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A NEW AGRICULTURAL ANT FROM TEXAS, WITH REMARKS ON THE KNOWN NORTH-AMERICAN SPECIES.[1]

WILLIAM MORTON WHEELER.

THE genus Pogonomyrmex, comprising the true "agricultural ants," is one of several formicid genera peculiar to the American fauna. It comprises more than a dozen species which range from Montana to Argentina, often over wide areas, though apparently absent from considerable portions of this vast region. As the species are mostly large and conspicuous and inhabit exposed situations, they have attracted more attention than many of our American ants. Notwithstanding this fact, however, we are still very far from possessing an adequate knowledge of the habits and taxonomic relationships of the various members of the genus.

The species described in the following pages seems to have escaped attention hitherto on account of its idiosyncrasies. It is small and inconspicuous, of a timid disposition, and lives under stones, instead of in exposed grassy regions like the other North-American species. It is, moreover, rather rare

[1] *Contributions from the Zoölogical Laboratory of the University of Texas*, No. 24.

and local. Up to the present time I have seen it in only one locality, on the flat limestone terraces which form the southern slope of Mt. Barker, a short distance from the Colorado River, near Austin, Texas. Though but a few acres in extent and on warm days fully exposed to the rays of a pitiless sun, these terraces are, nevertheless, a rich collecting ground for the myrmecologist. All about the place there is something of the local color of the dry Mexican plateau, and this peculiarity extends also to the ant-life of the region. Here, under the flat, detached pieces of limestone scattered among a sparse but interesting vegetation,[1] occur at least four species of grain-storing ants: the new Pogonomyrmex described below, a golden yellow variety of the ubiquitous subtropical and tropical "fire ant" (*Solenopsis geminata* Fab.), and two species of Pheidole (a diminutive new form and *Ph. kingii* André, var. *instabilis* Emery). This is also one of the few localities in which I have seen the little mushroom-growing ant *Cyphomyrmex wheeleri* Forel, the first of its genus to be taken in the United States.[2] Here, too, occur *Odontomachus clarus* Roger, *Pheidole hyatti* Emery, *Xiphomyrmex spinosus* Pergande, and, of course, *Dorymyrmex pyramicus* Rog., *Forelius fœtidus* Buckley, and *Camponotus fumidus* Rog., var. *festinatus* Buckley. While many of these species abound in this locality, I have failed to find more than a dozen nests of the new Pogonomyrmex, and these were so close together — within an area of

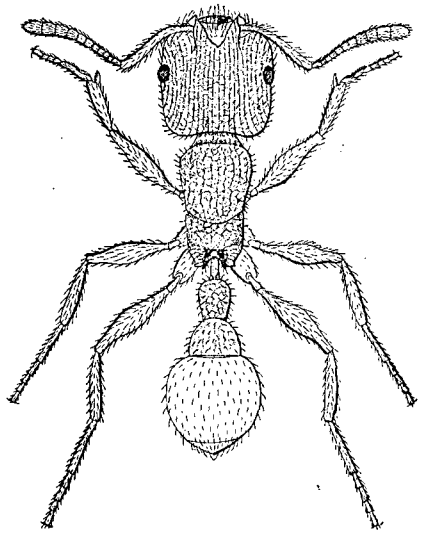

FIG. 1. — *Pogonomyrmex imberbiculus* n. sp. Worker. Dorsal view.

[1] A brief account of the flora of this region is given by Oberwetter ('86).

