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KEY TO THE SPECIES OF *PHEIDOLE*
(HYMENOPTERA: FORMICIDAE) IN THE
UNITED STATES

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It is eight years since Creighton (1950) published a comprehensive revision of the North American ant fauna. In this work a key to the species and subspecies of the genus *Pheidole* north of Mexico was attempted for the first time, and with a high degree of success for a very difficult assemblage of forms. In the interval following the appearance of Dr. Creighton's book, however, some important changes in our knowledge of the ants in this group have been made and others are included in this report. Ten new taxa have been described altogether, ten have been placed in synonymy, and eight have been revised in one way or another in the light of recent data. The latter includes a complex tangle of species and subspecies associated with the ant now recognized as *Pheidole tepicana* Pergande (Creighton and Gregg, 1955), and certain adjustments in concepts concerning the members of the *flavens* group occurring in the United States. Two species new to this fauna have been found since 1950, and were recorded by M. R. Smith in the Catalog of Hymenoptera of America North of Mexico. One subspecies is being raised to full species rank.

In view of the large number of species of *Pheidole* (69) known from this part of the world at the present time, a key is definitely advantageous for anyone wishing to identify these ants, unless examples of all of them are in his possession or available museum collections. Owing to the extreme rarity of many of the forms, a complete collection is virtually impossible for most investigators, as some species are known from but a few specimens, and others are still known only from types. Furthermore, in view of recent advances in the nomenclature and knowledge of the distribution of the species, Dr. Creighton's treatment has been rendered somewhat less usable, and it is considered desirable to offer a revised key which takes these changes into account.

The advantages of continuity with the work of previous authors, however, has led me to depart as little as possible from the key Creighton presented in 1950, for the most part adopting only those changes that are clearly imperative. One subgenus, namely *Ceratopheidole*, has been discovered new to the fauna of the United States, and this brings to three, the number of subgenera of *Pheidole* which it is now necessary to handle. For reasons already expressed by Creighton, and because two of the subgenera are represented in our area by only one or two species so far, it is not thought advisable to give separate tables for these species. As Creighton demonstrated, adequate determination of the species of *Pheidole* depends on samples consisting of both worker major (soldier) and worker minor castes, consequently both of these are freely used wherever necessary or unavoidable, and no effort is made to provide separate keys for each caste. In a limited segment of the North American fauna, involving just a few species and subspecies of *Pheidole*, it is perfectly possible to construct tables for the separate castes, but it is quite impossible to do so as yet for the entire continent.

I am under obligation to Dr. Creighton for the gift of numerous specimens, for the opportunity of studying material in his personal collection, and for valuable assistance in working out this revision. Dr. M. R. Smith and Dr. A. C. Cole have both been very helpful through the loan and gift of specimens critical to the study. Dr. Charles Ferrière, of Geneva, Switzerland, has made it possible for me to examine a number of type specimens of species originally described by Forel and Mayr. The contributions of all of these persons is sincerely appreciated and is acknowledged with pleasure.

The diagnostic plan which follows may be regarded as an effort to assemble the more recent data as well as the older data concerning the North American *Pheidole* fauna (not including Mexico), with emphasis on its taxonomy. Detailed treatment of the distribution of the various species has been omitted purposely, not because this is unimportant, but the information is still fragmentary for many forms and a greater abundance of records is needed for most of the species. Additional studies are contemplated which should yield a better understanding of the geographic distribution and the biology of this interesting group of

insects. The group is widely spread in the tropics and subtropics over the world, occurring also in the southern Palearctic and in the Nearctic Regions. It is the latter which is of special concern here, of course, and of particular interest are the northern and the altitudinal limits of penetration of *Pheidole* in our territory. The ants are decidedly thermophilous, and only a few species actually reach those limits, the number of species increasing notably at low elevations and southern latitudes. These ants are also absent from the upper levels of many isolated mountain ranges in the west and southwest.

Key to the Species of *Pheidole*
(majors and minors)

1. Antennal club composed of four segments (Subgenus *Ceratopheidole*) 2
 Antennal club composed of three segments 3
2. Eyes of the minor with 10-12 facets in the greatest diameter; head subquadrate; dorsum of head, thorax, pedicel, and gaster somewhat shining; color reddish brown *grundmanni*
 Eyes of the minor with 8-10 facets in the greatest diameter; head longer than broad; dorsum of body subopaque; color black *clydei*
3. Gaster truncate or subtruncate at the base; species small to moderately large in size, usually dimorphic though occasionally polymorphic (Subgenus *Pheidole*) 4
 Gaster not truncate at the base; giant species, polymorphic; epinotal spines unusually long and sharp (Subgenus *Macropheidole*) *rhea*
4. Head of major cylindrical in cross-section and obliquely truncate in front, the truncation involving the clypeus, frontal area, and mandibles *lamia*
 Head of major not cylindrical in cross-section and not truncate 5
5. Scares of major reaching or surpassing the occipital angles 6
 Scares of major not reaching the occipital angles 7
6. Upper surface of the head of the major densely granulo-rugose and dull; epinotal spines slender and directed upward *grallipes*
 Upper surface of the head of the major with prominent longitudinal rugae, the interrugal spaces not granulo-rugose or at most very feebly granulo-rugose with the surface shining; epinotal spines thick at the base and directed posteriorly *desertorum*
7. Antennal scape of the major abruptly bent at the base so that the scape turns toward the midline of the head in passing to the antennal socket, the basal portion of the scape flattened, and as broad or broader than the distal portion 8
 Antennal scape of the major not abruptly bent at the base, not flattened or only slightly so, and the base never as broad as the distal portion of the scape 17

8. Antennal scape of the major reaching three-fourths or more of the distance between its insertion and the occipital angle 9
 Antennal scape of the major reaching two-thirds or less of the distance between its insertion and the occipital angle 14
9. The entire dorsal surface of the head of the major covered with reticulo-rugose sculpture, the interrugal spaces granulose 10
 The reticulo-rugose sculpture of the head of the major largely confined to the anterior half, the occipital lobes punctate or feebly granulose, the surface moderately to strongly shining at least on the posterior half of the head 12
10. Head of minor densely sculptured and completely opaque; postpetiole transversely oval and twice as wide as the node of the petiole *texana*
 Head of the minor in part, especially the frons, strongly shining and smooth, the rest punctate; postpetiole globular and less than twice as wide as the node of the petiole 11
11. Pronotal rugae of the major coarse, transverse, and with interrugal spaces notably shining; petiolar notch broad and shallow; gastric hairs long, nearly of equal length, coarse, blunt at the tips, and widely spaced *sciara*
 Pronotal rugae of the major weak and somewhat reticulate, with interrugal spaces granular, subopaque; petiolar notch feeble; gastric hairs short, uneven in length, fine, pointed at the tips, and more numerous *cockerelli*
12. Head of minor densely punctate, opaque; erect hairs on the gaster of the major sparse and widely spaced *vallicola*
 Head of the minor smooth and shining; erect hairs on the gaster of the major numerous, long, and closely spaced 13
13. Head of major measuring 1.4 mm. × 1.3 mm.; female 7 mm. in length *hyatti*
 Head of major measuring 1.2 mm. × 1.1 mm.; female 5 mm. in length *hyatti* subsp. *solitanea*
14. Occipital lobes of the major striato-granulose and scarcely shining *subdentata**
 Occipital lobes of the major strongly shining and bearing piligerous punctures only 15
15. The flattened basal portion of the scape of the major notably broader than the distal portion *porcula*
 The flattened basal portion of the scape of the major no wider than its distal portion 16
16. Erect gastric hairs, when present, much longer and coarser than the fine appressed pubescence *crassicornis*

* The strongly polymorphic worker caste of *subdentata* is a source of considerable confusion. The larger medias run through the key to *hyatti* or *cockerelli*, from which they would differ in having more rugose occipital lobes. The smaller medias approach the condition found in the major of *desertorum*, but have shorter and more numerous erect hairs on the thorax and gaster. For recent changes in the nomenclature of this and related species, see discussion at the end of this paper.

- Erect gastric hairs very numerous, rather short and so fine that they merge with the pubescence, most of which is semi-erect
..... *crassicornis* subsp. *tetra*
17. The tops of the occipital lobes of the major, and usually their front faces as well, covered with sculpture, the surface opaque or feebly shining 18
The tops of the occipital lobes of the major, and usually their front faces also, free from sculpture except for piligerous punctures, the surface in most cases strongly shining 35
18. Anterior border of the clypeus of the major with a deep semicircular emargination which extends inward almost to the level of the frontal lobes *tepicana*
Anterior border of the clypeus of the major entire, or if impressed, the emargination is shallow and not semicircular 19
19. Humeral angles of the pronotum of the major weakly developed and not forming lateral bosses 20
Humeral angles of the pronotum of the major strongly developed and forming distinct, epaulet-like lateral bosses 23
20. Occipital lobes of the major with deep, broad, piligerous foveolae *sitarches* subsp. *littoralis*
Occipital lobes of the major with distinct, transverse rugae 21
21. Head and thorax of minor punctate, opaque; hairs on the promesonotum of the major and especially the minor strongly clavate
..... *sitarches* subsp. *campestris*
Head and thorax of minor, at least in part, strongly shining; hairs not clavate 22
22. Entire head and promesonotum of minor smooth and strongly shining; transverse pronotal rugae of the major weak *sitarches*
Head of the minor with the frons striato-punctate and the occipital border punctate; pronotal rugae of the major prominent
..... *sitarches* subsp. *soritis*
23. Postpetiole of the major lenticular in shape, the lateral connules well-developed 24
Postpetiole of the major trapezoidal, the lateral connules absent or poorly developed 31
24. Head of the major 0.85 mm. in length, or less 25
Head of the major 1.4 mm. in length, or more 26
25. Occipital sculpture of the major reticulate, with no trace of transverse or longitudinal rugae *dentigula*
Occipital sculpture of the major longitudinal, continuous with that of the rest of the head, and extending fully to the posterior occipital margin *nuculiceps*
26. Transverse rugae on the occiput of the major pronounced and usually extending onto the front face of the lobes 27
Transverse occipital rugae of the major much finer, resembling striations, and largely confined to the top of the occiput 30
27. Occipital rugae of the major straight or wavy, but not reticulate; lateral postpetiolar connules very prominent and sharp 28

