* (*loco citato* p. 768). Unfortunately I was unable to reach any of the chambers in these nests and was therefore unable to determine whether the size and conditions described for the single nest excavated with the aid of Mr. Palmerlee, were normal. I believe, however, judging from the character of the soil in which these ants live, that the chambers are commonly under stones and that the fungus-gardens are suspended from the under surfaces of these and not from rootlets as in the other species of *Trachymyrmex* that have been studied.

On warm days the *arizonensis* workers may be seen about the entrances of their nests. They go forth timidly and singly like

other species of *Trachymyrmex*, not in populous files like the species of *Atta sens. stricto*, *Acromyrmex* and *Mælleri*, and bring in caterpillar excrement and bits of green and withered vegetable débris with which to replenish the substratum of their gardens. Microscopic examination of these shows that they have essentially the same minute structure as those cultivated by other species of *Atta*. The brown, triturated substratum is enveloped and shot through with a delicate, ramifying mycelium on which numerous glistening white clusters of food-bodies are formed as pyriform swellings at the ends of the hyphæ. In my former paper I employed the name "bromatia" for the clusters ("Kohlrabihäufchen" of Moeller) and that of "gongylidia" for the hyphal swellings ("Kohlrabiköpfchen" of Moeller), but Neger¹ has recently suggested that the term "ambrosia" be given to the hyphal modifications produced and eaten by all fungus-growing insects, *i. e.*, by the ants and termites as well as by the Ipid (Scolytid) beetles for which the term "ambrosia" was originally suggested by Schmidberger as long ago as 1836. I am quite willing to accept this term and to abandon my own nomenclature.

The only insects that could be suspected of myrmecophily in connection with *T. arizonensis* were a number of small, yellow, wingless, cockroaches which I found in the superficial galleries of a nest in Hunter Canyon. These cockroaches, however, were not species of the genus *Attaphila*, which Berg and I have taken from the nests of the large species of *Atta*, but were probably merely the young of some much less remarkable cockroach and were behaving as scavengers. The same species was also found in the upper galleries of several other ants in the same locality, especially in nests of *Odontomachus clarus*.

2. *Atta* (*Trachymyrmex*) *desertorum* sp. nov. (Fig. 2).

Worker. Length 2.5–3.5 mm.

Head, without the mandibles, as broad as long, slightly narrower in front than behind, with feebly convex lateral and straight or nearly straight posterior border and angularly rounded posterior corners. Eyes hemispherical, in front of the middle of the head. Mandibles with two larger apical and several minute basal teeth. Clypeus flattened, with its anterior border sinuately reflected. Frontal area triangular, rather distinct. Frontal carinæ with angular external borders and flattened but not concave surfaces; continued back as a pair of diverging ridges to the pos-

¹ Ambrosiapilze. Ber. Deutsch. Bot. Gesell. 1908, Bd. XXVI, Heft 10, pp. 735–754, 1 pl.

terior corners of the head. Vertex without a pair of short ridges, but each of the inner orbits with a distinct ridge which runs obliquely and mesially and stops half way between the eye and the ridge from the frontal carina of the same side. Antennal scapes somewhat thickened just beyond the middle, reaching a little less than $\frac{2}{3}$ their length beyond the posterior corners of the head. Thorax in profile with deep mesoepinotal constriction; pro- and mesonotum convex; epinotum with subequal base and declivity, the former slightly convex, the latter sloping and concave. Inferior pronotal spines prominent, with blunt tips; superior spines reduced to angular projections, between which there is a pair of small blunt median protuberances. Mesonotum on each side with two angular projections which are as large as the superior pronotal pair and of similar size and shape. Extreme posterior portion of mesonotum with a small blunt projection just in front of the mesoepinotal constriction. Base of epinotum with four longitudinal ridges, the inner pair of which is the more prominent, diverges somewhat posteriorly and terminates in the spines, which are acute, a little longer than broad at their bases and directed up-

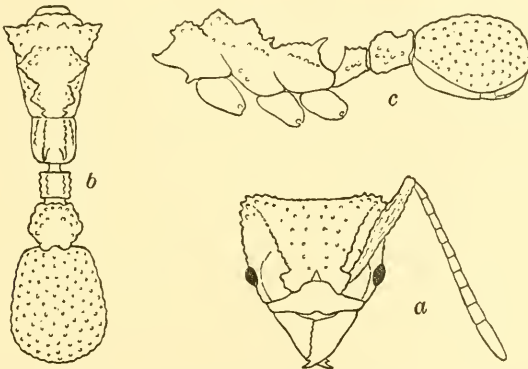


Fig. 2. *Trachymyrmex desertorum* sp. nov. Worker: a, head; b, thorax and abdomen seen from above; c, same seen in profile.