[2] I have since discovered a dark variety of *C. rimosus* Spinola at New Braunfels, Texas.

a few square rods — as to suggest that they may have been merely parts of a single colony. These nests were all under rather small flat stones, which were often located by following up the foraging workers as they trudged home slowly over the hot soil in the intense glare of the sun. The nest is a simple structure consisting of a few broad and very shallow surface chambers (1½–3 inches in diameter) connected by one or two vertical or oblique galleries with a few chambers situated at lower levels in the soil. The superficial chambers always contained from about ½ to ⅔ of a teaspoonful of seeds, mostly, but not exclusively, from the grasses of the neighborhood. These seeds were all dry and unhusked, and hence of a very different appearance from those found in neighboring nests of *Solenopsis geminata*. This ant carefully shells its seeds and treats them in some singular manner, so that they all have a glistening yellow color like the ants themselves. Although I collected the Pogonomyrmex at different times of the year and excavated their entire nests, it was impossible to discover either the queens or the males. Even the larvæ and pupæ, found in great numbers in the chambers of the nests June 1–10 were all of the worker type. The specific description which follows is drawn therefore exclusively from the worker. This, however, can scarcely be confounded with the workers of any of the other North-American species of the genus.

Pogonomyrmex imberbiculus n. sp.

Worker: Length 4–4.8 mm. Color rich ferruginous red, legs somewhat paler, eyes and edges of mandibles black; hairs covering the body yellowish. Head quadrangular, scarcely longer than broad, its posterior margin hardly incised. Mandibles sexdentate, the two apical teeth largest, blades traversed nearly their entire length by coarse longitudinal ridges. Clypeus subopaque, with longitudinal rugæ separated by series of faint striæ and provided with long, anteriorly projecting hairs. Antennal scape covered with faint longitudinal ridges, the hairs on its anterior surface suberect, on the posterior surface more appressed. Dorsal and lateral surfaces of head covered with coarse rugæ, which are scarcely divergent behind and connected with one another by irregular transverse ridges; the areolæ thus enclosed are subglabrous, coarsely and confluently punctate. Hairs on the upper and lateral surfaces of the head short, erect, subobtuse. Lower surface of head more delicately longitudinally rugose, with somewhat longer

and more tapering hairs, which, however, do not form a conspicuous beard as in the other North-American species of Pogonomyrmex. Thoracic dorsum and pleuræ covered with coarse reticulate rugæ, enclosing more finely reticulate rugose and confluently punctate, polygonal areolæ. In some specimens the rugæ have a transverse trend on the pronotum and a slightly longitudinal trend on the meso- and metanotum; promesonotal suture usually indistinct. Epinotum armed with two pairs of rather blunt spines, scarcely longer than the breadth of their bases; anterior pair connected with each other at the base by a transverse ridge and with the spines of the posterior pair on either side by a longitudinal ridge; the space thus enclosed is subglabrous and traversed by a few longitudinal rugæ. Hairs covering the thorax short, subobtuse, and perfectly erect. Stem of petiole laterally compressed, slender, provided below near its insertion with a small but distinct tooth; node scarcely longer than the stem, its apex obtuse in profile, its dorsal surface subelliptical, covered with coarse reticulate rugæ like those of the thorax, but bearing somewhat longer and more pointed hairs. Postpetiole campanulate, subdepressed dorsally, with a prominent rounded projection below near its base; sculpture decidedly fainter than that of the petiole and consisting of rather indistinct rugæ interspersed with punctate spaces. Gaster small, smooth, and shining throughout, without basal striæ and punctures, and covered with prominent, suberect hairs. Legs glabrous, clothed with suberect hairs.

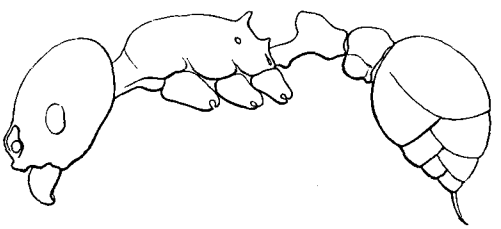

FIG. 2. — *Pogonomyrmex imberbiculus* n. sp. Worker. Profile view.