- Occipital rugae of the major notably reticulate and often coarse; lateral postpetiolar connules usually blunt 29
28. Cephalic rugae of the major wavy, with interrugal spaces granular producing a subopaque appearance; thorax except for the pronotum, granular and subopaque, dorsal rugae transverse *senex*
Cephalic rugae of the major straight, with interrugal granules very fine or absent producing a shining surface; thorax almost completely smooth and shining *creightoni*
29. Longitudinal rugae extend across the entire length of the head of the major; interrugal spaces finely punctured, opaque *pilifera*
Longitudinal rugae on the head of the major interrupted at the vertex, which is distinctly shining and possesses only scattered hair punctures *pilifera* subsp. *artemisia*
30. Front and vertex of the head of the major with coarse, widely spaced, piligerous foveolae, longitudinal rugae, and interrugal granulations; feebly shining *pilifera* subsp. *coloradensis*
Front and vertex of the major with almost no sculpture other than small piligerous punctures, strongly shining; occipital rugae feeble *pilifera* subsp. *pacifica*
31. Transverse occipital sculpture of the major in the form of fine rugules or striations 32
Occipital sculpture of the major in the form of more or less coarse rugae 33
32. Occipital striations very fine and turning forward onto the genae where they extend to the insertions of the mandibles *micula*
Occipital striations heavier and more obvious, but not turning forward onto the genae *rugulosa*
33. Sides of the epinotum on the major granulose, weakly shining or opaque 34
Sides of the epinotum on the major not granulose, very smooth and shining *californica* subsp. *pyramidensis*
34. Occipital rugae of the major coarse and wavy, usually forming reticulations in the occipital sulcus *californica*
Occipital rugae of the major finer, straight or nearly so, and usually not forming reticulations in the occipital sulcus *californica* subsp. *oregonica*
35. Head of the major cordate, gradually but distinctly narrowed toward the mandibular insertions, broadest at the occipital lobes *megacephala*
Head of the major not cordate, either quadrate or rectangular with sides parallel, or if slightly convergent, the broadest part of the head anterior to the occipital lobes 36
36. Head of the minor with a well-developed psammophore on the ventral surface, the latter flattened or slightly concave *psammophila*
Head of the minor without a psammophore on the ventral surface, the latter convex 37
37. Head, thorax, and gaster of the minor, and often the major as well, with distinct violaceous or bluish reflections 38

- Head, thorax, and gaster of the minor and major without violaceous reflections 39
38. Head of the minor in large part sculptured, only a narrow central strip smooth and shining *metallescens*
 Head of the minor largely smooth and shining
 *metallescens* subsp. *splendidula*
39. Entire thorax of minor densely covered with granulose sculpture and completely opaque 40
 At least a part of the promesonotum shining in the minor, or, if the entire thorax is opaque, the promesonotum is longitudinally striate and not densely granulose 45
40. Antennal scapes of the minor surpass the occipital angles by an amount greater than the length of the first funicular segment, sometimes twice as great *sciophila*
 Antennal scapes of the minor just reach the occipital angles or barely surpass them by an amount less than the length of the first funicular segment 41
41. Both major and minor with the entire dorsal surface of the first gastric segment finely and densely granulose and opaque *anastasi*
 Dorsum of the first gastric segment in both major and minor entirely, or at least largely, smooth and shining; sculpture when present confined to an area near the base of the gaster 42
42. Pronotum of the major strongly convex when seen from behind, the humeral angles not prominent and lying well below the level of the middle of the pronotum; head of the minor largely free from sculpture and strongly shining *davisi*
 Pronotum of the major flat or feebly convex when seen from behind, the humeral angles sharp, prominent, and lying at or near the level of the middle of the pronotum; head of minor usually densely sculptured and completely opaque, but if not at least the sides of the head are sculptured and only the middle is shining 43
43. Postpetiole of the minor small and globular, not more than one-and-one-half times as wide as the petiole *flavens*
 Postpetiole of the minor not globular but pyriform, and twice as wide as the petiole 44
44. Occipital lobes of the major smooth and shining throughout; clypeus with several longitudinal rugae; hairs long, tapering, and pointed
 *floridana*
 Occipital lobes of the major reticulo-rugose and opaque, except for a narrow shining band along their posterior margins; clypeus without rugulae; hairs short and obtuse *floridana* subsp. *constipata*
45. Epinotum of the major angular at the junction of the basal and declivous faces, but the angles not produced into distinct teeth or spines 46
 Epinotum of the major armed with distinct teeth or spines 48
46. Prothorax of the major with well-developed humeri; postpetiole with prominent lateral connules *barbata*

- Prothorax of the major without well-developed humeri; postpetiole without prominent lateral connules 47
47. Abdominal pilosity largely limited to coarse, erect hairs; length of the major 3.5-4 mm. *morrisi*
 Abdominal pilosity with many fine, subappressed hairs in addition to the coarse, erect hairs; length of the major 4-5 mm.
 *morrisi* subsp. *impeza*
48. Large species, the head of the major at least 2 mm. in length and usually more 49
 Small species, the head of the major not exceeding 1.5 mm. in length and usually less 54
49. Pronotum of the major with transverse striae 50
 Pronotum of the major without transverse striae 52
50. Head of the major with longitudinal rugae confined to the anterior half, posterior half without sculpture except for piligerous punctures 51
 Head of the major with longitudinal rugae extending onto the anterior portions of the occipital lobes *titanis*
51. Head of the major with a flattened, rugose area interposed between the frontal lobe and the eye, and furnished with large, interrugal foveolae; petiole with prominent lateral spiracles *macclendoni*
 Head of the major without a flattened, rugose area between the frontal lobe and the eye; petiole unarmed *virago*
52. Postpetiole of the major, seen from above, very strongly transverse and notably constricted posteriorly, with prominent, sharply pointed lateral connules *spadonia*
 Postpetiole of the major, seen from above, only moderately transverse and not greatly constricted posteriorly, with rather short and blunt lateral connules 53
53. Head of the major notably longer than broad (2.2 mm. \times 1.6 mm.); the genae suddenly expanded just behind the insertions of the mandibles *ridicula*
 Head of the major very little broader than long (2.5 mm. \times 2.4 mm.); the genae not expanded above the insertions of the mandibles *militicida*
54. Sculpture on the head of the major extending to the vertex, only the occiput smooth and shining *ceres*
 Sculpture on the head of the major largely confined to the anterior half of the head, the posterior half smooth and shining 55
55. Mesonotum of the major depressed below the adjacent portion of the pronotum so that in profile it forms a distinct step or angular projection between the pronotum and the epinotum *dentata*
 Mesonotum of the major not depressed below the adjacent portion of the pronotum, in profile the two forming an evenly curved outline which usually descends abruptly at the mesoëpinotal suture 56
56. Eyes of the major with 60 facets, or more 57
 Eyes of the major with 40 facets, or less 60
57. Head of the major with a flattened area extending posteriorly from the antennal fossa toward the occipital lobe; occipital lobes compressed

- dorso-ventrally, the posterior one-third of the head, seen in profile, with dorsal and ventral surfaces converging notably toward the crest of the lobe 58
- Head of the major without a flattened area extending posteriorly from the antennal fossa; the occipital lobes not compressed dorso-ventrally, thick and evenly rounded when seen in profile, and not sharply set off from the anterior part of the head *yaqui*
58. Major with the dorsum of the pronotum covered with numerous, coarse, reticulate rugae in addition to the more nearly parallel transverse rugae on the anterior face and on the neck; interrugal surfaces heavily coriaceous, opaque or nearly so *xerophila* subsp. *tucsonica*
- Major with the dorsum of the pronotum bearing few or no rugae, the rugae mainly restricted to the anterior face and neck of the pronotum, and not noticeably reticulate; interrugal surfaces smooth to slightly coriaceous, moderately to strongly shining 59
59. Postpetiole of the major trapezoidal, the lateral connules short and obtuse; color golden yellow to dull yellow, head of the minor sometimes infuscated *gilvescens*
- Postpetiole of the major strongly transverse, with long lateral connules; color ferruginous red to blackish red, the minor piceous brown. *xerophila*
60. Vertex and occiput of the minor with small, close-set punctures which give the surface a noticeably duller appearance on those parts than elsewhere on the head 61
- Vertex and occiput of the minor strongly shining or only slightly less shining than the rest of the head, the punctures widely scattered over the whole head 62
61. Basal face of the epinotum of the major sculptured and opaque..... *casta*
- Basal face of the epinotum of the major in large part shining, its sculpture restricted to punctures near the mesoepinotal suture *cerebrosior*
62. Basal face of the epinotum of the major free from sculpture and strongly shining *humeralis*
- Basal face of the epinotum of the major distinctly sculptured, feebly shining and opaque 63
63. Sides of the epinotum of the minor largely free from sculpture and strongly shining *tysoni*
- Sides of the epinotum of the minor densely punctured, feebly shining and opaque 64
64. Lateral connules on the postpetiole of the major prominent and sharp pointed *pinealis*
- Lateral connules on the postpetiole of the major blunt and not prominent 65
65. Erect hairs on the thorax of the minor short, sparse, and strongly clavate *marcidula*
- Erect hairs on the thorax of the minor long, abundant and, although often blunt at the tips, not clavate 66

66. Anterior clypeal margin of the major sinuate; pronotum smooth and shining *bicarinata* subsp. *paivute*
 Anterior clypeal margin of the major bluntly bidentate; pronotum punctate and usually with transverse rugae or striae 67
67. Basal face of the epinotum in the major largely covered with transverse striae, and with punctures confined to the region of the mesoepinotal suture; pronotal rugae coarse and prominent *bicarinata*
 Basal face of the epinotum in the major largely punctate, transverse striae, when present, restricted to the area between the bases of the epinotal spines; pronotal rugae feeble 68
68. Epinotum of the minor armed with thick, short spines *bicarinata* subsp. *vinelandica*
 Epinotum of the minor armed with angular teeth which are broad at the base and do not resemble spines *bicarinata* subsp. *longula*

Subgenus CERATOPHEIDOLE

1. *Pheidole* (*Ceratopheidole*) *clydei* Gregg
Ph. (Ceratopheidole) clydei Gregg, Jour. N. Y. Ent. Soc., 1950, 58, p. 89, ♂; Gregg, Amer. Mus. Novit., 1953, No. 1637, ♂.
 Type locality: Carrizozo, New Mexico
2. *Pheidole* (*Ceratopheidole*) *grundmanni* M. R. Smith
Ph. (Ceratopheidole) grundmanni M. R. Smith, Jour. N. Y. Ent. Soc., 1953, 61, p. 143, ♀.
 Type locality: Vernal, Utah

Subgenus MACROPHEIDOLE

3. *Pheidole* (*Macropheidole*) *rhea* Wheeler
Ph. rhea Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 452, ♀.
Ph. (Macropheidole) rhea M. R. Smith, Proc. Ent. Soc. Wash., 1943, 45, p. 5, ♂; Gregg, Psyche, 1949, 56, p. 70, ♂, ♀, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 168.
 Type locality: Nogales, Arizona

Subgenus PHEIDOLE

4. *Pheidole anastasioi* Emery
Ph. anastasioi Emery, Bull. Soc. Ent. Ital., 1896, 28, p. 76, ♂, ♂; Forel, Mitt. Naturh. Mus. Hamburg, 1901, 18, p. 78, ♀; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 169.
 Type locality: Jimenez, Costa Rica

5. *Pheidole barbata* Wheeler

Ph. barbata Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 448, ♀, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 170; Creighton and Gregg, Univ. Colo. Stud., 1955, Ser. Biol. No. 3, p. 1.

Type locality: Mojave Desert, Needles, California

6. *Pheidole bicarinata* Mayr

Ph. bicarinata Mayr, Verh. Zool-bot. Ges. Wien, 1870, 20, p. 989, ♂; Mayr, Ibid., 1887, 37, p. 596, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 170.

