Revision of the Genus Stenamma Westwood in America North of Mexico (Hymenoptera, Formicidae)

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Stenamma is one of the most primitive and also one of the smallest genera of myrmicine ants. The total number of described forms for the world is less than 30. This revision treats of 11 species for America north of Mexico, three of which are described as new. Although the genus was formerly thought to occur only in the Holarctic region, recently several forms have been described from the Neotropical region. However, some of these may eventually prove to be *Stenamma* in a broad sense only. The small number of recorded forms may be due to the small, well-concealed nests and the secretive habits of the ants. Headley (1952), for instance, in studying the ants of a locust grove in Ohio found *brevicorne* to be the second most common species in the number of colonies present, but he was able to locate colonies only by spreading bread crumbs on the surface of the soil and watching the foraging workers return to their nest with the food. Mary Talbot, in her unpublished studies of ants in the Droste Woods, St. Charles County, Missouri, in 1948-53, found three species of *Stenamma* in that area. Two of them, *schmittii* and *impar*, were common in the soil stratum. W. L. Brown has stated that, although he could find stray workers of one or more species in the spring or early summer in eastern Massachusetts, he had difficulty in locating colonies. Although *schmittii* is known to occur in the Edwin S. George Reserve in Michigan, Mary Talbot writes that she has not only been unable to find colonies but failed even to collect the species. The restricted habitats and drabness of color of the workers may also be responsible for the infrequent collecting of *Stenamma*. There appears to be no reason, though, why *Stenamma* should not be found in every one of our States, although records are still lacking from a number of them, especially the more central and southern States. Since the ants are confined largely to wooded areas, one should not expect to find them in all types of ecological habitats. In approximately the northeastern fourth of the United States four of our most common species are *brevicorne, schmittii, diecki,* and *impar*. Present records indicate that in our Western States *diecki* and *occidentale* are not uncommon.

Stenamma is represented by a fossil species, *berendti* Mayr of the Baltic Amber. Geologists assign the Baltic Amber to the Tertiary period, which is supposed to have existed about 60 million years ago. This single fossil species is known from two males only, which, peculiarly enough, have the same type of wing venation as our common North American *brevicorne* (Mayr) and not that of the common *European westwoodii* Westw. Ants of

the Baltic Amber had essentially the same general habits as our present-day forms; that is, they lived in colonies, some were of terrestrial habits, others arboreal, some forms attended plant lice, others did not. The lack of *Stenamma* workers in the Baltic Amber can be explained by the fact that the ants are noted for their terrestrial habits.

BIOLOGY

The general habits of our *Stenamma* are more or less stereotyped. The ants are usually confined to wooded areas, where their small and well-concealed nests may be found in objects lying on the surface of the soil such as logs, stumps, branches of trees or other woody debris, nuts and acorns. More commonly the ants nest in the soil beneath rocks, logs, moss, debris or humus. Their nests consist usually of only one to a few chambers (seldom more than an inch in width or length) placed in the upper 12-18 inches of the soil. The colonies are smaller than those of most other ants, ranging from a few dozen to several hundred adults, depending on the age of the colony and the time of year. The colonies are probably largest in midsummer to early fall. The largest colony that has come to my attention had 376 adults, including workers, males, and alate females.

Our knowledge of the life history and seasonal activities of *Stenamma* is based on random observations. During the winter a young colony may be expected to contain a mother queen, workers, and larvae. A few eggs have been found as late as October, but it appears doubtful that many, if any, of them overwinter. Although apparently accustomed to cool temperatures, the ants hibernate during the coldest months. In the spring, usually about April, activity begins again in the colony. The workers forage for food and the queen resumes egg laying. The overwintering larvae resume development and reach the adult stage by late spring or early summer. Adults from overwintering larvae appear a few weeks earlier than do those that develop from eggs laid in the spring. Apparently no males or alate females are produced in the younger colonies. In the older colonies these castes usually reach maturity between midsummer and early fall. There is reason to believe that males and alate females may take their nuptial flights as late as the middle of October. However, it is quite common for at least some of the males and alate females to overwinter in the parental colony and to take nuptial flight the following spring or later. It appears that some colonies produce only males, others only females, and still others a mixture of both males and females. As with many ants, it is not uncommon for males and alate females to fly at night and be attracted to artificial lights. It is believed that a single mated female is capable of establishing her colony alone and raising her first brood to maturity.

These ants feed on animal flesh, probably mostly arthropods. Brown and Wilson (unpublished observations) found the larvae of *diecki* feeding on a small dipterous larva determined by W. W. Wirth as probably an empidid, and also on what they thought might be a springtail. Cole and Wilson fed caged *diecki* workers collembolans and thysanurans. Donisthorpe (1927) kept a colony of *westwoodii* Westw. under observation in a cage for

at least five years and fed the ants flies and other insects, bread, cake crumbs, and honey. He found that they did not care much for honey but ate the other food readily. No reports have come to my attention that workers of *Stenamma* attend honeydew excreting insects or show any interest in feeding on honeydew. Donisthorpe found *westwoodii* docile and easy to rear and study in cages. It is my belief that our North American species would also be easy to study in cages. Since these ants have often been found within or in close proximity to the nests of other species, it has sometimes been assumed that they are associated with other ants, but this seems very doubtful.

Some new and interesting observations on *Stenamma schmittii* have been made by W. L. Brown at Lexington, Massachusetts. On October 10, 1954, he noted two foraging workers in leaf litter, and very near them two males though he was unable to locate their nest. One worker was carrying what appeared to be a small dipterous pupa, dead but in good condition; the other worker carried an immature but dead collembolan, *Tomocerus* sp., also in good condition. After studying the two workers in confinement, Brown remarked:

"The workers appear to have no set way of approaching the collembolans, but merely rush their prospective prey with mandibles opened wide. The collembolans usually manage to escape if attacked in an open space between the leaves in my jar, but if caught in a crevice or pocket, they have little chance of getting away. The attack by the ants is clumsy and hurried, in contrast to the finesse displayed by the collembola catching dacetines, and there seems little doubt that springtails form only a part of their diet. . . . Use of the sting has not yet been observed but the rapid immobilization of the collembolan renders stinging a possibility to be considered when conditions of observations can be made more favorable than they were in the cases studied."