While *P. imberbiculus* is very sharply distinguished from any of the other North-American species of Pogonomyrmex by its small size, peculiar sculpture, and the lack of the beard of long hairs which suggested the generic name to Mayr ('68, p. 11), it is, singularly enough, very closely related both in these and other particulars to a Brazilian species, *P. nægelii* Forel ('86 pp. 4, 5). Through the kindness of Professors Forel and Emery, who have sent me specimens of the Brazilian form, I have been able to compare the two species, which at first sight would almost certainly be confounded. More careful examination, however, reveals the following differences: In *nægelii* the gaster is of a distinctly darker color than the head and thorax, and its extreme basal portion is longitudinally striated and finely

punctate. The head, thorax, and petiole are somewhat more coarsely rugose than in *imberbiculus*, and the epinotal spines more acuminate at their tips. The most striking difference, however, is in the sculpture of the postpetiole, which in *nægelii* is but little finer than that of the petiole, whereas in the Texan species this segment is nearly smooth.

Recently Forel ('99, pp. 61, 62) has discovered in Columbia still another beardless and otherwise aberrant Pogonomyrmex (*P. mayri*), which he assigns to a new subgenus, Janetia. This is based very largely on the predaceous, non-granivorous habits of the species and on the neuration of the male fore wings, which exhibit only a single cubital cell. He expresses doubt as to whether *P. nægelii* should be included in his new subgenus, but leaves the matter undecided, as he supposes the male of this species to be unknown. This, however, appears to be an oversight, since Mayr ('87, p. 612) describes both the male and female of *P. nægelii*. He clearly states that the female has two cubital cells and that the wings of the male are the same as those of the female. Now from the very close affinity of *P. imberbiculus* with *P. nægelii* it is safe to predict that the latter is also a grain-eating species. We are compelled, therefore, to regard the small group of Pogonomyrmex comprising the beardless Texan and Brazilian species as transitional between Pogonomyrmex *sensu stricto* and the subgenus Janetia rather than as belonging to the latter. It may be advisable ultimately to erect a special subgenus for the two small grain-storing species, but a careful study of the males and females of all the known species of the genus should be previously undertaken.

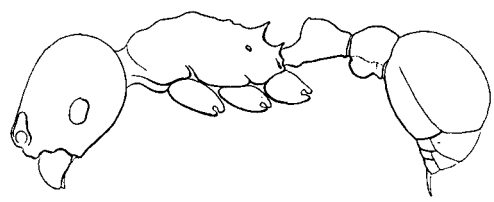

FIG. 3. — *Pogonomyrmex nægelii* Forel. Worker.

The workers from two nests of *P. imberbiculus*, with their numerous pupæ, nearly mature larvæ, and their store of seeds, were put together in the same artificial nest. The ants from different nests fraternized without the slightest signs of hostility,

thereby indicating that they were perhaps members of the same colony. They soon distributed their progeny and provisions in three separate piles — one for the larvæ, one for the pupæ, and one for the seeds. During the first few days of their captivity the ants were fed on house flies. These were not only eaten with avidity by the adult Pogonomyrmex, but cut into pieces and fed to the larvæ in the same manner as I have described for the Ponerinæ and some Myrmicinæ ('00 and '00a). On one occasion nearly every larva in the nest could be seen munching a small piece of house fly. But a still more remarkable method of feeding was adopted after a few days, when the supply of insect food was exhausted. Then the ants were seen to bring seeds from their granary, crack them open with their strong mandibles, and, after consuming some of the softer portions themselves, to distribute the remainder among their larvæ. The latter could be seen under the lens cutting away with their mandibles and devouring the softer starchy portions of the seeds. The hard and useless hulls were afterwards carried away by the ants and placed on the refuse heap. These observations show that *the larvæ of certain ants are not only able to subsist on solid food, but even on food of a vegetable nature.* The adaptation of what were probably once exclusively carnivorous ants to a vegetable diet, although not yet complete, is, nevertheless, so far advanced that the larva already participates in the peculiar feeding habits of the adult insect. The *P. imberbiculus* seem not to possess the power of feeding one another or their larvæ by regurgitation. At any rate they were not seen to make use of this method in the artificial nests.