Ph. hayesi M. R. Smith, Ent. News, 1924, 35, p. 251, ♀, ♂.

Type locality: Illinois

7. *Pheidole bicarinata longula* Emery

Ph. vinelandica var. *longula* Emery, Zool. Jahrb. Syst., 1895, 8, p. 292, ♀, ♂; Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 453, ♂.

Ph. vinelandica subsp. *longula* Wheeler, Ibid., 1915, 34, p. 405.

Ph. bicarinata longula Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 171.

Type locality: Pueblo, Colorado

8. *Pheidole bicarinata paiute* subsp. nov.

MAJOR: Length, 4.25 mm.; head length (excluding mandibles), 1.08 mm.; head width, 1.00 mm.; head index, 0.93; thorax length, 0.92 mm.

This ant runs in Creighton's key to *Ph. bicarinata vinelandica*, and comparison with undoubted specimens of that form confirms the close relationship. It is, however, not identical, and may be distinguished from *vinelandica* by the following characters: head slightly longer and overall body size a little larger; anterior clypeal margin broadly sinuate (a narrow median emargination in *vinelandica* and other subspecies of *bicarinata* is bounded by prominent though rounded lobes); cephalic sculpture more restricted anteriorly, so that in some cases, fully 2/3 of the head, including the frons, vertex, and occiput is smooth and shining; the humeral angles less prominent, and the pronotum with punctures completely absent and virtually no transverse rugules or striae, the surface very shining; basal face of the epinotum punctate, sometimes with one or two weak interspinal striae, but the surface somewhat shining (heavily punctate and opaque in *vinelandica*); strong rugae running diagonally from the mesoepinotal suture to the bases of the spines and enclosing the punctate epinotal base (absent on *vinelandica*); color almost identical except that the head is a little lighter yellowish red.

MINOR: practically indistinguishable except a little larger in size than *vinelandica* and with longer epinotal spines.

Holotype: Major.

Paratypes: 36 majors and 135 minors

The type material was collected by W. S. Creighton at Goldfield, Nevada, on October 17, 1952, elevation 5800 feet, and was obtained from two colonies.

This subspecies is known at present only from the type locality, and this makes it difficult to correctly appraise its status. It might be regarded as a Great Basin race of *bicarinata*, and in fact has been described as a subspecies because of its close morphological resemblance to that species, but further revision must depend on future collections and better knowledge of its general distribution. It is conceivable that *paiute* may have to be interpreted later as a full species.

9. *Pheidole bicarinata vinelandica* Forel

Ph. bicarinata race *vinelandica* Forel, Ann. Soc. Ent. Belg., 1886, 30, p. 45, ♀, ♂, ♀, ♂.

Ph. vinelandica Mayr, Verh. Zool.-bot. Ges. Wien, 1886, 36, p. 458, ♂; Emery, Zool. Jahrb. Syst., 1895, 8, p. 292; Forel, Ann. Soc. Ent. Belg., 1901, 45, p. 348, ♀, ♂, ♀, ♂; Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 453.

Ph. (Allophidole) vinelandica Forel, Mem. Soc. Ent. Belg., 1912, 19, p. 237.

Ph. (Allophidole) vinelandica var. *nebrascensis* Forel, Rev. Suisse Zool., 1922, 30, p. 92, ♀, ♂, ♀.

Ph. vinelandica laeviuscula Emery, Zool. Jahrb. Syst., 1895, 8, p. 292, ♀, ♂.

Ph. vinelandica subsp. *buccalis* Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 454, ♀, ♂, ♀.

Ph. vinelandica longula var. *castanea* Wheeler, Bull. Amer. Mus. Nat. Hist., 1915, 34, p. 405, ♀, ♂.

Ph. vinelandica longula var. *huachucana* M. R. Smith (nom. nov.) Cat. Hym. Amer. No. of Mex., 1951, U. S. D. A. Mon. No. 2, p. 805.

Ph. bicarinata buccalis Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 171.

Ph. bicarinata vinelandica Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 172.

Type locality: Vineland, New Jersey

10. *Pheidole californica* Mayr
Ph. californica Mayr, Verh. Zool-bot. Ges. Wien, 1870, 20, p. 987, ♂, ♀; Emery, Zool. Jahrb. Syst., 1895, 8, p. 289; Wheeler, Bull. Amer. Mus. Nat. Hist., 1915, 34, p. 406, ♂, ♀; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 172.
Ph. californica var. *incenata* Wheeler, Bull. Amer. Mus. Nat. Hist., 1915, 34, p. 407, ♂, ♀.
Ph. californica var. *satura* Wheeler, Ibid., 1915, 34, p. 407, ♂, ♀.
 Type locality: San Francisco, California
11. *Pheidole californica oregonica* Emery
Ph. oregonica Emery, Zool. Jahrb. Syst., 1895, 8, p. 291, ♂, ♀.
Ph. californica subsp. *oregonica* Wheeler, Bull. Amer. Mus. Nat. Hist., 1915, 34, p. 407, ♂, ♀; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 173.
Ph. californica var. *shoshoni* Cole, Ann. Ent. Soc. Amer., 1933, 26, p. 618, ♂, ♀.
Ph. californica *shoshoni* Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 174.
Ph. californica var. *hagermani* Cole, Canad. Ent., 1936, 68, p. 35, ♂, ♀.
 Type locality: The Dalles, Oregon
12. *Pheidole californica pyramidensis* Emery
Ph. californica subsp. *nevadensis* Wheeler, Bull. Amer. Mus. Nat. Hist., 1915, 34, p. 408, ♂, ♀.
Ph. californica subsp. *pyramidensis* Emery, in Wytzman, Gen. Insect., 1921, Fasc. 174, p. 105 (nomen novum); Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 173.
 Type locality: Pyramid Lake, Nevada
13. *Pheidole casta* Wheeler
Ph. casta Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 454, ♂, ♀; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 174.
 Type locality: Canyon of the Rio Grande, Langtry, Texas
14. *Pheidole cerebrosior* Wheeler
Ph. vinelandica subsp. *cerebrosior* Wheeler, Bull. Amer. Mus. Nat. Hist., 1915, 34, p. 405, ♂, ♀.

- Ph. cerebrosior* Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 175; Creighton and Gregg, Univ. Colo. Stud., 1955, Ser. Biol. No. 3, p. 3. 21.
Type locality: Tucson, Arizona
15. *Pheidole ceres* Wheeler
Ph. ceres Wheeler, Bull. Amer. Mus. Nat. Hist., 1904, 20, p. 10, ♀, 21, ♀, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 174.
Type locality: Colorado Springs, Colorado
16. *Pheidole cockerelli* Wheeler
Ph. cockerelli Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 464, ♀, 21; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 175.
Type locality: Arroyo Pecos, Las Vegas, New Mexico
17. *Pheidole crassicornis* Emery
Ph. crassicornis Emery, Zool. Jahrb. Syst., 1895, 8, p. 296, 21; Forel, Ann. Soc. Ent. Belg., 1901, 45, p. 350, ♀, 21, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 175.
Ph. crassicornis var. *diversipilosa* Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 467, ♀, 21, ♀.
Type locality: Charlotte, North Carolina
18. *Pheidole crassicornis tetra* Wheeler
Ph. crassicornis subsp. *porcula* var. *tetra* Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 467, ♀, 21.
Ph. crassicornis tetra Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 176.
Type locality: Austin, Texas
19. *Pheidole creightoni* Gregg
Ph. creightoni Gregg, Psyche, 1955, 62, p. 19, ♀, 21, ♀, ♂.
Type locality: Applegate, Oregon
20. *Pheidole davisii* Wheeler
Ph. davisii Wheeler, Bull. Amer. Mus. Nat. Hist., 1905, 21, p. 380, ♀, 21; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 176.
Type locality: Lakehurst, New Jersey
21. *Pheidole dentata* Mayr
Ph. morrissi var. *dentata* Mayr, Verh. Zool-bot. Ges. Wien, 1886, 36, p. 457, ♀, 21, ♂.

- Ph. dentata* Forel, Ann. Soc. Ent. Belg., 1901, 45, p. 351, ♀, 2♂, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 177.
- Ph. dentata* var. *faisonsica* Forel, Ann. Ent. Soc. Belg., 1901, 45, p. 352, ♀, 2♂.
- Ph. commutata* Mayr, Verh. Zool-bot. Ges. Wien, 1886, 36, p. 459, ♀, 2♂; Emery, Zool. Jahrb. Syst., 1895, 8, p. 289, ♀, 2♂.
- Ph. dentata* var. *commutata* M. R. Smith, Cat. Hym. Amer. No. of Mex., 1951, U. S. D. A. Mon. No. 2, p. 802.
Type locality: Florida
22. *Pheidole dentigula* M. R. Smith
Ph. dentigula M. R. Smith, Ent. News, 1927, 38, p. 310, ♀, 2♂; M. R. Smith, Ibid., 1928, 39, p. 245, ♀; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 178.
Type locality: A & M College, Mississippi
23. *Pheidole desertorum* Wheeler
Ph. desertorum Wheeler, Bull. Amer. Mus. Nat. Hist., 1906, 22, p. 337, ♀, 2♂, ♀, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 178.
Ph. desertorum var. *comanche* Wheeler, Bull. Amer. Mus. Nat. Hist., 1906, 22, p. 339, ♀, 2♂, ♀.
Ph. desertorum var. *maricopa* Wheeler, Ibid., 1906, 22, p. 339, ♀, 2♂.
Type locality: Ft. Davis, Texas
24. *Pheidole flavens* Roger
Ph. flavens Roger, Berlin Ent. Zeitschr., 1863, 7, p. 198, ♀, 2♂; Mayr, Verh. Zool-bot. Ges. Wien, 1870, 20, p. 981, 983; Emery, Bull. Soc. Ent. Ital., 1894, 26, p. 155; Emery, in Wytsman, Gen. Insect., 1921, Fasc. 174, p. 107.
Type locality: Cuba
25. *Pheidole floridana* Emery
Ph. flavens subsp. *floridana* Emery, Zool. Jahrb. Syst., 1895, 8, p. 293, ♀, 2♂, ♀.
Ph. floridana Emery, Bull. Soc. Ent. Ital., 1896, 28, p. 77; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 179.
Ph. lauta Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 470, ♀, 2♂, ♀, ♂.