Upon returning to the exact spot where he made his first observations on *schmittii,* Brown made further observations as follows:

"Yesterday, November 14 was rather chilly and windy, and as before the *Prenolepis* were foraging in anbundance in the leaf litter, as was the single specimen sent you [*schmittii*—author]. I have checked my notes on old collections and I find that in Pennsylvania all of my *Stenamma* were taken either early in the spring (mostly March) or else in October to December. I think the evidence is becoming very clear that *Stenamma* has unusual seasonal foraging habits geared to cool weather and resembling closely those of *Prenolepis imparis.* It is interesting to note the sudden abundance of *Stenamma* nests easily found in the forest belt where the hardwoods and northern coniferous forests blend into one another, in places that are cool, dark and moist, where few or no other ants are present. In such places, the ants forage actively in the soil cover even on cool, rainy days. Similar conditions are indicated by what I have heard about *Stenamma* collections in the high Smokies and in the Douglas fir forest of the Pacific Northwest."

TAXONOMY

Creighton (1950) has presented an excellent account of the confused and deplorable state of the taxonomy of our North American *Stenamma.* As he pointed out, unsuccessful attempts to develop a satisfactory classification for this group of ants were made by such eminent myrmecologists as Emery, Forel, and Wheeler. All these workers appear to have misinterpreted the significance of wing venation as a character for the differentiation of species, and consequently treated related but distinct forms as variants of a single species. To my knowledge Creighton was the first to indicate that many, if not all, of our named North American *Stenamma* are distinct species. He

apparently arrived at this conclusion largely on the basis of their geographical distribution, since he states, for example, that *schmittii, impar,* and *impressum* often occur in the same stations, a condition which would not be likely if these forms were subspecies. My study of the taxonomy and geographic distribution of these ants fully supports Creighton's contention. I have therefore treated all forms, both old and new, as species.

METHODS

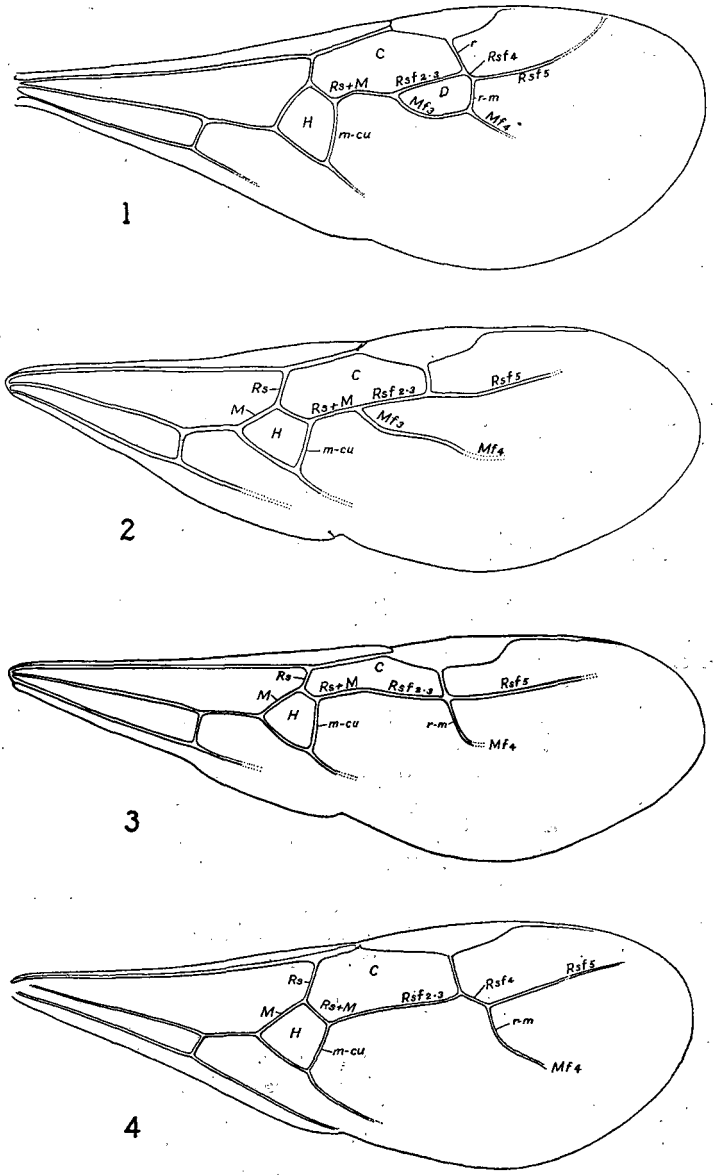
All specimens were studied with a Spencer stereoscopic binocular equipped with 9x ocular and 4.8x objective. The light was an alternating current transmitted through a G.E. automotive interior 6 cp. bulb. The position of the light and its intensity are very important. The sculpturing of the body of certain species, although highly characteristic, is best seen only from certain aspects and under certain light intensities. The longitudinal rugulae at the base of the gaster, for instance, are scarcely apparent when examined from one aspect but distinct from another. It is therefore best to examine body structures, sculpturing, pilosity, or color from a number of aspects.

Measurements are as follows: The length of the ant is the distance from the most anterior part of the head (the head being held in a normal position and not fully extended) to the most posterior part of the body; wings are not included. Head measurements exclusively do not include the mandibles. The length of the head is the distance through the central plane of the head from the most anterior border of the clypeus to a point touching an imaginary transverse line connecting the posterior border of each occipital lobe. The eye is not included in the greatest width of the head, this width being obtained by measuring transversely across the head on a line perpendicular to the axis of the head. The ommatidia counted in each eye are those lying only in the line of greatest diameter. Two thoracic lengths have been used, the greatest length from the anterior border of the pronotal collar either to the apices of the epinotal spines or to a point where the pedicel of the petiole joins the thorax. In the worker the greatest width of the thorax is represented by an imaginary transverse line connecting the two pronotal humeri. In the female and the male this measurement is taken just anterior to the first pair of wings. The narrowest width of the thorax occurs on the epinotum, where a similar transverse line connects the narrowest region of that part of the body.

TYPES STUDIED

Eleven species of *Stenamma* are included in this revisionary study, three of which are new. The new species are *huachucanum, meridionale,* and *occidentale.* I have been especially fortunate in being able to study worker types of all species except *impressum.* Two workers of this species from the U. S. National Museum collection were available for examination, but they are believed to belong to the original nest series, since not only do they very well fit Emery's description but they also bear the proper locality and determination labels, all in Theodore Pergande's handwriting. It should be noted, though, that the type locality of *impressum* is not Richs Springs, N. Y., as given by Emery (1895), but Richfield Springs (Otsego County), N. Y., as

PLATE 1



Figs. 1-4.—Anterior wing. 1. (Aberrant type), male of *S. brevicorne* (Mayr); 2. Female of *S. brevicorne;* 3. Male of *S. occidentale,* n. sp.; 4. Male of *S. westwoodii* Westw.

the labels on these two individuals show. In this revision *impressum* has been synonymized with *diecki*. I have not seen the dealate female type of *impar* or of *sequoiarum*. Table 1 shows the known castes for each of the eleven species.