These observations are quite in line with some which I made on artificial nests of the large "agricultural ant of Texas" (*P. barbatus* Smith, var. *molifaciens* Buckley). In this case the workers carried the seeds, a few at a time, into the chamber containing the queen and her attendants. Here the ants, including the queen, gnawed away the soft portions of the seeds till they had satisfied their hunger. Thereupon the empty hulls were carried out. Even when the nest was supplied with honey or syrup, each ant helped herself from the food supply, and neither fed other ants nor permitted herself

to be fed by regurgitation. I deem it probable, therefore, that the larvæ of *molifaciens* are also fed like those of *imberbiculus* by what we may call the direct method, to distinguish it from the indirect method adopted by the Camponotinæ. In the Ponerinæ and many Myrmicinæ, including Pogonomyrmex, the direct appears to be the prevailing, if not the exclusive, method. In the Camponotinæ, on the other hand, the indirect method prevails, since at a given time only a comparatively small number of ants function as caterers for the whole colony and distribute the food by regurgitation to the larvæ and the other ants.

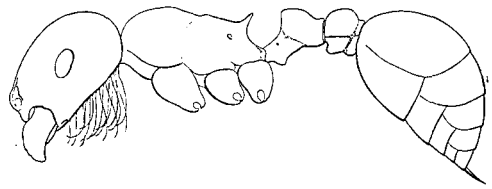

FIG. 4. — *Pogonomyrmex barbatus* F. Smith (typical). Worker.

It may not be altogether out of place in this paper to record a few other observations on *P. molifaciens*, inasmuch as this form has been singled out among all the known members of the genus as presenting certain remarkable instincts. Lincecum is responsible for the myth that this Pogonomyrmex sows a certain species of grass, the "ant rice" (*Aristida oligantha*), protects it from harm and frees it from weeds while it is growing, for the purpose of reaping the grain. This notion, which even the Texan schoolboy has come to regard as a joke, has been widely cited, largely because the great Darwin stood sponsor for its publication in the *Journal of the Linnean Society* ('**62**). McCook, after spending a few weeks in Texas observing *P. molifaciens* and recording his observations in a book of 310 pages ('**79**), failed to obtain any evidence either for or against the Lincecum myth. He merely succeeded in extending its vogue by admitting its plausibility.[1]

[1] Not only have able myrmecologists like Forel ('**99**, p. 63) been deceived by the accounts of Lincecum and McCook into assuming the existence of a kind of symbiotic relation between the Pogonomyrmex and the "ant rice," but this myth, now in its fortieth year, still flourishes in the newspapers. There it grows by intussusception with other droll fancies, as shown in the following extract from the *Chicago Tribune* of May 19, 1901: "Many species of ants fertilize and apparently cultivate many varieties of foodstuffs. The trimmer ants and the

Two years of nearly continuous observation of *P. molifaciens* and its nests enable me to suggest the probable source of Lincecum's and McCook's misconceptions. In either case the observer has started with a few facts and has then stopped short to draw inferences before gathering more facts. If the nests of *molifaciens* be studied during the cool winter months, — and this is the only time to study the nests leisurely and comfortably, since the cold subdues the fiery stings of their inhabitants, — the seeds which the ants have garnered in many of their chambers will often be found to have sprouted.[1] On sunny days the ants may often be seen removing these seeds when they have sprouted too far to be fit for food and carrying them to the refuse heap, which is always at the periphery of the cleared earthen disk or mound. In this place the seeds thus cast away as inedible often take root and somewhat later form an arc of tall grass more or less closely approximating a complete circle around the nest. Since the Pogonomyrmex feeds largely, though by no means exclusively, on grass seeds, and since, moreover, the seeds of the Aristida are a very common and favorite article of food, it is easy to see how this grass should often predominate in the circle. In reality, however,