- Ph. floridana lauta* Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 179.
Type locality: Coconut Grove, Florida
26. *Pheidole floridana constipata* Wheeler
Ph. constipata Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 468, ♀, ♂, ♀, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 175.
Type locality: Austin and New Braunfels, Texas
27. *Pheidole gilvescens* Wheeler
Ph. xerophila tucsonica var. *gilvescens* Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 448, ♀, ♂.
Ph. gilvescens Creighton and Gregg, Univ. Colo. Stud., 1955, Ser. Biol. No. 3, p. 5, ♀, ♂.
Type locality: Phoenix and Tucson, Arizona
28. *Pheidole grillipes* Wheeler = *vistana* Forel
Ph. susannae subsp. *longipes* Pergande, Proc. Calif. Acad. Sci., 1895, (2), 5, p. 885, ♀, ♂ (nec F. Smith).
Ph. longipes Forel, Biol. Centrali. Amer. Hym., 1899, 3, p. 65; Wheeler, Bull. Amer. Mus. Nat. Hist., 1915, 34, p. 397, ♀.
Ph. grillipes Wheeler, Psyche, 1916, 23, p. 40 (nomen nov.); Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 180.
Ph. grillipes var. *vistana* M. R. Smith, Cat. Hym. Amer. No. of Mex., 1951, U. S. D. A. Mon. No. 2, p. 802.
Type locality: Sierra San Lazaro, Mexico
29. *Pheidole humeralis* Wheeler
Ph. humeralis Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 456, ♀, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 180.
Type locality: Corsicana, Texas
30. *Pheidole hyatti* Emery
Ph. hyatti Emery, Zool. Jahrb. Syst., 1895, 8, p. 295, ♀, ♂; Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 462, ♀, ♂, ♀; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 180.
Ph. hyatti var. *ecitonodora* Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 463, ♀, ♂, ♀, ♂.
Type locality: San Jacinto, California

31. *Pheidole hyatti solitanea* Wheeler
Ph. hyatti subsp. *solitanea* Wheeler, Bull. Amer. Mus. Nat. Hist., 1915, 34, p. 409, ♀, ♂, ♀; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 181.
 Type locality: Point Loma, San Diego, California
32. *Pheidole lamia* Wheeler
Ph. lamia Wheeler, Amer. Nat., 1901, 35, p. 534, ♀, ♂; Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 477, ♀, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 182.
 Type locality: Austin, Texas
33. *Pheidole macclendoni* Wheeler
Ph. macclendoni Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 450, ♀, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 182.
 Type locality: Laredo and Corsicana, Texas
34. *Pheidole marcidula* Wheeler
Ph. marcidula Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 457, ♀, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 182.
 Type locality: Barton Creek, Austin, Texas
35. *Pheidole megacephala* (Fabricius)
Formica megacephala Fabricius, Ent. System., 1793, 2, p. 361, ♂.
Pheidole megacephala Emery, Gen. Insect., 1921, Fasc. 174, p. 85; M. R. Smith, Cat. Hym. Amer. No. of Mex., 1951, U. S. D. A. Mon. No. 2, p. 803.
 Type locality: Isle de France. (Mauritius)
36. *Pheidole metallescens* Emery
Ph. metallescens Emery, Zool. Jahrb. Syst., 1895, 8, p. 294, ♀; Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 476, ♀, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 183.
 Type locality: St. George, Florida
37. *Pheidole metallescens splendidula* Wheeler
Ph. metallescens subsp. *splendidula* Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 474, ♀, ♂, ♀, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 183.
 Type locality: Del Rio, Texas

38. *Pheidole micula* Wheeler
Ph. californica subsp. *micula* Wheeler, Bull. Amer. Mus. Nat. Hist., 1915, 34, p. 408, ♀, 2♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 173.
 Type locality: Miller Canyon, Huachuca Mts., Arizona
39. *Pheidole militica* Wheeler
Ph. militica Wheeler, Bull. Amer. Mus. Nat. Hist., 1915, 34, p. 398, ♀, 2♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 183; Creighton and Gregg, Univ. Colo. Stud., 1955, Ser. Biol. No. 3, p. 9, ♀, ♂.
 Type locality: Hereford and Benson, Arizona
40. *Pheidole morrisi* Forel
Ph. morrisii Forel, Ann. Soc. Ent. Belg., 1886, 30, p. 46, ♀, 2♂; Forel, Ibid., 1901, 45, p. 350, ♀, 2♂, ♀, ♂ (*morrisi*); Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 183 (*morrisi*).
Ph. morrisi var. *vanceae* Forel, Ann. Soc. Ent. Belg., 1901, 45, p. 351, ♀, 2♂, ♀, ♂.
 Type locality: Vineland, New Jersey
41. *Pheidole morrisi impeza* Wheeler
Ph. morrisi var. *impeza* Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 461, ♀, 2♂, ♀, ♂.
Ph. morrisi impeza Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 184.
 Type locality: Del Valle, Austin, Texas
42. *Pheidole nuculiceps* Wheeler
Ph. nuculiceps Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 473, ♀, 2♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 184.
 Type locality: Comal River, New Braunfels, Texas
43. *Pheidole pilifera* (Roger)
Leptothorax pilifer Roger, Berl. Ent. Zeitschr., 1863, 7, p. 180, ♀.
Pheidole pilifera Emery, Zool. Jahrb. Syst., 1895, 8, p. 290, ♀, 2♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 184.
Ph. pilifera var. *simulans* Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 436, 2♂.
Ph. pilifera subsp. *septentrionalis* Wheeler, Ibid. 1908, 24, p. 436, 2♂.

Ph. pennsylvanica Roger, Berl. Ent. Zeitschr., 1863, 7, p. 199, ♂; Mayr, Verh. Zool-bot. Ges. Wien, 1886, 36, p. 455, ♀, ♂, ♀, ♂.

Type locality: Pennsylvania

44. *Pheidole pilifera artemisia* Cole

Ph. pilifera subsp. *artemisia* Cole, Ann. Ent. Soc. Amer., 1933, 26, p. 616, ♀, ♂; Cole, Amer. Midl. Nat., 1938, 20, p. 372, ♀; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 187.

Type locality: Provo, Utah

45. *Pheidole pilifera coloradensis* Emery

Ph. pilifera var. *coloradensis* Emery, Zool. Jahrb. Syst., 1895, 8, p. 290, ♀, ♂.

Ph. pilifera subsp. *coloradensis* Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 434, ♀, ♂, ♀, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 187.

Ph. pilifera coloradensis var. *neomexicana* Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 436, ♂.

Type locality: Westcliffe (West Cliff) and Pueblo, Colorado

46. *Pheidole pilifera pacifica* Wheeler

Ph. xerophila subsp. *pacifica* Wheeler, Bull. Amer. Mus. Nat. Hist., 1915, 34, p. 404, ♀, ♂, ♀, ♂.

Ph. pilifera pacifica Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 187.

Type locality: Pasadena and Lakeside, California

47. *Pheidole pinealis* Wheeler

Ph. pinealis Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 459, ♀, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 187; Creighton and Gregg, Univ. Colo. Stud., 1955, Ser. Biol. No. 3, p. 12, ♀, ♂.

Type locality: Limpia Canyon, Ft. Davis, Texas

48. *Pheidole porcula* Wheeler

Ph. crassicornis subsp. *porcula* Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 466, ♀, ♂.

Ph. porcula Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 187.

Type locality: Chisos Mountains, Texas

49. *Pheidole psammophila* Creighton and Gregg

Ph. psammophila Creighton and Gregg, Univ. Colo. Stud., 1955, Ser. Biol. No. 3, p. 15, ♀, ♂.

Type locality: Greys Well, Imperial County, California

50. *Pheidole ridicula* Wheeler

Ph. ridicula Wheeler, Proc. New Eng. Zool. Club, 1916,
6, p. 29, 24; Creighton, Bull. Mus. Comp. Zool., 1950,
104, p. 188.

Type locality: Brownsville, Texas

51. *Pheidole rugulosa* sp. nov.

MAJOR: Length, 3.62 mm.; head length (excluding mandibles), 1.08 mm.; head width, 1.0 mm.; head index, 0.93; thorax length, 0.83 mm.

Head, without the mandibles, slightly longer than broad, occipital lobes prominent but well-rounded; cephalic sulcus well-developed and rather broad toward the rear; frontal area small and depressed; clypeus with very weak median carina, its anterior border sinuate, and the median emargination very shallow. Frontal carinae short and slightly divergent. Antennae 12-segmented; scapes slender at the base, widened apically and extending $\frac{1}{2}$ or slightly more of the distance from their insertions to the occipital corners; funiculus with distinct 3-segmented club whose articles are longer than broad. Mandibles stout, abruptly curved, with two apical teeth and the remaining border edentate except for a small basal denticle. Eyes with approximately 65 facets.

Promesonotum strongly convex, descending through an obtuse angle to the mesoepinotal suture, which is impressed; humeral bosses well-defined; basal face of epinotum and the declivity subequal, and joined through an obtuse angle; epinotal spines stout but pointed. Petiole with a long anterior peduncle, anterior face of the node gently sloping, posterior face vertical, and the crest blunt, transversely flat to faintly concave. Postpetiole trapezoidal, widest anterior to the middle, the lateral angles blunt, rounded, and poorly developed. Gaster truncate at the base, and slightly smaller than the head.

Sculpture: Cephalic rugules longitudinal and fine, crossing the clypeus, frons, diverging from the carinae, and extending to the vertex where they disappear; rugules present on the genae, extending from the mandibles to a little beyond the posterior border of the eyes, and on the lateral aspects also of the gula. Transverse rugules or striae cross the occipital lobes and converge into the cephalic sulcus. Vertex, upper portions of the genae, and middle of the gula smooth and shining. Piligerous punctures coarse and deep. Dorsum of the pro-mesonotum longitudinally rugose, front of pronotum transversely rugose, subopaque to weakly shining; prothoracic pleurae longitudinally rugose-punctate, mesopleurae and epinotal pleurae punctate and opaque. Epinotal base and declivity punctate and opaque; one or two interspinal rugulae. Petiole punctate and opaque; postpetiole punctate laterally but smooth and shining dorsally. Gaster smooth and shining.

Pilosity: Hairs yellow, pointed, numerous on the head and short, mixed on the thorax, and long and numerous on the pedicel and gaster; sparse on the appendages. Pubescence limited mostly to the antennae; sparse on the legs and completely absent from the gaster.

Color: Reddish brown, appendages and gaster somewhat lighter (some individuals are dark brown, approaching black).

MINOR: Length, 2.42 mm.; head length (excluding mandibles), 0.5 mm.; head width, 0.46 mm.; head index, 0.92; thorax length, 0.5 mm.

Head a little longer than broad, occipital border feebly concave, clypeal border straight, clypeus ecarinate, frontal area depressed, frontal carinae straight to faintly divergent. Antennal scapes like those of the major, except they reach almost to the occipital corners. Eyes with about 50 facets.

Thorax moderately convex and sharply depressed at the meso-epinotal suture. Epinotal spines stout, sharp, and pointed upward. Petiole with long anterior peduncle, and postpetiole lacks connules; in general similar to the corresponding segments in the worker major.

Sculpture: Head smooth and shining except for a few striae on the sides of the frons associated with the frontal carinae, and a few rugules with weak interrugal punctures on the genae between the eyes and the mandibles. Pronotum and propleurae for the most part smooth and shining, rest of thorax, petiole, and sides of postpetiole punctate, opaque. Dorsum of postpetiole and gaster shining.

Pilosity: Similar to that of the worker major.

Color: Like that of the major.

FEMALE: Length, 4.67 mm.; head length (excluding mandibles), 0.87 mm.; head width, 0.92 mm.; head index, 1.06; thorax length, 1.42 mm.

Head broader than long, occipital border almost flat, sides straight. Clypeus ecarinate, anterior border weakly sinuate. Frontal area small, depressed and pear-shaped. Frontal carinae small and slightly divergent. Antennae like those of the soldier; scapes reaching $\frac{3}{4}$ of the distance from their insertions to the occipital corners. Eyes large, convex, and composed of 180 or more facets; placed in front of the middle of the head. Ocelli large and prominent.