WING VENATION

Since no attempt has been made to study the wing venation of *Stenamma* from other parts of the world except for the genotype, any remarks in this paper apply to the wing venation of the forms that occur in America north of Mexico. As the emphasis in the venational studies of ant wings is laid on the anterior pair of wings, only the venation of this pair of wings will be discussed.

Apparently the ancestral stock of *Stenamma* possessed an anterior wing similar to that on pl. 1, fig. 1, in which there was a single closed discoidal cell (H) and two closed cubital or submarginal cells (first cubital or first submarginal cell (C) and second cubital or second submarginal cell (D)). When vein r-m vanished from this wing, only Mf3 and possibly a trace of Mf4 were left as shown on pl. 1, fig. 2. This figure represents the normal type of wing now possessed by our species *brevicorne, impar, diecki,* and perhaps others (winged females and males are not yet known for *carolinense, foveolocephalum, heathi, huachucanum, meridionale,* and *sequoiarum*). When vein r-m and possibly Mf4 are retained but Mf3 vanishes, we have a condition like that shown on pl. 1, fig. 3, which is typical for our species *schmittii* and *occidentale* (*neoarcticum*). The *occidentale* type may also be present in other of our species when their wing venation is known. There are thus two characteristic types of venation in the anterior wing of our *Stenamma,* which I shall designate as the *brevicorne* type (pl. 1, fig. 2) in which r-m is absent but Mf3 present and the *occidentale* type (pl. 1, fig. 3) in which r-m is present but Mf3 vanishes. The *brevicorne* type, according to Wheeler (1914), is simliar to that of the fossil *berendti* (Mayr). The *occidentale* type, on the other hand, is similar to that of the common European species (also the genotype of *Stenamma*) *westwoodii* Westw. Owing to the instability of venation, wings are frequently seen with various aberrations. The anterior wing may possess two cubital cells instead of one or a wing in which the discoidal cell is lacking, or the second cubital cell and the discoidal cell may be only partly closed. Similar aberrations may occur in one or both wings.

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Vincent D. Roth, E. O. Wilson, Merle Wing, D. L. Wray, H. V. Weems, Jr., W. L. Brown.

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STENAMMA Westwood

Stenamma Westwood, 1840, Introduct. Mod. Class. Ins. Sup. 2:83. Type: *Stenamma westwoodii* (Stephens, ms.) Westwood. Monob.

Asemorhoptrum Mayr, 1861, Die Europäischen Formiciden, p. 76. Type: (*Myrmica lippula* Nylander) = *Stenamma westwoodii* Westwood. Monob.

Theryella Santschi, 1921, Soc. d'Hist. Nat. l'Afrique du Nord Bul. 12:68. Type: (*Theryella myops* Santschi) = *Stenamma punctiventris* Emery. Monob.

Revisions: Emery, 1895, Zool. Jahrb. Abt. f. System. 8:297-301. Forel, 1901, Soc. Ent. Belg. Ann. 45:347-348. W. M. Wheeler, 1903, Psyche 10:164-168. Creighton, 1950, Harvard Univ., Mus. Comp. Zool. Bul. 104:133-138.

TABLE 1.—Known castes: The following castes have been described for the various species. Only dealate females are known for *meridionale* and *sequoiarum*.

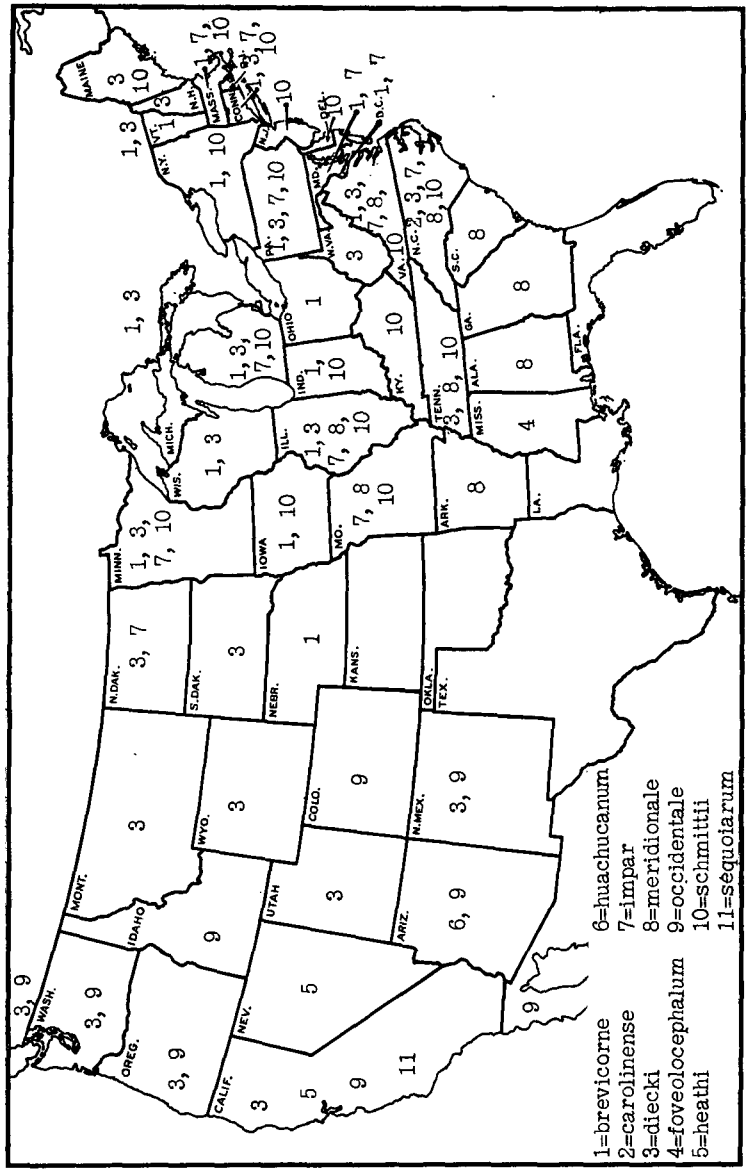
Species	Worker	Female	Male
brevicorne (Mayr)	x	x	x
carolinense M. R. Sm.	x	–	–
diecki Em.	x	x	x
foveolocephalum M. R. Sm.	x	–	–
heathi W. M. Whlr.	x	–	–
huachucanum n. sp., M. R. Sm.	x	–	–
impar Forel	x	x	x
meridionale n. sp., M. R. Sm.	x	x	–
occidentale n. sp., M. R. Sm.	x	x	x
schmittii W. M. Whlr.	x	x	x
sequoiarum W. M. Whlr.	x	x	–