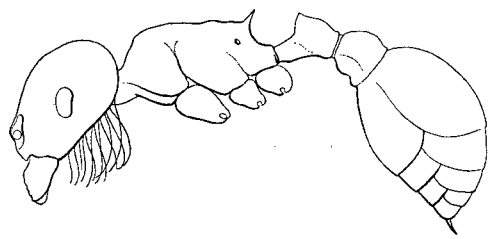

FIG. 5. — *Pogonomyrmex occidentalis* E. T. Cresson. Worker.

harvesting ants of Texas are both of this kind. The trimmers prune a sort of weed which is to their taste so that it shall grow strong and sturdy, and the harvesting ants go even further than this. They clear disks several yards across around about their nests of all manner of vegetation. Then they plant these farms with ant rice, which they watch and tend until it ripens, keeping the crop carefully free of weeds and insects. The ants' dogs keep the ant cows out of the growing grain, and the farmer ants probably sit around themselves at night with shotguns to shoot colored ants suspected of pilfering."

[1] The same is true of the seed stores of *Pheidole kingii*, var. *instabilis*. It is therefore certain that these ants are not able to prevent the seeds from germinating as Moggridge ('**73**, p. 54) claims for the European species of Messor, except by conveying them to drier chambers. And in protracted spells of wet weather even this precaution seems to be of no avail.

only a small percentage of the Pogonomyrmex nests, and only those situated in certain localities, present such circles. Now to state that the *molifaciens*, like a provident farmer, sows this cereal and guards and weeds it for the sake of garnering its grain is as absurd as to say that the family cook is planting and maintaining an orchard when some of the peach stones which she has carelessly thrown into the back yard with the other kitchen refuse chance to grow into peach trees.[1]

There are several other facts which show that the special ring of grass about the *molifaciens* nest is an unintentional and inconstant by-product of the activities of the ant colony. First, the Aristida often grows in flourishing patches far from the nests of *molifaciens*. Second, one often finds very flourishing ant colonies that have existed for years in the midst of much-traveled roads or in stone sidewalks often a hundred or more feet from any vegetation whatsoever. In these cases the ants simply resort for their supply of seeds to the nearest field or lawn, or pilfer the oat bin of the nearest stable. Third, it is very evident that even a complete circle of grass like those described by Lincecum and McCook would be entirely inadequate to supply more than a very small fraction of the grain necessary for the support of a flourishing colony of these ants. Hence, they are always obliged to make long trips into the surrounding vegetation, and thereby wear out regular paths which radiate in different directions, often to a distance of forty to sixty feet from the entrance of the nest. These paths in the case of the Mexican agricultural ant (*P. barbatus* sens. str.) remind one of human footpaths, as they may be as much as four to six inches wide in places. The existence of these paths, which are often found in connection with grass-encircled nests, is alone sufficient to disprove Lincecum's statements.

McCook's conceptions of the external architecture of the *molifaciens* nest are hopelessly confused, notwithstanding the

[1] Lincecum was fond of attributing agricultural and horticultural propensities to ants. Thus he states ('**67**, pp. 28, 29) that the leaf-cutting ant (*Atta fervens*) plants trees and vines on its nest! At the same time of course, like McCook, he failed to observe the marvelous mushroom-gardening habits of these ants, — another instance in which truth is stranger than fiction.