Thorax flat dorsally, as wide as the head through the wing insertions, and tapering posteriorly to the epinotum. Scutum, scutellum, metanotum, and epinotum all separated by well-marked sutures. Epinotal base slightly shorter than the declivity, and both joined by a depressed trough with no angle. Epinotal spines stout, blunt, and directed upward and backward. Petiole with moderate peduncle, and narrowed but blunt and flat-crested node. Postpetiole transverse, almost 1 and $\frac{1}{2}$ times as wide as the petiole, and with blunt, subconnular lateral angles.

Sculpture: Entire upper surface of head (except clypeus and frontal area which are shining) furnished with longitudinal rugae which are divergent on the occiput, and which become reticulate on the genae and the occipital corners; opaque. Cephalic punctures coarse; interrugal sculpture weak. Clypeus crossed with fine, longitudinal striae which do not dull the surface. Gula smooth and shining. Mandibles coarsely punctate, shining. Dorsum of thorax smooth and shining except for coarse, deep, scattered, piligerous punctures. Sides of prothorax and epinotum longitudinally rugose, the remainder of thorax smooth and shining. Epinotal base with rugae transverse and also converging toward the bases of the spines. Petiole and postpetiole punctate and weakly shining. Gaster slightly shagreened.

Pilosity: Like that of the major; pubescence limited to the legs and antennae.

Color: Similar to that of the major.

MALE: Length, 3.82 mm.; head length, 0.54 mm.; head width (including eyes), 0.67 mm.; head index, 1.24; thorax length, 1.33 mm.

Head, as measured through the eyes, much broader than long. Eyes so large they occupy most of the sides of the head, and contribute to the broad, flat, anterior margin of the head, the mandibles (when closed) and the clypeus hardly projecting. Sides of head behind the eyes converging rapidly to the occiput, which is almost flat. Vertex surmounted by prominent ocelli. Antennae 13-segmented; scape short, about equal in length to the first two funicular segments. Second funicular segment globular. Mandibles with two, weak, blunt denticles.

Thorax broader than the head, promesonotum flat, scutellum raised slightly. Mayrian furrows feeble. Epinotal base and declivity subequal, the former strongly sloping and the two joined by a very obtuse angle. Epinotal spines reduced to very faint tubercles. Petiole slender, peduncle long, node low and merging with the peduncle. Postpetiole trapezoidal, 1 and $\frac{1}{2}$ times as wide as the petiole.

Sculpture: Head longitudinally striate and punctate, somewhat shining on the frons and clypeus where punctures are reduced, the rest opaque; thorax smooth and shining. Pedicel smooth and shining above, sides of both petiole and postpetiole punctate. Gaster smooth and shining.

Color and pilosity: As in the other castes, except legs, mandibles, antennae and genitalia are yellow. A male from Naco, Arizona, is slightly larger, darker in color and has more definite epinotal denticles.

Wings transparent, with yellow veins and stigma, one open marginal cell, two submarginal cells and one discoidal cell. Cerci small and knobbed; stipites small, rounded and mesially curved into blunt hooks.

Holotype: Major

Paratypes: 18 majors, 145 minors and 3 dealate females.

The type material comprises two colonies collected by Miss Mina Winslow at Harding's ranch near Tucson, Arizona, on February 25, 1920.

Additional specimens which are referable to this species were collected at the following localities:

Greaterville, Arizona, 5300 feet, July 7, 1950, W. S. Creighton (17 majors, 24 minors, 1 male); Ft. Huachuca and desert near Ft. Huachuca, Arizona, 5000 feet, August 26, 1932, W. S. Creighton, (10 majors, 29 workers); Brown Canyon, Baboquivari Mts., Arizona, 4000 feet, September 16, 1951, W. S. Creighton (4 majors, eight minors); 7 miles east of Aguila, Arizona, 2200 feet, April 6, 1952, W. S. Creighton (2 colonies, 35 majors,

41 minors, 1 female); 20 miles east of Gila Bend, Arizona, 2700 feet, October 29, 1952, W. S. Creighton (3 majors, 6 minors); Ranger Station, Nogales, Arizona, May 26, 1946, L. F. Byars (4 majors, 19 minors); Bisbee Junction, Arizona, October 2, 1948, L. F. Byars (2 majors, 26 minors); Naco, Arizona, September 30, 1948, on whitethorn mesquite, L. F. Byars (7 majors, 3 minors, 1 male).

Some of the majors in the above colonies are a bit darker in color, have more pronounced prothoracic longitudinal rugae and a slightly broader postpetiole, but as these differences are not confined to separate colonies nor to any different geographic areas, it appears certain that the ants are all members of the species herein described.

Pheidole rugulosa may be distinguished from *Ph. micula*, its closest relative, in the following manner: overall size a little larger; transverse occipital rugules (resembling striae) very similar to those of *micula* except somewhat coarser, more abundant in the cephalic sulcus, extending further onto the vertex, but *absent* from the upper portions of the genae; piligerous punctures on the smooth areas of the head larger and more evident; humeral bosses more prominent; transverse rugae of the pronotum extending to the prothoracic pleurae, the surface opaque; promesonotum more convex; petiolar node more truncate or straight at the summit; postpetiole wider, the lateral angles distinct though blunt (practically absent in *micula*).

52. *Pheidole sciara* Cole

Ph. sciara Cole, Jour. Tenn. Acad. Sci., 1955, 30, p. 47, ♀, ♂.

Type locality: Lordsburg, New Mexico

53. *Pheidole sciophila* Wheeler

Ph. sciophila Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 443, ♀, ♂, ♀, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 188; Creighton and Gregg, Univ. Colo. Stud., 1955, Ser. Biol. No. 3, p. 19, ♀, ♂.

Ph. sciophila var. *semilaevicéphala* M. R. Smith, Ann. Ent. Soc. Amer., 1934, 27, p. 385, ♂.

Ph. sciophila semilaevicéphala Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 188.

Ph. proserpina Wheeler, Bull. Amer. Mus. Nat. Hist., 1908,

- 24, p. 437, ♂, ♀; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 188; Creighton and Gregg, Univ. Colo. Stud., 1955, Ser. Biol. No. 3, p. 19.
Type locality: Austin and New Braunfels, Texas
54. *Pheidole senex* Gregg
Ph. senex Gregg, Amer. Mus. Novit., 1952, No. 1557, p. 1, ♂, ♀.
Ph. pilifera subsp. *anfracta* Cole, Jour. Tenn. Acad. Sci., 1952, 27, p. 278, ♂, ♀; Cole, Ibid., 1953, 28, p. 298.
Type locality: Campo, Colorado
55. *Pheidole sitarches* Wheeler
Ph. sitarches Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 440, ♂, ♀; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 189.
Ph. sitarches var. *transvarians* Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 442, ♂, ♀.
Type locality: New Braunfels, Texas
56. *Pheidole sitarches campestris* Wheeler
Ph. sitarches subsp. *rufescens* Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 443, ♂, ♀.
Ph. sitarches rufescens var. *campestris* Wheeler, Ibid., 1908, 24, p. 443, ♂, ♀.
Ph. sitarches campestris Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 189.
Type locality: Henrietta, Texas
57. *Pheidole sitarches littoralis* Cole
Ph. sitarches littoralis Cole, Ann. Ent. Soc. Amer., 1952, 45, p. 443, ♂, ♀.
Type locality: Lido Beach, Sarasota, Florida
58. *Pheidole sitarches soritis* Wheeler
Ph. soritis Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 439, ♂, ♀.
Ph. sitarches soritis Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 190.
Ph. tepicana subsp. *cavigenis* Wheeler, Bull. Amer. Mus. Nat. Hist., 1915, 34, p. 403, ♀; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 190.
Type locality: Albuquerque, New Mexico
59. *Pheidole spadonia* Wheeler
Ph. spadonia Wheeler, Bull. Amer. Mus. Nat. Hist., 1915,

34, p. 400, ♀, 2; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 190; Creighton and Gregg, Univ. Colo. Stud., 1955, Ser. Biol. No. 3, p. 22, ♀.

Type locality: Santa Cruz River, Tucson, Arizona

60. *Pheidole subdentata* Pergande = *obtusospinosa*

Ph. subdentata Pergande, Proc. Calif. Acad. Sci., 1895, 5, p. 888, ♀; Creighton, Jour. N. Y. Ent. Soc., 1957, 65, p. 203. preocc. Mayr 1852

Ph. obtusospinosa Pergande, Proc. Calif. Acad. Sci., 1895, 5, p. 889, 2.

Ph. arizonica Santschi, Bull. Soc. Ent. Ital., 1909, 41, p. 3, 2.

Ph. vasliti subsp. *subdentata* Wheeler, Jour. N. Y. Ent. Soc., 1914, 22, p. 50, 2; Emery, in Wytsman, Gen. Insect., 1921, Fasc. 174, p. 102.

Ph. vasliti subdentata var. *arizonica* Wheeler, Jour. N. Y. Ent. Soc., 1914, 22, p. 50, 2.

Ph. vasliti arizonica Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 192.

Type locality: Tepic, Nayarit, Mexico

61. *Pheidole tepicana* Pergande

Ph. tepicana Pergande, Proc. Calif. Acad. Sci., 1895, 5, p. 878, ♀, 2; Creighton and Gregg, Univ. Colo. Stud., 1955, Ser. Biol. No. 3, p. 24, ♀ (media; minor), 2.

Ph. rugifrons Pergande, Proc. Calif. Acad. Sci., 1895, 5, p. 880, 2.

Ph. carbonaria Pergande, Ibid., 1895, 5, p. 881, ♀, 2.

Ph. kingi E. André, Bull. Soc. Ent. France, 1898, p. 244, ♀, 2.

Ph. townsendi E. André, Ibid., 1898, p. 246, ♀, 2.

Ph. kingi subsp. *instabilis* Emery, Ibid., 1901, p. 120, ♀, 2; Wheeler, Bull. Amer. Mus. Nat. Hist., 1907, 23, p. 2, ♀, 2, ♀, ♂; Wheeler, Ibid., 1908, 24, p. 431, ♀, 2, ♀, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 181.

Ph. kingi subsp. *torpescens* Wheeler, Bull. Amer. Mus. Nat. Hist., 1915, 34, p. 404, ♀, 2; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 182.