WORKER

Slender ants. Length 2.2-4 mm. Head usually subrectangular, 1.1-1.34 times as long as broad, with subparallel or moderately convex sides, rounded posterior corners and with an emarginate or almost straight posterior border. Antenna 12-segmented; apex of scape not attaining the posterior border of the head; funiculus noticeably enlarged toward the apex, the last four segments longer than the others but not forming a very distinct club; second through the 5th, 6th or 7th funicular segments broader than long. Mandible rather large, subtriangular, with 2-3 large apical teeth and usually 4-6 small, irregular basal teeth. Eye vestigial to moderately large, with from 3-12 ommatidia in its greatest diameter. Frontal carinae short, subparallel. Frontal area impressed, somewhat subtriangular, usually distinct. Clypeus with a pair of longitudinal carinae. Promesonotal suture indistinct or absent. Promesonotum usually rather strongly convex and prominent. Mesoepinotal region with a distinct to a very pronounced impression. Epinotal spines varying greatly in shape and size, ranging from small and tuberculate to large and well developed. Petiole very distinctly pedunculate. Postpetiolar node larger than the petiolar node. Postpetiole separated from the gaster by a distinct constriction. Gaster, from above, subelliptical, without basal humeri. Body, exclusive of the gaster, usually with a rugulose or rugulose-reticulate sculpture and not smooth or strongly shining except in restricted areas. Hairs on the clypeus and front of the head usually longer than elsewhere on the body. Color ranging from light brown through reddish brown to blackish with the appendages and also the base and apex of the gaster commonly lighter.

FEMALE

Larger than the worker (3.2-4.6 mm in length) but otherwise similar in many respects. Differing especially in the larger eye, the greatest diameter of which is from 0.2-0.3 mm and contains 10-18 ommatidia, the possession of 3 ocelli on the vertex of the head and



Map. 1.—Distribution of species of *Stenamma* in United States and contiguous countries

the usual thoracic modifications including the presence of wings. The anterior wing normally contains a closed cubital and discoidal cell but only an open radial cell. Occasionally the venation is aberrant; for a general discussion of this see section on WING VENATION. The normal venation of the anterior wing is of two types, the *occidentale* and the *brevicorne*. The *occidentale* type is characterized by the presence of the r-m cross vein but the absence of Mf3, the *brevicorne* type has the Mf3 but lacks the r-m cross vein. *S. schmitti* has the same venation as *occidentale*, and *diecki* and *impar* the same as *brevicorne*. The wing venation is not yet known for *carolinense, foveolocephalum, heathi, huachucanum, meridionale* and *sequoiarum*.

MALE

Rather slender and small (approximately 2.5-3.5 mm in length). Head 1.1-1.5 times as long as broad, with rounded posterior corners and rounded posterior border; not flattened as in *Aphaenogaster*. Ocelli distinct but not large or prominently protruding above the general surface of the head. Eye placed anteriorly on the head, its greatest diameter approximately 0.2-0.3 mm. Antenna 13-segmented; scape approximately 0.2-0.37 mm in length and about as long as the combined lengths of the first 2.5-6 funicular segments; all funicular segments longer than broad, the funiculus enlarging toward the apex but the last 4 or 5 segments not forming a well defined club. Mandible bearing 2-5 teeth of variable size. Mayrian furrows usually present but sometimes feebly developed or obsolescent. Anterior wing with the same type of cells and veins as with the female of the same species, also subject to the same aberrations. Base of epinotum depressed or flattened in *brevicorne* and also tuberculate on each side; in the other species the base of the epinotum is straight, convex or concave and meets the declivity on each side to form a tubercle or else a rounded or angular protuberance. Legs long and slender, without noticeably enlarged femora and tibiae. Petiole distinctly pedunculate. Gaster without basal humeri. Genitalia not well developed or prominent, seldom exserted, cerci present. Pilosity light yellowish or grayish depending upon the intensity of the artificial light. Sculpture of body more feeble than that of the worker or female. Color of body ranging from brown through blackish brown to black, the appendages usually lighter.

KEY FOR THE IDENTIFICATION OF WORKERS

1. Dorsal surface of much of the first gastric segment with a peculiar shagreening and also scattered punctures which produce a subopaque effect; (epinotal spines rather long and especially acute; dorsal surface of thorax coarsely sculptured, usually of a rugulose-reticulate nature, with the interspaces often quite broad); Calif. and Nev.; pl. 3, figs. 9, 9a ..... *heathi* W. M. Wheeler

1. Dorsal surface of the first gastric segment not as described 2

2. Base of the first gastric segment either without or with vestigial longitudinal rugulae (the length of the rugulae not exceeding 0.05 mm); (body brownish black to black, with lighter appendages, which give the ant a bicolored appearance; much of the body with the punctulate sculpture predominating; epinotum bearing extremely small or vestigial tuberculate spines; petiolar node, in profile, unusually high and very noticeably compressed anteroposteriorly); Ariz.; pl. 2, figs. 8, 8a ..... *huachucanum* n. sp.

2. Base of first gastric segment with well developed or normal longitudinal rugulae 3

3. Large species (length 2.75-4 mm); eye usually with 5-12 ommatidia in its greatest diameter 4

3. Small species (length 2.3-3.5 mm); eye with 3-6 ommatidia in its greatest diameter 7

4. Rugulae or the rugulose-reticulate sculpturing of the promesonotum transverse in direction 5

4. Rugulae or the rugulose-reticulate sculpturing of the promesonotum usually longitudinal in direction 6

5. Eye large, 0.2 mm in its greatest diameter and with 10-12 ommatidia; base of epinotum subhorizontal; epinotal spines extremely short, blunt and tuberculate; N. C.; pl. 4, figs. 14, 14a ..... *carolinense* M. R. Smith

5. Eye smaller, 0.15 mm in its greatest diameter and with 7-8 ommatidia; base of epinotum sloping; epinotal spines tuberculate but with rather acute apices; Miss.; pl. 4, figs. 16, 16a ..... *foveolocephalum* M. R. Smith

6. Petiolar node commonly subconical when viewed from above and behind; (base of epinotum often with a transverse welt; body usually subopaque); Nova Scotia to Va. and west to Nebr. and Minn.; pl. 4, figs. 13, 13a ..... *brevicorne* (Mayr)

6. Petiolar node not usually subconical when viewed from above and behind, also rather compressed anteroposteriorly especially when viewed in profile (epinotal spines commonly unusually long and somewhat digitiform); Va. and S. C. west to Ill., Mo. and Ark.; pl. 4, figs. 15, 15a ..... *meridionale*, n. sp.