fact that he seems to have been much interested in ant architecture, and has devoted no less than thirty-five pages to a presentation of this feature. It does not seem to have occurred to him that the character of the architecture of *molifaciens* must be profoundly affected by two factors, — the nature of the soil and the age of the ant colony. Gravel-cone nests can, of course, be built only in soil that abounds in small pebbles, whereas nests dug in a uniform soft, loamy soil, like that of northern Texas along the Red River, must be simple disks or very low mound nests, as the soil brought up by the ants is spread out by the rains and the movements of the ants themselves. On the other hand, a small, incipient colony of ants is unable to clear away much of the vegetation about the entrance to the nest. At least the tougher plants, like the grasses, whose hard siliceous stems offer considerable resistance to the mandibles of the ants, cannot be cut away till the colony waxes strong both in the size and number of its individuals. Then the work proceeds rapidly, the circular area coëxtensive with the subterranean galleries is completely cleared and opened up to the sun's light and warmth. This clearing is evidently an adaptation for insuring the greatest possible dryness in the granaries of the nest. The circular denuded disk or mound enlarges slowly year after year, and it should be noted that during this progressive enlargement even the peripheral circle of ant rice is quite as ruthlessly cut down and cleared away along its inner edge as any other plants that may cast a shadow on the disk, and thereby enable the soil to retain the moisture.

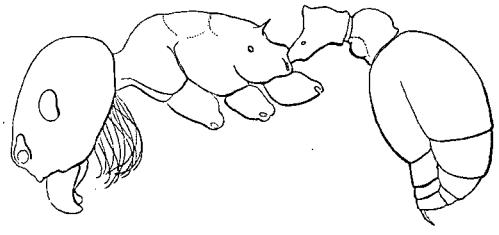

FIG. 6. — *Pogonomyrmex subdentatus* Mayr. Worker.

While we possess the observations of Buckley ('**61**), Lincecum ('**62**, '**66**, '**74**), and McCook ('**79**), on the habits of the Texan *P. molifaciens*, of Mrs. Mary Treat ('**77**) and McCook ('**79**) on the "Florida harvester" (*P. badius* Latr.), and of McCook ('**82**)

on the "occident ant" (*P. occidentalis* Cresson), no observations seem to have been published on the two distinctively Californian species (*P. californicus* Buckley and *P. subdentatus* Mayr). My friend Dr. Harold Heath, who has made strenuous effort to fill this gap in our knowledge, kindly supplies me with the following notes on the latter species:

The red agricultural ant (*P. subdentatus*) is one of the most abundant ants in the neighborhood of Pacific Grove, Cal. Here one is constantly coming upon them and their nests along the roadsides and in the sandy soil of the woods and fields. The nests, so far as I have been able to observe, are never placed under stones or logs, but in exposed regions, — that is, away from the shadow of vegetation. Little attempt is made to clear away the short grass in their vicinity. The earth carried out from their burrows is usually deposited several inches from the opening, especially along their runways, which extend out in various directions into the surrounding region. Large quantities of chaff and the hulls of seeds are also scattered about, usually in fairly definite dumping grounds, but neither these materials nor the earth are ever fashioned into a mound. Some of the ants entering the nest carry pods, others bits of leaves and grass, all well dried, while an equal number of the insects leaving the nest carry away similar materials, but the pods are emptied of their seeds and the leaves are evidently thrown away as non-nutritious and useless. Within the nest there are several little granaries, or accumulations of seeds, each sometimes amounting to as much as a teaspoonful, though usually considerably less. The foodstuffs seem to be carried to one spot within the nest and there hulled and assorted. The seeds are then carried to the storehouses, while the chaff is at once carried out, although it may accumulate and almost completely fill a burrow for a distance of several inches. On comparing the seeds taken from the nest with those of the surrounding plants, I find them to be chiefly those of a species of grass and of two species of Compositæ. At the present writing these seeds are fully ripe, but as soon as those of other plants mature they appear to be equally acceptable. I may add that these ants defend their homes with extraordinary pugnacity and inflict stings more painful than those of the honey-bee. As I write I feel the dull ache of several stings inflicted more than a day ago.

These observations, by a thoroughly competent zoölogist, show that at least one of the Californian species of Pogonomyrmex conforms rather closely to what is known of the other species of the genus.