Type locality: Tepic, Nayarit, Mexico

62. *Pheidole texana* Wheeler
Ph. texana Wheeler, Psyche, 1903, 10, p. 97, ♀, 2f; Wheeler Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 464, ♀, 2f; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 191.
Type locality: Travis County, Texas
63. *Pheidole titanis* Wheeler
Ph. titanis Wheeler, Psyche, 1903, 10, p. 95, ♀, 2f; Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 461, 2f; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 191; Creighton and Gregg, Univ. Colo. Stud., 1955, Ser. Biol. No. 3, p. 35, ♀, 2f.
Type locality: Paisano Pass, Brewster Co. and Chisos Mts., Texas
64. *Pheidole tysoni* Forel
Ph. tysoni Forel, Ann. Soc. Ent. Belg., 1901, 45, p. 348, ♀, 2f, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 191.
Type locality: Mt. Mitchell, North Carolina
65. *Pheidole vallicola* Wheeler
Ph. crassicornis subsp. *vallicola* Wheeler, Bull. Amer. Mus. Nat. Hist., 1915, 34, p. 409, ♀, 2f.
Ph. vallicola Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 191.
Type locality: Miller Canyon, Huachuca Mts., Arizona
66. *Pheidole virago* Wheeler
Ph. virago Wheeler, Bull. Amer. Mus. Nat. Hist., 1915, 34, p. 401, ♀, 2f; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 192.
Type locality: Santa Cruz River, Tucson, Arizona
67. *Pheidole xerophila* Wheeler
Ph. xerophila Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 446, ♀, 2f, ♂; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 192; Creighton and Gregg, Univ. Colo. Stud., 1955, Ser. Biol. No. 3, p. 37, ♀, 2f.
Type locality: Ft. Davis, Texas
68. *Pheidole xerophila tucsonica* Wheeler
Ph. xerophila subsp. *tucsonica* Wheeler, Bull. Amer. Mus. Nat. Hist., 1908, 24, p. 448, ♀, 2f; Creighton, Bull. Mus. Comp. Zool., 1950, 104, p. 192; Creighton and Gregg, Univ. Colo. Stud., 1955, Ser. Biol. No. 3, p. 40, ♀, 2f.
Type locality: Tucson, Arizona

69. *Pheidole yaqui* Creighton and Gregg

Ph. yaqui Creighton and Gregg, Univ. Colo. Stud., 1955,
Ser. Biol. No. 3, p. 43, ♂, ♀.

Type locality: Yaqui Well, Anza Desert State Park,
California

It will be apparent from the foregoing key and the list of species now recognized in the North American fauna, that there are important changes from the revision which Creighton presented in 1950. Many of these innovations have been treated in our joint paper of 1955 and need not be repeated here, but a few additional ones made since then deserve explanation.

Pheidole californica micula has been raised to species rank because, though related to the *californica* complex, it is quite distinct from the various subspecies of this complex. It is similar to the *californica* group in the possession by the worker major of a small, trapezoidal postpetiole, with no connules, and a shining promesonotum, but it differs in that the cephalic rugae are not rugae at all (rather fine rugules or better striations), and striations are present on the genae also. The humeri lack bosses, and the vertex is smooth and shining. In some respects, *micula* is related to the *sitarches* complex, from the appearance of the transverse occipital striations and the absence of humeral bosses. But it differs from this group in that the vertex is virtually smooth and shining (opaque in *sitarches*), postpetiole is not furnished with blunt connules, and the pronotum is not transversely striated and punctured. In other words, *micula* is structurally intermediate between these two groups, and is best regarded as an independent species.

It has been suspected that *Pheidole californica shoshoni* Cole might be an invalid taxon, and to help determine its status Dr. Cole kindly lent me two paratype soldiers. Comparison of these with soldiers of the subspecies *oregonica* showed the forms to be indistinguishable from each other. The subspecies *shoshoni* must be placed in the synonymy of *oregonica* as the latter has priority. Comparisons were made also between the types of *shoshoni* and the typical *californica*, with the following results. The occipital rugae of *shoshoni* are straight, rugae are almost absent from the sulcus, and the cephalic punctures are no wider in diameter than the hairs, whereas in *californica* the occipital rugae are wavy, rugose reticulations are visible in the sulcus, and the cephalic hair punctures are distinctly wider than the

hairs arising from them. The crest of the petiole in *californica* is broadly and shallowly emarginate, but in *shoshoni* it is entire and straight. These are the distinctions which separate *californica* and *oregonica* also, and would be expected of *shoshoni*, of course, if as now thought, it is identical with *oregonica*.

Pheidole sciara Cole is closely related to *Ph. cockerelli* Wheeler, and Dr. Cole (1956) has presented a detailed and careful differentiation between these two ants. Upon comparing specimens of *cockerelli* with paratypes of *sciara* kindly given me by Dr. Cole, I am confident they are separate species, and I have summarized the observed differences in the accompanying key. It may be added here that the workers have pilosity like that of their conspecific soldiers, and the pronotum in *sciara* is less shining. Also, the scapes of the *sciara* major are slightly shorter than $\frac{3}{4}$ the distance from their insertions to the occipital border, and thus approach the condition in *crassicornis*.

Pheidole sciara might be easily confused with the polymorphic species *Ph. subdentata* if only intermediates of the latter form were available for identification. Comparison of the major of *sciara* with individuals of *subdentata* comparable in size, shows a number of notable differences as follows: occipital lobes of *sciara* fully rounded (lobes of *subdentata* somewhat flattened laterally, more pointed toward the rear, and producing a constricted aspect to the posterior portion of the head); clypeal border with a distinct and narrow notch (clypeus sinuate in *subdentata*); scapes of *sciara* decidedly shorter; apical mandibular teeth sharp and quite similar except that in *subdentata* a conspicuous sulcus on the blade of the mandible separates the two teeth basally; epinotal spines longer, further apart and quite blunt and rounded at the tip in *sciara*; postpetiole much broader than long in *sciara*, more quadrate in *subdentata*. The full-sized major of *subdentata* shows all these differences in more pronounced degree except the occipital character; the head of the major in *subdentata* is very broad.

The workers (minors) of these two species are readily distinguished by the fact that in *sciara* the head (except for frons and clypeus), the thorax and the pedicel are heavily punctured and opaque, while in *subdentata* the head, pronotum and the tops of the pedicular nodes are smooth and shining. There is a marked notch in the promesonotum of *sciara* and the epinotal

spines are long, strong, and pointed upward (in *subdentata* reduced to minute points, almost denticles).

The two species may be separated also on the basis of color; *sciara* is dark red-brown while *subdentata* is ferruginous to yellowish in the minor.

Pheidole floridana and *Ph. floridana lauta* are here considered to be identical, and the latter falls as a synonym. In the American Museum of Natural History are types of both which Dr. Creighton has carefully compared for me. Specimens from Florida which I left with him were also compared to the types. His conclusions (in litt.) may be reproduced as follows: "Your specimens from Royal Palm Park are identical with the types of *floridana* in the A.M.N.H. collection. . . . I also compared them again with the types of *lauta*. The differences which Wheeler notes in clypeal sculpture and shape of the mesothorax in the major simply don't exist. The sculpture on the first gastric segment of the minor varies. Two of your specimens have it (therefore would be *lauta* according to Wheeler) and two of them lack it (therefore would be *floridana*)." It is also worthy of notice that in Creighton's 1950 treatment of these ants (p. 180), he anticipated the possibility that further study would show them incapable of subspecific separation. My study of authentically determined specimens of *floridana* and of *lauta* shows that, in the major, the clypeus is longitudinally rugose and medially carinate in both, the thorax is equally punctate, and the mesonotum equally angular. In the minor the base of the gaster is opaque or subopaque in many individuals of *floridana*.

The ant Wheeler described as *Pheidole constipata* is still known only from type material, and its proper status cannot be conclusively determined. It appears, however, to be only a western race of *floridana* as far as we could tell from re-examination of the types, and the differences are cited in the accompanying key.

Creighton suggested in 1950 that *Pheidole ceres* might be divisible into two subspecies, the usual form being represented by populations in the southern part of its range, and a more heavily sculptured, northern race centered around Boulder, Colorado. At that time he also restricted the type locality to Colorado Springs in an effort to clarify the nature of the species.

Wheeler had included material from several localities in the type series.

In order to test the above possibility, I have examined specimens from many colonies of *Pheidole ceres* collected in Colorado at widely separated stations. There are heavily sculptured soldiers and others with the cephalic sculpture reduced enough to leave the vertex virtually smooth and rather shining. But I could not find any correlation between these conditions and geographic position. Furthermore, there are a number of collections representing mixed nest series, for example, one from Kosslers Lake, near Boulder, one from Turkey Canyon, at Morrison, west of Denver, two from Colorado Springs, one from Durango, and one from Mesa Verde, Colorado. It may be concluded that there is considerable lability in the head sculpturing of the major caste in *ceres*, so that a good series of specimens is desirable for making determinations of this species, but there is no evidence so far to support the recognition of any subspecies. The species is fairly common, and sufficient material has been studied to warrant the conclusions drawn.

Considerable doubt exists as to the validity of the ant which Wheeler described as *Pheidole vinelandica* subsp. *buccalis*. Creighton designated this ant a subspecies of *bicarinata*, but stated that it intergrades with *vinelandica* in western Texas. Any of the subspecies of a species may breed (at least potentially or theoretically) with any other, but since *vinelandica* is, according to Creighton, an eastern and southern race which extends to Texas, and since it was thought to intergrade with *buccalis* in west Texas, it would seem that *buccalis* is more closely related to *vinelandica* than to the typical *bicarinata*, and to be a southwestern form whose range overlaps that of the southern race. The range of *buccalis* is given as Arizona, southern Utah and east to Texas. Morphological examination of specimens which key out to *buccalis* appear to bear out this conclusion. In 1956, Cole published the results of his experience with this form in Arizona (including the type locality, Prescott), and in New Mexico. He states that it occurred intimately interspersed with colonies of typical *bicarinata* (the latter was not supposed to extend west of the Rockies as far as Creighton's records showed in 1950), and even to nest in identical stations. If this is the case, then the two forms cannot be geographic races, and must

be either distinct species, or one a synonym of the other. The confusing structural intermixture of supposed *buccalis* with both *vinelandica* and *bicarinata* makes it extremely unlikely that *buccalis* can be an independent species, and to demonstrate that it is such would take many more data than at present exist. I can see no objection to accepting Dr. Cole's suggestion (1956) for relegating *buccalis* to synonymy, but I have placed it under the subspecies *vinelandica* to which it seems somewhat more closely linked and under which it was originally described (vide supra).

Cole also suggested (1956) that *Ph. bicarinata longula* be raised to full specific rank. Though there is apparently no known evidence of intergradation between *longula* and the typical *bicarinata* as yet, the morphological differences between them are very slight, and the range and habits of *longula* are imperfectly understood. I agree with Creighton that the evidence for specific distinctness here is weak and am disinclined to follow Cole's proposal. Until more information is obtained, it seems preferable to regard *longula* as a subspecies of *bicarinata*. Structural characteristics and geographical range of the ant are not, so far, inconsistent with this view.

The discovery of a new member of the *bicarinata* complex in Nevada has been described above as the subspecies *paiute* and is carried in the key. Its status at this time is provisional owing to the small amount of material available for study.