7. Base of gaster with unusually long and rather well defined rugulae (some of which are 0.2 mm in length); postpetiole also with well defined longitudinal rugulae; (thorax coarsely sculptured, rugulose to rugulose-reticulate with the interspaces often as broad as 0.10 mm or more; body 3-3.5 mm in length and light brown to dark reddish brown in color); Calif.; pl. 3, figs. 11, 11a ..... *sequoiarum* W. M. Wheeler

7. Base of gaster without unusually long or well defined longitudinal rugulae; if the postpetiole bears longitudinal rugulae these are not normally well defined 8

8. Thorax either shining in the promesonotum or the general surface of the thorax not dulled throughout by numerous, dense and distinct punctures 9

8. Thorax subopaque; the sculpturing highly variable but always of such a nature that the punctures are dense enough to dull the general surfaces regardless of their position or abundance 10

9. Small (2.3-2.7 mm in length); thoracic sculpturing weak; postpetiole seldom noticeably smooth and shining; (ommatidia of eye unusually coarse; petiolar node in profile subangular or angular); Mass. and N. C. west to N. Dak., Ill., and Mo.; pl. 2, figs. 6, 6a ..... *impar* Forel

9. Larger (2.7-3.5 mm in length); thoracic sculpturing highly variable but seldom weak, the promesonotum usually distinctly shining; postpetiole usually smooth and rather strongly shining; Southeastern and Southwestern Canada and most of the United States except the Central and a few of the Southern States; pl. 3, figs. 10, 10a ..... *diecki* Emery

10. Sculpturing of the thorax other than the punctulations often very coarse; prothoracic humeri not well defined; postpetiole seldom entirely smooth or noticeably shining; N. Y. and Mass. to N. C., west to Minn. and Mo.; pl. 2, figs. 5, 5a ..... *schmittii* W. M. Wheeler

10. Sculpturing of the thorax other than the punctulations usually weak; prothoracic humeri often well defined; postpetiole commonly smooth and shining; B. C. to Lower Calif. (Mex.), east to Idaho, Colo. and N. Mex.; pl. 2, figs. 7, 7a ..... *occidentale*, n. sp.

STENAMMA SCHMITTII W. M. Wheeler

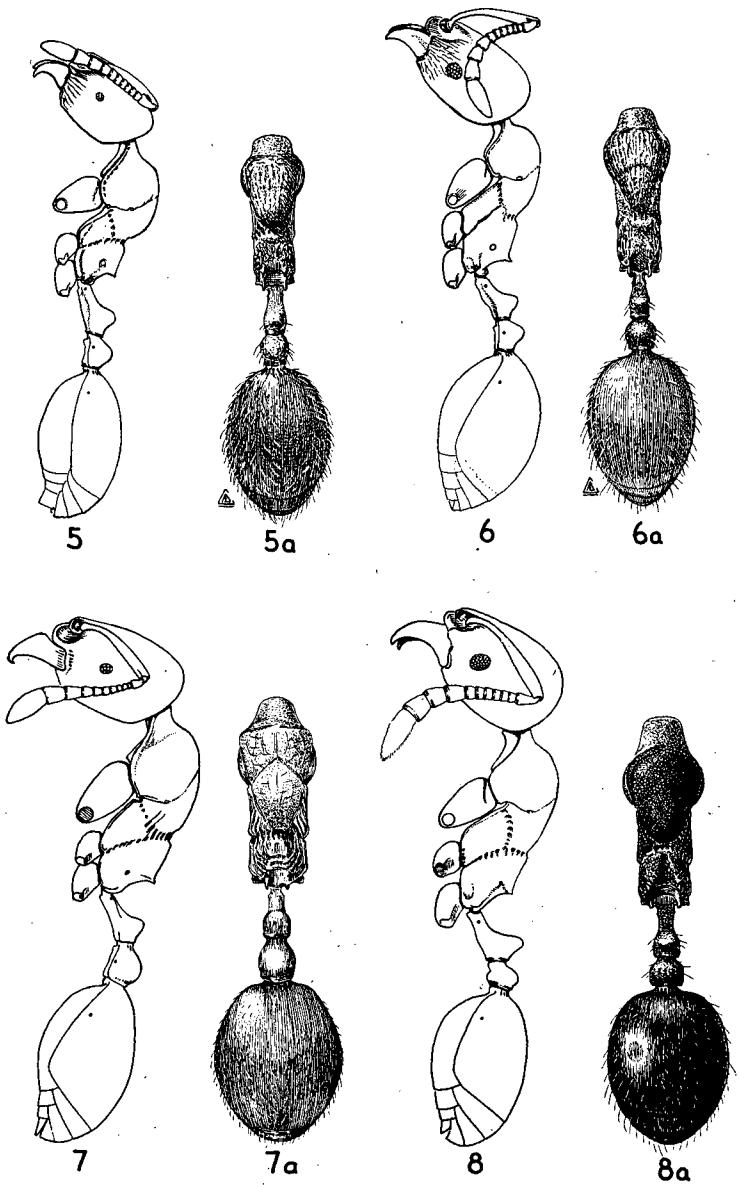
Stenamma brevicorne schmittii W. M. Wheeler, 1903, Psyche 10:167, worker. Wesson and Wesson, 1940, Amer. Midl. Nat. 24:93. Gregg, 1944, Ent. Soc. Amer. Ann. 37:456, 464-465, worker. M. R. Smith, 1947, Amer. Midl. Nat. 37:555, worker. M. R. Smith, 1951, *In* U. S. Dept. Agr., Monogr. 2, p. 795, worker.

Stenamma schmittii W. M. Wheeler, Creighton, 1950, Harvard Univ., Mus. Comp. Zool. Bul. 104:136, 138, worker.