Some interesting problems center about the geographical distribution of the species of Pogonomyrmex. These ants

evidently represent an extreme adaptation to the open, dry and sunny, and more or less grass-covered regions of the New World. Such regions are, perhaps, most typically represented by the deserts of Wyoming, the plateau of central and northern Mexico, and the pampas of La Plata. The area occupied by the genus and extending, as above stated, from Montana to Argentina, presents in North America an eastern offshoot to Florida (*P. badius*) and a peculiar western offshoot to the Sandwich Islands (*P. occidentalis*). In South America there is between Colombia and Argentina a considerable area from which species of Pogonomyrmex are unknown, but the continuity of the distribution, though broken at this point, is at least in part preserved further to the east by the Brazilian *P. nægelii*.

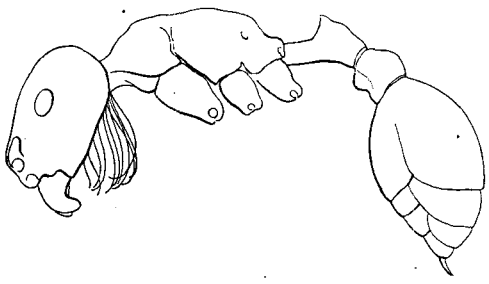

FIG. 7. — *Pogonomyrmex californicus* Buckley. Worker.

This distribution over two continents naturally suggests an inquiry as to whether the species arose in North America and migrated thence along the Andes into South America, or had their origin in the pampas of Argentina and migrated into North America over the same lofty road. Two authors, v. Ihering ('94, p. 416) and Emery ('94, p. 354), who have seriously studied the interesting problems suggested by the distribution of the American ants, agree in regarding North America as the primeval home of the species of Pogonomyrmex. Concerning this genus and the genera Dorymyrmex and Forelius, which have a very similar distribution, Emery says:

> Their migration probably proceeded along the Andes at a time when the climate was cooler and the vegetation therefore different from the present. Later, on the supervention of new floral conditions, they were crowded out of a portion of their former domain by the tropical ant fauna. For the reason that the southern species of Pogonomyrmex and Dorymyrmex are more numerous than the northern, we might, perhaps, assume that these animals had migrated from the south to the north. But it is not in

the least improbable that these ants, like the South-American species of Didelphys, deer, camelids, and mastodons, are of North-American origin. Without being able to adduce stringent proof in favor of my opinion, I nevertheless incline to accept this latter view.

The migration between the continents is supposed to have taken place during the Pliocene. This view of the North-American origin of Pogonomyrmex is supported to some extent by the flourishing condition of the closely allied holarctic genera Myrmica and Stenamma (including the subgenera Aphænogaster and Messor) in the United States and Canada.

A problem of more subordinate interest is suggested by the close morphological relationship of the Brazilian *P. nægelii* and the Texan *P. imberbiculus*, without known forms of a similar aberrant character in the intervening geographical region. It is possible, however, that a more searching investigation of the Mexican and West-Indian fauna may bring to light still other beardless forms of Pogonomyrmex and thereby fill this gap. It should be mentioned, nevertheless, that the new Texan species has all the appearance of being a geological "relict."

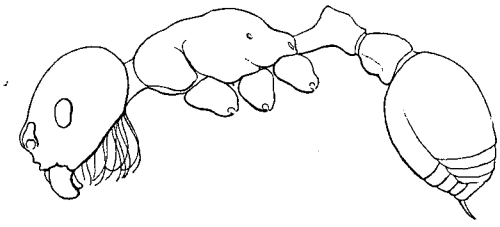

FIG. 8. — *Pogonomyrmex badius* Latreille. Worker.