In 1953 Cole, after studying types of both, proposed that *Ph. sitarches campestris* be synonymized with *Ph. sitarches soritis* on the basis of inconsequential differences between them. Later, in 1956, upon reviewing numerous samples from New Mexico and Arizona, he reversed this decision by concluding that *soritis* was a variant population within the widespread, typical subspecies, and therefore suggested that *soritis* be made a synonym of *sitarches sitarches*. It cannot be denied that much variability exists in the representatives of this complex coming from New Mexico and Arizona, but Dr. Cole's contention that this does not indicate intergradation between two subspecies (*soritis* and *sitarches*) is open to reasonable doubt. As Dr. Creighton has pointed out, Wheeler's type series for the typical *sitarches* included specimens from New Braunfels and Austin, Texas, and he showed that Austin is an area of intergradation for *sitarches*

with its northern race, *campestris*. Wheeler's unfortunate inclusion of the Austin specimens created confusion with respect to the nature of the true *sitarches*, and Creighton (1950) attempted to correct this by restricting the type locality to New Braunfels where the ants show more constant characters, and where a certain number of the types of *sitarches* were obtained. Cole states that west of Amarillo, Texas, there is a blending zone of the subspecies *campestris* with the subspecies *sitarches*. It thus appears that the region from which part of the original type series of *sitarches* came (Austin), and from which the types of *soritis* were collected (Albuquerque), are areas of extensive mixing and intergradation. It would not be surprising then to find the differences between the types of these forms something less than convincing. The restriction of the type locality for *sitarches* to New Braunfels appears to be a step in the right direction toward elucidation of the tangle, as the following points will indicate. Dr. Creighton kindly supplied me with homotypes of *sitarches* collected at Iturbide, Nuevo Leon, Mexico, which differ from the Wheeler types only in being darker in color. The promesonotum and the entire head of the minor, except for weak striae on the anterior genae, are smooth and shining, agreeing in part with the original description which was based on a mixed series. He also sent me specimens of *soritis* from Parral, Chihuahua, Mexico and from the Henry Mountains in southern Utah, in which the heads are striato-punctate.

These data lead to the conclusion that three western races of *sitarches* do in reality exist, and from them we may draw a tentative picture of the distributional pattern. The typical *sitarches* has a coastal range centering around Brownsville, Texas and southward into Mexico, extending inland to a limited degree. The subspecies *soritis* has a very large range reaching from Parral in southern Chihuahua through west Texas, New Mexico, Arizona, and into southern Utah. The subspecies *campestris* occurs from central Texas to Mississippi, north to Missouri, and (from recent records) west into the plains of Colorado. A confusing intergradation of these forms seems to take place from the region of Austin, Texas, north and west, and it is precisely this area in which a large number of the records so far gathered have come. This, coupled with the description of races based on collections made in that region, have served

to compound the uncertainties. The evaluation of the subspecies of *sitarches* in western North America as presented here is offered not as a final solution, but as one subject to further modification with the acquisition of more information. The region of southern Texas and particularly adjacent states in northern Mexico, eventually, should yield critical data bearing on this problem. I venture to suggest that *sitarches* may turn out to be a coastal and lowland race, and that *soritis* will be seen as a subspecies of the mesas and mountain flanks of the high interior. Intergradation between the two in northern Mexico, has, so far as I know, not been demonstrated, but this may be attributed to the scarcity of records.

Pheidole sitarches littoralis Cole is quite distinct morphologically and geographically from the other forms of the species. In fact, one may suspect that *littoralis* is an independent species on the basis of the cephalic sculpture of the soldier, which is reticulate and foveolate rather than transversely striate, but until more is known about this ant, it seems best not to elevate its position.

In 1951, Smith listed all forms of *Pheidole* that up to that time had been recorded from America north of Mexico, and this included two new introductions. *Pheidole flavens sculptior* is a West Indian species that is now said to be present in Florida also. *Pheidole megacephala* is a well-known tropical tramp of considerable economic importance, and has apparently reached Florida in recent years.

The most aggravating situation with respect to our North American forms of *Pheidole* centers around certain species of the *flavens* group. In 1908, Wheeler described *Pheidole nuculiceps* from a single soldier and three workers taken at New Braunfels, Texas. I am informed by Dr. Creighton (in litt.) that the type major and a minor are now present in the collection of the American Museum, and this means that the only type of the soldier caste in existence is in the possession of that institution. According to Wheeler, *nuculiceps* is very distinct from all the described North American species of the *flavens* group. But he says it closely resembles *Ph. exigua* Mayr of South America, the main difference being that the head sculpture of *nuculiceps* is heavier and extends over the occiput, whereas in *exigua* this region is smooth and shining.

In 1941, Mrs. Gregg and I collected a member of the *flavens* group in Brickel Hammock, Miami, Florida, and its identification has caused no small amount of difficulty. In Creighton's key of 1950, it runs out to *nuculiceps*, but upon comparison with the original description, with which it appears to coincide very well, there is an important discrepancy in the cephalic sculpture. Creighton has very kindly compared my specimens, side-by-side, with the above mentioned types in the American Museum, and is able to assure me that the two ants are *not* conspecific. He states that the type of *nuculiceps* has a much broader postpetiole and the lateral connules are prominent. It also shows the cephalic rugae crossing the occipital lobes all the way to their rear margins, whereas in the Miami specimens the occiput is smooth and shining; the difference is stated to be very striking. This has led to the conclusion that the Brickel Hammock specimens may be, in reality, *Pheidole exigua* Mayr, and thus constitute an addition to the North American fauna.

The difficulty, however, does not end here. As indicated above, Smith recorded *Ph. flavens sculptior* from Florida, and in the interest of further clarification, I have asked Dr. Smith for permission to examine specimens of *sculptior* and *exigua* which he obtained in good series during residence on the island of Puerto Rico. Dr. Smith replied by lending me samples of *sculptior* from Martinique, St. Croix, and Puerto Rico in the West Indies, and from Miami, Florida, but said that he was unable to locate any *exigua* in the collection of the National Museum. Wheeler (1908) provided a detailed description of the worker, soldier, and female castes of *exigua*, based on three females, numerous soldiers, and workers collected in Puerto Rico. The Brickel Hammock specimens agree fairly well with this description, except that the flattened, scrobe-like areas on the head of the major are distinctly punctate (not indistinctly), and shining. According to Mayr (1887), the major of *exigua* has the antennal furrows smooth, humeral angles weak, and the mesonotum without transverse striae but finely reticulo-punctate. The first two of these characters, and particularly the first, would appear to differ from the Florida ants to hand. Emery, in 1894, from examination of a topotype of *exigua*, states that the antennal scrobes are smooth and very shining, and further

maintains it is so similar to the typical *flavens* that it should rank only as a subspecies of that form.

It will be noticed that there is disagreement among these accounts with regard to the nature of the so-called antennal scrobes, which in most of the forms are not truly scrobes but flattened or slightly concave areas lying beneath the scapes when these are in repose. Emery possessed presumably typical examples from Cayenne (the type locality), but it is not clear whether he also had seen any of Mayr's types for comparison. Wheeler received two workers of *exigua* from Emery, and this may have led him to identify his Puerto Rican material as *exigua* and to the redescription of that ant as outlined in the preceding paragraph. The worker caste among related species and subspecies of *Pheidole* is so often unreliable for specific identification it is surprising that Wheeler would have made use of them (Emery workers) in this way, and it is further possible that Wheeler may not have possessed specimens of the true *exigua* at all. In the American Museum collection a tray labelled *exigua* contains two pins of specimens from British Guiana, but they cannot be that insect, nor even members of the *flavens* group, for the head and thorax of the minors are smooth and shining. Wheeler's 1908 description of *exigua* is supposed to have been based upon a long series of specimens, but if they are in the American Museum, they are not in the tray of *exigua* specimens, and thus far have not been located.

The difficulties with regard to these species, however, are not insoluble. Dr. Charles Ferrière, at the Museum of Natural History in Geneva, Switzerland, generously permitted me to borrow a single cotype soldier of *Pheidole exigua* Mayr, from Cayenne, and several types of *Pheidole flavens sculptior* Forel, from the collections of the museum. I have made careful comparisons of the *exigua* cotype with Wheeler's description of this species as given in the Bulletin of the American Museum, Volume 24, page 134 (1908). The agreement between the two is very good, except for certain apparent discrepancies which can be traced to the difficulties of language and interpretation. Since it is impossible to know precisely what Wheeler meant, we are forced to rely on his probable meaning. The head is stated by Wheeler to be a little longer than broad, and indeed it appears

to be, but actual micrometer measurements show that the length (excluding the mandibles) exactly equals the width. It is possible Wheeler depended upon apparent conditions and may not have taken measurements. The mandibles are said to have two apical teeth and two smaller basal ones. The closed mandibles of the type make it impossible to see the basal teeth, and the apical ones are not present, though it is evident they did exist and have been worn off. According to Wheeler, the anterior $\frac{3}{4}$ of the head, thorax, petiole, and sides of the postpetiole are subopaque. The specimen agrees with this except for the head, which, though sculptured anteriorly, is nevertheless shining. The expressions "shining", "subopaque", and "opaque" are susceptible to variable shades of meaning, as anyone who has studied myrmecological descriptions can testify. Whether a surface is thought to be subopaque or shining can depend upon the amount of illumination and the power of magnification used, and it has been observed also that the same investigator may vary in his interpretation, regarding a surface of a given texture as subopaque in one species and as quite shining in another. On the type of *exigua* the cephalic interrugal sculpture is faint enough to leave the surface virtually shining. This, of course, might not be true if one had additional specimens to examine, and it points up one of the serious limitations of type material, despite the admittedly great importance of such material. Wheeler further states that the antennal scrobe is sharply defined laterally by a distinct ruga, and that all rugae on the sides of the head stop abruptly at the scrobes, their surfaces being indistinctly punctate and shining. At first sight this seems to be a serious discrepancy between the type and the description, but upon closer examination the situation clears up. In certain other members of the *flavens* group, the so-called "scrobe" is nothing more than a broad flattened area on the side of the head between the frontal carina and the eye, and is much wider than the antennal scape. This same flattening is evident also on the *exigua* type, but there appears to be a much deeper longitudinal groove just below the carina (which extends far posteriorly), and this groove is wide enough only to accommodate the scape. There are no rugae in the groove, it is shining, and it is bounded laterally by a long ruga which parallels the frontal carina. Be-

yond it, other rugae cross the flattened area on the head, which upon initial view appear to disagree with Wheeler's statement. If this is the correct interpretation of Wheeler's treatment, then the above-mentioned inequities among the descriptions of Mayr, Emery, and Wheeler with reference to the scrobe, disappear, and we may conclude that the latter's description of *exigua* was based on specimens belonging actually to that taxon.

It is now necessary to return to the ants which Dr. Smith sent me as representatives of *Ph. flavens sculptior*. Those from St. Croix and Puerto Rico (Smith det.), and from Martinique (Forel det.) fit precisely the characters given in Smith's key to the ants of Puerto Rico (1936). Smith's conception of this species (in litt.) is based upon Wheeler's determined specimens and published descriptions. The specimens of *Ph. flavens sculptior* sent me from Geneva are labelled "Typus" and they are from the Island of St. Vincent, the type locality. Dr. Ferrière cautions, however, that while there are several cotypes of *sculptior*, he sent specimens marked as types because it is not always certain that specimens labelled cotypes in Forel's collection are really from the same locality. Nevertheless, these ants are the only samples of presumably undoubted type material I have been able to examine. Upon comparison of them with Smith's specimens from Puerto Rico, I find there is complete agreement, and we may conclude that Dr. Smith had examples of the true *sculptior* when he wrote his account of the ants of Puerto Rico.