ward, backward and slightly outward. Petiole with a very short, narrow peduncle; its node seen from above as long as broad, rectangular, with four longitudinal ridges; in profile the node is pointed above, with subequal anterior and posterior slopes, the former concave, the latter straight. Postpetiole twice as broad as the petiole, nearly as long as broad, broadest just behind the middle; its posterior border excised in the middle, with a rounded lobe on each side; dorsal surface somewhat impressed behind, so that in profile the upper surface is convex and rounded in front and concave posteriorly. Gaster suboblong, broadest behind the middle, with straight sides in front and without any trace of a median dorsal furrow. Legs moderately long and stout.

Mandibles longitudinally striated, at least their apical portions and the border of the clypeus shining; remainder of body opaque, finely granular, except the legs which are very faintly shining. The various ridges and projections on the head,

thorax and petiole, as well as the vertex, occiput and posterior corners of the head and the upper surface of the gaster beset with small, rather blunt tubercles. These are largest on the posterior corners of the head. Antennal scapes and legs covered with smaller and much less distinct tubercles.

Hairs and pubescence fulvous, the former hooked, uniformly distributed over the body, scapes and legs, suberect on the body, scapes and legs, more reclinate on the legs. Pubescence very short and delicate, confined to the antennal funiculi.

Body ferruginous red; mandibles, antennæ and legs somewhat paler; clypeus darker, mandibular teeth, frontal area and a longitudinal mid-dorsal streak on the gaster, black.

Described from nine specimens taken Nov. 24, 1910 a few hundred yards from the Carnegie Desert Botanical Laboratory near Tucson, Arizona.

This species is readily distinguished from all our other North American species of *Trachymrmex* by its smaller size and the conformation of the pro- and mesonotum. Seen from above this region presents three successive pairs of bluntly angular projections of much the same size and shape, whereas in all our other forms at least the first pair is long, rather slender and pointed and differs considerably either in shape or size from the succeeding pairs.

T. desertorum was first seen on the banks of a dry arroyo that skirts the rocky hill on which the Desert Botanical Laboratory is situated. Here in the feeble shade of the *Parkinsonia* and *Acacia* trees and in the very hard, pebbly, desert soil, two nests were located by following single workers that were returning home laden with caterpillar excrement or with green or yellow *Acacia* leaflets. These nests were so inconspicuous that they could not have been found in any other way, for the entrance to each was merely a circular opening only 1/16 of an inch in diameter among the pebbles, with a few dead leaves forming a small and very indistinct crater around it. The entrance gallery descended perpendicularly into the soil. As I did not discover the ants till late in the afternoon and was obliged to leave Tucson the following morning, I was unable to excavate the nests. These are probably similar in structure to those of *T. turrifex* which I have described in detail in my paper on the North American Attii (*loco citato* p. 753).

T. desertorum is one of three fungus-growing ants I have found in the dry arroyo near the Desert Botanical Laboratory. As these insects will be within very convenient reach of the botanist who

may care to study the interesting fungi which they grow and eat, I may add a few remarks on the two species which occur with *T. desertorum*. These are *Atta* (*Møllerius*) *versicolor* Pergande and *Cyphomyrmex rimosus* Spinola. The former is very common and conspicuous not only in the open deserts about Tucson, but also at Yuma, Yucca and Benson, where I took it during the past autumn and in Garden Canyon in the Huachuca Mts., where it has been taken by Mr. W. M. Mann. Its workers are polymorphic and those of the smallest caste are in size and coloration so much like *Trachymyrmex desertorum* that this ant is very easily overlooked even when one is scrutinizing the surface of the soil with the closest attention. *Cyphomyrmex rimosus*, which, as I have shown (*loco citato* p. 771), grows a very peculiar fungus on moist caterpillar excrement, nests in the shade of trees and bushes, and although I have taken a few specimens along the banks of the dry arroyo near the Desert Laboratory, I have found the species more abundant on the damp walls of the irrigating ditches along the Santa Cruz River between the laboratory and the city of Tucson. Since *C. rimosus* is a very small ant, colored much like the soil and quickly stops running or curls up and feigns death when the soil in its vicinity is jarred, it readily escapes observation. Fortunately its nests are shallow and its remarkable fungus-gardens, so unlike those of the various species of *Atta*, *Mycetosoritis*, etc., are easily unearthed and examined after they have once been located by following homing workers.



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