WORKER (pl. 2, figs. 5, 5a)

Length 2.5-3.5 mm. Second through the sixth funicular segments broader than long, the last segment of the antennal club approximately as long as the combined lengths of the three preceding segments. Eye extremely small to very small, the greatest diameter 0.10 mm and composed of three to six ommatidia. Thorax, in profile, usually with a very pronounced mesoepinotal impression which is often 0.10 mm in length and proportionally

PLATE 2



Figs. 5-8.—Lateral view of worker with all segments of legs omitted except coxae and (a) dorsal view of worker with head and legs omitted. 5. *S. schmittii* Whlr.; 6. *S. impar* Forel; 7. *S. occidentale,* n. sp.; 8. *S. huachucanum,* n. sp.

as deep. Epinotum commonly sloping posteriorly, the base and declivity meeting to form a pair of distinct but variably sized spines, which range from about one-sixth to one-fourth the length of the base of the epinotum. Petiolar node, in profile, rounded to subangular resembling that of *impar* but perhaps not quite so extreme; from above and behind, although it resembles that of *impar,* it is usually blunter and more rounded. Postpetiolar node, from above, subcampanulate to subrectangular, with the bluntly rounded apex of the node directed somewhat posterodorsad. Longitudinal rugulae at the base of the gaster varying from obsolescent to moderately well developed, ranging in length from less than 0.10 mm to slightly more.

Frontal area smooth and shining. Front with posteriorly diverging, longitudinal striae, remainder of head largely reticulate or rugulose-reticulate, with punctate interspaces. Sides of thorax longitudinally rugulose and also densely punctate, the punctures sometimes predominating over the rugulae, especially in certain parts; mesopleuron often largely punctate. Thorax above, varying from fine to very coarsely regulose-reticulate or rugulose with punctate interspaces; often the rugulae on the promesonotum have a longitudinal trend. Petiolar and post petiolar nodes largely densely punctate but not always opaque. The shagreening on the first gastric segment varies from obsolescent to moderately well developed, the sculpturing more evident in some lights than others. Head and thorax subopaque or opaque, the petiolar and postpetiolar nodes less so, the gaster smooth and shining.

Body highly variable in color ranging from a yellowish brown or light brown through reddish brown to almost blackish; appendages lighter, gaster usually light at the base and apex with an infuscated, transverse band midway of its length.

This is a highly variable species in many respects. Such variations especially apply to the size of the eye and the number of ommatidia in its greatest diameter; the number (usually 4-6) and size of the basal teeth of the mandibles; the size and shape of the mesoepinotal impression, size of the epinotal spines, shape and proportions of the petiolar and postpetiolar nodes. The color and sculpture of the body are very variable as is also the degree of development of the longitudinal rugulae and shagreening on the first segment of the gaster.

The worker can be distinguished by the size and structure of the eye; the nature and appearance of the sculpturing of the body; the usually well developed and very distinct mesoepinotal impression; shape and proportions of the petiolar and postpetiolar nodes. The worker is most apt to be confused with that of *impar.* It differs especially in the smaller eye, the larger and more coarsely sculptured and also more opaque body.

ALATE FEMALE

Similar to the worker except as described below.

Length 4-4.3 mm. Anterior ocellus located 0.35-0.40 mm back of frontal area. Antennal scape failing, by its greatest breadth or less, to attain the posterior border of the head. Greatest diameter of eye approximately 0.2 mm and with 12-14 ommatidia. Viewed frontally, the anterior border of the eye is located about 0.25-0.30 mm posterior to the base of the mandible. Thorax from the anterior border of the pronotal collar to the apices of the epinotal spines 1.45-1.55 mm in length, widest slightly anterior to the wing insertions where it measures 0.70-0.75 mm; humeri subangular. Venation of anterior wing similar to that of *occidentale.* Veins and stigma light brown or yellowish. Thorax with tuberculate to normal shaped spines which are 0.10 mm or less in length. Petiole, in profile, pedunculate with subangular to distinctly angular node. Postpetiole, in profile, 0.3 mm high, convex above, almost as high as long. Petiolar node, from behind, with dorsally converging sides and weakly rounded to subtruncate superior border. Postpetiole from 0.25-0.30 mm broad, approximately as broad as long.

Thorax above, coarsely rugulose-reticulate; the longitudinal rugulae somewhat convergent toward the middle of the anterior border of the mesonotum. Scutellum often more

finely sculptured than the mesonotum. Area above the epinotal spines transversely rugulose-punctulate. Side of the anterior coxa transversely rugulose-punctate. Petiolar and postpetiolar nodes above rugulose- or rugulose-reticulate, punctulate, subopaque. Much of the first gastric segment varying from finely reticulate and subopaque to smooth and shining (the reticulations more distinct in some lights than others). Frontal area and infraspinal area smooth and shining.

Pilosity yellowish to golden, fairly abundant, slender, consisting of variable lengthened hairs that are suberect to erect. Pubescence on legs and scapes rather dense.

Occasionally there may be infuscated spots on the head and thorax, or the head and thorax may be darker than the rest of the body. The gaster may vary from brown to blackish but the apex is apparently lighter than the remainder; commonly the darker portion gives the appearance of a broad, transverse band.

There is considerable variation in color as well as in some of the body proportions. As mentioned above much of the first gastric segment may be finely reticulate or else smooth and shining.

The female of this species is distinguished by its size, nature of the wing venation which is similar to that of *occidentale*, the peculiarly dull, subopaque appearance of the body and the subangular to angular node.

MALE

Length 3.3-3.5 mm. Head approximately twice as long posterior to the eyes as in front of the eyes. Eye large, convex, protuberant, 0.20-0.25 mm in length and more than 0.10 mm in width. Anterior ocellus located approximately 0.2 mm posterior to the frontal area. Clypeus convex above and bearing a longitudinal furrow or impression, the anterior border of the clypeus arched. Mandible subtriangular, with 3-4 distinct teeth. Scape exceptionally short, usually 0.23-0.25 mm long and approximately as long as the combined lengths of the first three funicular segments. Thorax from the anterior border of the pronotal collar to the articulation with the peduncle of the petiole, 1.2-1.5 mm in length; widest anterior to the articulations of the anterior wings where it measures 0.65-0.75 mm. Mesonotum with distinct Mayrian furrows, the parapsidal sutures indistinct to distinct but more commonly distinct. Epinotum, in profile, with concave basal surface, which is approximately 0.35-0.40 mm in length and meets the declivity in either an angle or an angular tubercle. Petiole, in profile, with the peduncle meeting the node above to form a bluntly rounded to distinct angle. Petiole and postpetiole, from above, slender in appearance but the postpetiolar node often almost as broad as long.

Frontal region of head to at least as far posteriorly as the anterior ocellus very finely longitudinally striated, remainder of the head, for the most part, densely and finely punctulate. Thorax largely punctulate; in some lights there are discernible above, on at least the posterior part of the mesonotum, very fine, longitudinal striae. Side of epinotum longitudinally to irregularly rugulose-punctulate. Petiolar and postpetiolar nodes above, largely smooth and shining; on the sides the punctures are more apparent but never dense. Dorsal surface of epinotum, petiolar and postpetiolar nodes, and gaster shining; remainder of body subopaque. Mesopleuron and anterior portion of mesonotum often shining, at least in some lights; the mesopleuron frequently smooth or very finely sculptured.