Before attempting to decide what the Miami, Florida ants are, it seems advisable to distinguish between *exigua* and *sculptior*, especially in view of the opportunity for comparing type material. The results of this study may be outlined as follows. The cephalic rugae on *exigua* are coarse, far apart, and cover the anterior $\frac{3}{4}$ of the head, leaving the vertex and occiput smooth and shining. The interrugal sculpture is sparse so even the anterior sculptured part of the head is shining also. The antennal scrobe is distinct, smooth surfaced, bordered by a long frontal carina and a lateral ruga, and appears to be truly a scrobe for the reception of the scape. The flattened area of the head continues the scrobe laterally and is crossed by coarse rugae.

The cephalic rugae on *sculptior* are finer, closer together, and

merge into weak reticulations on the vertex. Interrugal punctures are dense making the whole head opaque except for the narrow zone at the extreme rear margin of the head surrounding the foramen magnum, which is shining. The flattened lateral area of the head is hardly a true scrobe, the carina bordering it medially is weak and short, there is no lateral carina, its surface is densely punctate, and it is not traversed by rugae.

The promesonotum of *exigua* has prominent, wavy, transverse rugae anteriorly, whereas the posterior portion behind the humeral angles is heavily punctate. Viewed from behind, the promesonotum is transversely arched and strongly convex, with humeral angles inconspicuous. The mesonotum descends very abruptly in a vertical plane (even slightly undercut) to the mesoëpinotal suture, which is deep. The promesonotum antero-posteriorly is also decidedly convex.

The promesonotum of *sculptior* has a weaker, reticulate, transverse sculpture, but is also punctate posteriorly. Viewed from behind, the transverse convexity is weaker and lower so that the humeral angles are much more pronounced. The antero-posterior convexity is low, but the descent to the mesoëpinotal suture is abrupt as in *exigua*. The epinotal declivity is transversely striate in *exigua* and the hairs are short, stubby and sparse, whereas the declivity is punctate in *sculptior* and the hairs are long, uneven in length, and numerous.

Next, a specimen of the major of the typical *Pheidole flavens* Roger from Soledad, Cuba, sent me by Dr. Creighton, clearly shows important distinctions from the two foregoing species. The "scrobe" is much less distinct than that of *exigua*, being only a flattened lateral area between the carina and the eye, crossed by a few faint rugules and definitely punctate, but still it is shining. Dr. Creighton informs me that other variants of *flavens* show this same condition. The scrobe is even flatter and less distinct than the corresponding region on *sculptior*, which it will be recalled is a bit concave, is densely punctate and opaque, and is not crossed by rugae. Furthermore, the vertex and occiput of *flavens* are smooth and shining as in *exigua*, but the rest of the head is subopaque owing to interrugal sculpture, though not dense enough to render the head opaque as in *sculptior*.

The promesonotal rugae are weaker than in *exigua* and reticulate, being in this respect like those of *sculptior*. The epinotal spines of *flavens* point vertically upward in contrast to those of the other ants, which though they stand upright, slope diagonally to the rear. In view of all these differences, it is doubtful if *exigua* can be regarded as a subspecies of *flavens*, as Emery treats it, and therefore shall be designated a full species, *Pheidole exigua* Mayr. On the other hand, *Pheidole flavens sculptior* Forel is less distinct anatomically and its distributional behavior accords well with that of a subspecies. I believe it should remain in that status.

The specimens of *sculptior* from Miami, Florida (Buren det.) and the sample obtained from Brickel Hammock are indistinguishable. Despite the similarities of the scrobes and their sculpture, these ants are not identical, however, with the examples of *sculptior* from Puerto Rico and Martinique, nor with the types from St. Vincent. This is evident especially from the smooth (almost sculptureless) and shining occipital lobes of the Florida ants. In *sculptior*, the cephalic rugae and punctures completely cover the head, making it opaque, except at the extreme posterior margin around the foramen which is smooth and shining. In addition, the epinotal spines of the Brickel Hammock ants are longer and sharper than those of *sculptior*. These two samples of the *flavens* group in Florida cannot represent *Ph. flavens sculptior* (from the West Indies), and unless this subspecies is known from Florida by other specimens, or is there but not yet collected, this discovery requires a revision of the North American list. *Pheidole flavens sculptior* must be dropped, and that is the plan followed in this paper.

The Miami specimens cannot be considered *Ph. exigua* either, because of a number of structural differences. The scrobes are too weak, they are punctate, and the head is shining only posteriorly on the vertex and occiput. The promesonotum is not strongly arched in a transverse direction so that the humeral angles are more prominent as a consequence, and the descent of the mesonotum to the mesoëpinotal suture is sloping and gradual. They differ from *flavens* by having the scrobes slightly more concave and densely punctate (the flattened areas of *flavens* are sparsely punctured and shining), but otherwise these ants seem

to be closer to the typical *flavens* than to any of the other forms. Therefore, it may be assumed that the Miami ants are either a new species or that they represent a variant of the *flavens* population at the tip of the Florida peninsula, perhaps a new subspecies. I incline to the latter interpretation, but until a good series of specimens of this ant can be obtained for more complete study, it is preferred not to supply a formal name. The population will be regarded for the moment as not quite typical representatives of *Pheidole flavens*. The proximity of Cuba to south Florida and the ease of accidental spread to the mainland at some time in the remote past make this supposition at least plausible.

Whether *nuculiceps* will ultimately prove to be a synonym of *sculptior* (owing to the similarity of the cephalic-sculpture which entirely covers the head), it is impossible to say. The types of these ants would have to be compared, but in view of the wide gap in known distribution and the fact that *sculptior* is an insular form on a number of the islands of the Caribbean, it is decidedly improbable, unless a rare introduction onto the mainland of Texas could have taken place, in which case it ought to show up at intermediate points also. Furthermore, the relatively broad postpetiole and its prominent lateral connules would seem to preclude any possibility that *nuculiceps* would be the same as *flavens* or any of its variants.

Recently, a taxonomic tangle centering around *Pheidole vasliti* Pergande from Mexico has been detected by Creighton. He has published a revision of this complex which proposes to treat *vasliti*, *hirtula*, and *subdentata* as full species. The variety *arizonica* described by Santschi originally as a full species falls as a synonym of *subdentata*. Thus the ant designated by Creighton in 1950 as *Pheidole vasliti arizonica* Santschi now becomes *Ph. subdentata* Pergande. This is the only member of the group, so far as known, that occurs within the boundaries of the United States.

In 1950, Creighton placed the ant *Pheidole macclendoni* in a group where the major was supposed to lack transverse striae on the pronotum. This has been found to be in error because at the time his key was compiled he had not seen the true major of this polymorphic species, and it is now known that the latter caste

does possess transverse pronotal striae. Wheeler's description of the major of *macclendoni* fits the characters of that caste accurately, to judge from specimens collected recently by Cole near Laredo, Texas. Measurement of the head lengths in the various castes of this series give the following results: minors, 0.75 to 0.83 mm.; a larger media, 2.1 mm.; and majors, 2.5 mm. A smaller media (one of Wheeler's cotypes) in Creighton's collection has a head 1.5 mm. long. Wheeler states in the original description of the species that the head length of the intermediates varies from 1 to 2 mm., and that the length of the soldier head is 2.6 mm. Though the head of the majors in Cole's series is one tenth of a millimeter shorter than the measurement given by Wheeler for the type soldier, it would appear that they do belong actually to the major caste. There is one feature of this caste mentioned in Wheeler's description, however, that does need some clarification. According to his account, the petiole viewed from above is "violin-shaped," and as broad in front as it is behind, with concave sides. This appearance is due to the presence on the sides of the peduncle of broad, blunt, lateral tubercles, bearing the petiolar spiracles at their extremities. These protuberances are as prominent as the lateral borders of the petiolar node, and the margin of the segment between them and the node is consequently concave.

Besides the characters given in the key, the soldier of *macclendoni* can be distinguished from *titanis* by its bidentate clypeal margin as opposed to the deep, narrow notch on the clypeus of the latter species, and by its stout, convex mandibles as compared to the longer, straighter and sharper mandibles of *titanis*. From *virago* it differs by its bidentate rather than sinuate clypeal margin, its smooth rather than longitudinally rugulose median clypeal lobe, its longer scapes which reach as far as the eyes and a postpetiole which is less than twice as wide as the petiole. The petiolar tubercles mentioned above also clearly separate *macclendoni* from *virago* and the two ants differ much in size, the major of the former measuring 5.5 to 6.0 mm. and the latter 4.0 to 4.5 mm.

The ant described by Wheeler in 1915 as *Pheidole tepicana cavigenis* has been reviewed in connection with *tepicana* Pergande and other species which were formerly confused with it (Creigh-

ton and Gregg, 1955). In our revision it was shown that *cavigenis* could not be related to *tepicana*, despite Wheeler's placement of it, because it lacks the deep clypeal emargination so typical of *tepicana*, and for other reasons also. At that time it was suggested that *cavigenis* probably belongs to *sitarches*. The difficulty in this allocation results from the fact that several members of the *sitarches* complex are most certainly recognized from features shown by the minor. Since *cavigenis* was described from the major only, its exact relationship may never be certain. However on the basis of distribution it seems probable that *cavigenis* is a synonym of *sitarches soritis*. It has been so treated in this study.

Literature

- COLE, A. C. 1953. Studies of New Mexico ants. V. The genus *Pheidole* with synonymy. Jour. Tenn. Acad. Sci. 28: 297-299.
- . 1956. Observations of some members of the genus *Pheidole* in southwestern United States with synonymy. Jour. Tenn. Acad. Sci. 31: 112-118.
- CREIGHTON, W. S. 1950. The ants of North America. Bull. Mus. Comp. Zool. 104: 1-585.
- . 1957. A revisionary study of *Pheidole vasliti* Pergande. Jour. N. Y. Ent. Soc. 65: 203-212.
- CREIGHTON, W. S. AND R. E. GREGG. 1955. New and little-known species of *Pheidole* from the southwestern United States and northern Mexico. Univ. Colo. Stud., Ser. Biol. No. 3. pp. 1-46.
- EMERY, C. 1894. Studi sulle formiche della fauna neotropica, VII-XVI. Bull. Soc. Ent. Ital. 26: 137-241.
- MAYR, G. 1887. Sudamerikanische Formiciden. Verh. Zool.-bot. Ges. Wien. 37: 511-632.
- SMITH, M. R. 1936. The ants of Puerto Rico. Jour. Agri. Univ. Puerto Rico. 20: 819-875.
- . 1951. Hymenoptera of America north of Mexico, synoptic catalog: Family Formicidae. U. S. D. A. Mon. No. 2, pp. 778-875.
- WHEELER, W. M. 1908. The ants of Porto Rico and the Virgin Islands. Bull. Amer. Mus. Nat. Hist. 24: 117-158.
- . 1908a. The ants of Texas, New Mexico and Arizona. Bull. Amer. Mus. Nat. Hist. 24: 399-485.
- . 1915. Some additions to the North American ant-fauna. Bull. Amer. Mus. Nat. Hist. 34: 389-421.