In conclusion I subjoin a dichotomic table to aid in the identification of the workers of the North-American species of Pogonomyrmex:

1. Small species, less than 5 mm. long; under surface of head without a beard of long curved hairs; epinotum armed with four spines; head, thorax, and petiole coarsely reticulate rugose, base of gaster not striated. Formicary under stones. (Central Texas.)
   P. imberbiculus n. sp.
2. Larger species, more than 5 mm. long; under surface of head with a beard of long, curved hairs; epinotum with only two spines or none; head and thorax finely rugose, the rugæ being more or less parallel with one another, not reticulate. Formicary not under stones, exposed 3
3. Epinotum with a single pair of spines 5

4. Epinotum unarmed 12
5. Head finely and densely rugose, rugæ but little divergent posteriorly, without or with very indistinct interrugal sculpture . . . . 7 *a–e*
6. Head less densely rugose, rugæ very distinctly divergent posteriorly, interrugal sculpture distinct, consisting of dense foveolate punctures 8
7 *a*. Head, thorax, and legs black; petiole, postpetiole, and gaster red. (Mexico.) . . . . . *P. barbatus* F. Smith ('**58**, p. 130)
7 *b*. Cephalic rugæ finer and denser, body ferruginous red throughout. (Mex., Tex., Ind. Ter., Ark., Kans.)
P. barbatus, var. *molifaciens* Buckley ('**61**, p. 445)
7 *c*. Head and thorax brownish red, gaster in part or entirely brown. Rugosity as in 7 *b* or somewhat stronger. (Tex., Col.)
P. barbatus, var. *fuscatus* Emery ('**94**, p. 309)
7 *d*. Rugosity a little coarser than in 7 *a*; head, thorax, and legs black, petiole and postpetiole brown, abdomen red, node of petiole longitudinally rugose. (Marfa, Tex.) . *P. barbatus*, var. *marfensis* n. var.
7 *e*. Head and thorax much more coarsely rugose than in 7 *a–d*. Rugæ irregular in direction on the pro- and mesonotum, on the other regions transverse. Petiole rather strongly and irregularly rugose; its anterior stem-like portion shorter than in *P. barbatus*; postpetiole rugose-punctate. (Cal.) . *P. barbatus*, subsp. *rugosus* Emery ('**94**, p. 309)
8. Head less densely rugose, the rugæ distinctly divergent posteriorly, interrugal spaces densely foveolate punctate 9
9. Lower surface of petiole without a distinct tooth; infraspinal concavity of epinotum rugose, scarcely shining . . . . . 10 *a–b*
10 *a*. Head opaque, interrugal punctures distinct. (Col., New Mex., Utah, Ariz., Nev., Wyo., Mont., Kans., Neb., Honolulu.)
P. occidentalis Cresson ('**65**, pp. 426, 427)
10 *b*. Head more shining, interrugal punctures more indistinct; petiole less opaque than in 10 *a*. (S. Cal.)
P. occidentalis, var. *subnitidus* Emery ('**94**, p. 310)
11. Petiole with a distinct tooth below; infraspinal concavity of epinotum shining, without rugæ. (Cal.) . *P. subdentatus* Mayr. ('**70**, p. 971)
12. Interrugal spaces of head rather indistinctly and confluently punctate. Workers monomorphic . . . . . 13 *a–c*
13 *a*. Color yellowish red, stem of petiole about the same length as its nodal portion; postpetiole as high as long. (Cal., Lower Cal.)
P. californicus Buckley ('**66**, p. 236)
13 *b*. Darker red than 13 *a*; apical third or more of gaster more or less black; petiole and postpetiole often brown, the former slender, its node longer and less erect, with rounder or but slightly pointed apex. (Lower Cal.)
P. californicus, var. *estebanius* Pergande ('**93**, p. 33)
13 *c*. Yellowish red, gaster brown except at the base; stem of petiole shorter than the very long nodal portion, which is pointed above;

postpetiole not as high as long. Sculpture fainter than in 13 *a*; petiole and postpetiole punctate, without rugæ. (Cal.)

P. californicus, subsp. *longinodis* Emery ('**94**, p. 311)

14. Interrugal spaces regularly foveolate punctate. Color ferruginous red. Workers polymorphic, *i.e.*, with size of head greatly varying. (N. C., Ga., Fla.) . . . . . *P. badius* Latreille ('**02**, p. 238)

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