Pilosity consisting largely of short, suberect hairs; those on the anterior border of the clypeus unusually long.

Body blackish to black, with yellowish mandibles, antennae and tarsi; apex of the coxae and gaster, trochanters, and the articulations of the femora and tibiae lighter than the remainder of the segments.

Males vary considerably in size, proportions of the body, and sculpture. The scutellum is sometimes almost smooth and shining. The first segment of the gaster may bear fine reticulations or punctulations.

The male can be distinguished by the nature of the wing venation, which

is similar to that of *occidentale*, shape of the epinotum, which in profile has a concave basal surface that meets the declivity to form a pronounced angle or tubercle, the color of the body and appendages, and the nature of the sculpturing, especially that of the thorax.

Type locality.—St. Vincent, Pennsylvania (1½ miles SW of Latrobe in Westmoreland County). Described from workers collected by P. J. Schmitt.

Location of types.—American Museum of Natural History, Museum of Comparative Zoology at Harvard College.

Distribution.—This species has been recorded from Maine to North Carolina, west to Minnesota and Missouri.

SPECIMENS STUDIED: Two cotype workers; also 445 workers, 14 dealate females, 54 alate females and 33 males from localities other than the type locality.

BIOLOGY

Our knowledge of *schmittii* is based on fewer data than that of *brevicorne*. It appears, however, that it is primarily a woodland loving form which is capable of living in fairly dry to moist habitats. Colonies are usually found nesting in the soil beneath stones, logs, rotten wood, moss, leaf mould, and other debris and are often difficult to find. The species has been collected at altitudes ranging from only a few hundred feet to approximately 5,000 feet. Mary Talbot has excavated a number of colonies in the Droste Woods in St. Charles County, Missouri. She has found colonies apparently containing from only one to four chambers and at depths of 5 to 15 inches. It appears that there is only a single mother queen per colony. The largest colony examined, on September 29, 1950, consisted of four chambers at depths of 5, 6, 7, and 10 inches. The colony contained 310 workers, 31 alate females and 35 males, 9 eggs, and 67 larvae. No pupae were seen, nor was the mother queen found. Miss Talbot did not think that this was a hibernating colony. Her general observations on *schmittii* indicate that alate females and males are produced in late summer, by some colonies at least, and that these castes overwinter in the parental nest until the following spring. The most common if not the only immature stage in which the ant overwinters is the larval.

For further information on seasonal habits and feeding activities of *schmittii* the reader is referred to observations by W. L. Brown, page 135.

Stenamma occidentale, n. sp.

Stenamma neoarcticum Mayr, 1886, Zool.-Bot. Gesell. Wien, Verh. 36:454, alate female, male (not worker). Mayr, 1887, Zool.-Bot. Gesell. Wien, Verh. 37:628 (footnote), alate female, male. M. R. Smith, 1947, Amer. Midl. Nat. 37:555, alate female, male.

?Stenamma (*Stenamma*) *westwoodi nearcticum* Mayr, Emery, 1895, Zool. Jahrb. Abt. f. System. 8:299-300, worker, dealate female.

Stenamma (*Stenamma*) *nearcticum* Mayr, Forel, 1901, Soc. Ent. Belg. Ann. 45:347, alate female, male.

Stenamma nearcticum Mayr, W. M. Wheeler, 1903, Psyche 10:165-166, alate female, male. W. M. Wheeler, 1917, Amer. Acad. Arts and Sci. Proc. 52:519, alate female, male. W. M. Wheeler, 1926, Ants, Columbia Univ. Press, N. Y., p. 150. M. R. Smith, 1930, Ent. Soc. Amer. Ann. 23:564-565, alate female, male. Mallis, 1941, South. Calif. Acad. Sci. Bul. 40:66. Falconer Smith, 1941, Pan-Pacific Ent. 17:24. Creighton,

1950, Harvard Univ., Mus. Comp. Zool. Bul. 104:135, 138, alate female, male. M. R. Smith, 1951, *In* U. S. Dept. Agr. Monogr. 2, p. 795, alate female, male.

The European myrmecologist Gustav Mayr in 1886 (see reference above) described *Stenamma neoarcticum* on the basis of two workers, one each from New Hampshire and Virginia, and two winged females and two males collected in California. The following year, on page 628 of his *Südamerikanischen Formiciden* (see reference above), he stated that he considered the workers from New Hampshire and Virginia identical with those of *brevicornis* (*brevicorne*) and that the species would then stand on the basis of the females and males. Most myrmecologists, including myself, in accepting the facts as stated directly above have been in error. We have either overlooked or misinterpreted a statement in Mayr's original description reading as follows: "Die Beschreibung des Arbeiters bezeichne ich als fur die Art typisch." in which Mayr designated the worker caste as the type of the species. Therefore, as Mayr said, *neoarcticum* is a synonym of *brevicorne*. I have examined Mayr's type from New Hampshire and agree that it is *brevicorne*. I have also examined two of Mayr's California specimens, a winged female and a male labeled "Calif. Oct. 31, '83." The collection of the U. S. National Museum contains a pair of similar specimens which I believe to be a part of the original series. These four males and females I consider the same as the new species which I am here describing as *occidentale*.

WORKER (pl. 2, figs. 7, 7a)

Length 3.4 mm. Funicular segments 2 through 6 broader than long; last funicular segment longer than the combined lengths of the two preceding segments. Eye small, oval, approximately 0.10 mm in its greatest diameter with six ommatidia. Thorax, from above, slender, 1.2 mm in length from the anterior border of the pronotal collar to the junction with the petiole, broadest through the humeral angles (0.45 mm) and narrowest through the epinotum (0.35 mm), with pronounced humeral angles; in profile, the mesoepinotal impression is moderately well developed, approximately 0.10 mm in length and 0.05 mm in depth, base of epinotum distinctly sloping to meet the declivity and form two small, tuberculate spines which are 0.05 mm in length or less. In profile, the petiolar node is subangular; the postpetiolar node larger than the petiolar node and more convex in its anterior half than its posterior half, from above, the postpetiole is stout, almost as broad as long. Gaster with the apex more acute than the base, the latter lacking humeral angles.

Sculpturing of head and thorax very weak, subopaque (in some lights, however, part of the thorax is slightly shining), the head apparently more subopaque than the thorax, the propleuron is sculptured and subopaque and the mesopleuron largely reticulate; epinotal declivity postpetiole and gaster smooth and shining, the dorsal surface of the petiole, especially the anterior face, somewhat shining in some lights.

Hairs light yellowish or grayish depending upon the light, moderately abundant, of variable length, largely depressed or suberect, those on the front of the head and anterior border of the clypeus unusually long. Pubescence of legs and scapes distinct but depressed.

Head, thorax, petiole and postpetiole dark brown, legs and gaster lighter, the latter with a rather broad, infuscated, transverse band near its mid length.

Paratype workers differ from the holotype mainly in the proportions of the head which ranges from 1.15-1.25 times as long as broad; the length of the thorax, 1.05-1.2 mm; greatest width of the thorax, 0.4-0.45 mm; narrowest width of thorax 0.3-0.35 mm; epinotal spines 0.03-0.05 mm in length; mesoepinotal impression 0.03-0.05 mm in depth and the postpetiole from almost as broad as long to apparently as broad as long; length of body 2.8-3.4 mm.

Workers other than paratypes show considerable variation in a number of

characters, these variations are: Head 1.12-1.25 times as long as broad; thoracic length 1-1.10 mm, greatest width 0.5 mm; narrowest breadth 0.25 mm; greatest diameter of the eye ranging from 0.05-0.10 mm; mesoepinotal impression varying in size and shape, roughly U- or V-shaped and 0.10 mm long and about half as deep; epinotal spines 0.025 to 0.05 mm in length; pedicel of the petiole noticeably shorter and the petiolar node less high in some individuals than others; pronotum less flattened and without such prominent humeral angles; color ranging from light to dark brown with the anterior portion of the head, antennae, legs and usually the base and apex of the gaster lighter. Although the head, thorax and petiole are usually subopaque and the postpetiole smooth and shining, the former regions may be slightly shining in some lights.

This species can be distinguished in the worker caste by the following characters: Small eye with four to six ommatidia in its greatest diameter; distinctly angular prothoracic humeri; sloping base of the epinotum which meets the declivity to form two small, tuberculate spines which are 0.05 mm or less in length; subangular petiolar node (in profile); postpetiole (from above) almost as broad as long; weak sculpturing of the head and thorax; postpetiole smooth and shining.

ALATE FEMALE

Similar to the worker except as described below.

Length 4.5 mm. Ocelli small, not very distinct, the anterior ocellus located about 0.4 mm posterior to the frontal area. Antennal scape failing by less than its greatest diameter to attain the posterior border of the head. First funicular segment approximately as long as the combined lengths of the three succeeding segments; last segment of the club approximately as long as the combined lengths of the three preceding segments. Eye oblong, its greatest diameter approximately 0.20 mm and with 12-13 ommatidia. Thorax 1.6 mm in length from the anterior border of the pronotal collar to the apices of the epinotal spines, widest (0.8 mm) anterior to the points of articulation of the wings. Anterior wing hyaline, with light brown or yellowish veins and stigma and bearing a closed cubital and discoidal cell but only an open radial cell. Vein r-m present but Mf3 lacking. Epinotal spines, from above, scarcely half as long as the distance between their bases; in profile, short (less than 0.10 mm in length), tuberculate, with the apex of each directed latero-posteriorly but scarcely dorsad. Petiole, in profile, pedunculate, the anterior and posterior faces of the node meeting to form a very distinct angle. Postpetiolar node, in profile, convex above, concave beneath, scarcely higher than long. Petiolar node, from above and behind, with dorsally converging sides and subtruncate superior border. Postpetiole, from above, approximately 0.143 times longer than broad, with anteriorly converging sides in its anterior two-thirds and subparallel sides in the remainder. Gaster, from above, widest near its middle, the first segment occupying most of the gaster.

Mandibles striato-punctate, subopaque in some lights, shining in others. Clypeus, frontal area, area beneath epinotal spines, and much of each mesopleuron largely smooth and shining. Gaster entirely smooth and shining. Head with rather fine, longitudinal rugulae extending posteriorly from the frontal area, the rugulae becoming divergent posteriorly and even attaining the occiput; remainder of the dorsal surface of the head rugulose-reticulate with dull interspaces bearing umbilicate punctures. Cheeks largely longitudinally rugulose. Prothorax transversely rugulose anteriorly and longitudinally rugulose on the sides. Mesonotum and scutellum largely longitudinally rugulose, the interspaces shining, at least in some lights. Mesoepisternum and side of the epinotum longitudinally rugulose, the latter with finely punctulate interspaces. Base of epinotum transversely rugulose, with punctulate interspaces. Posterior surfaces of petiolar and postpetiolar nodes and side of postpetiolar node longitudinally rugulose. Dorsal surface of postpetiolar node rather smooth and shining. Longitudinal rugulae at the base of the gaster less than 0.10 mm in length.

Body rather uniformly dark reddish brown, with even lighter appendages. Eyes black. Mandibular teeth, region around the ocelli, epinotal spines and (certain regions of the thorax, when viewed in some lights) blackish. Mayr described the female as black-brown, mandibles and clypeus rust-red, antennae and legs more yellowish red, partly with a touch of brownish.

The above description of the female is based on one of the two individuals described by Mayr as *neoarcticum*. Females from other localities show the following variations: Head 1.12-1.16 times as long as broad, occasionally with weakly emarginate posterior border; mandibular dentition highly variable with three prominent apical teeth and the number of irregular basal teeth or denticulae ranging from four to six; anterior ocellus located from 0.35-0.40 mm behind the frontal area; thoracic length 1.3-1.6 mm, with greatest width 0.6-0.7 mm; petiolar node, from above and behind, with dorsally converging sides and subtruncate superior border to subparallel sides and rounded superior border; postpetiole usually slightly longer than broad, occasionally as broad as long; vein r-m in apposition with or slightly distad of vein r; prothorax more transversely rugulose at the humeral angles; body length 3.17-4.5 mm; head and thorax often darker than the petiole, postpetiole and gaster; the anterior portion of the head, antennae, legs and apex of gaster light brown or yellowish brown.

MALE

Length 2.9-3.1 mm. Eye large, oval, approximately 0.2-0.25 mm in its greatest diameter. Ocelli placed approximately 0.10 mm posterior to an imaginary transverse line connecting the posterior borders of the eyes. Frontal area distinct, longer than broad. Scape short, approximately 0.2-0.25 mm long, as long as the combined lengths of the first 2.5-3.5 funicular segments. Thorax measured similar to that of the worker, 1.25-1.3 mm long, widest at the base of the anterior wings, where it measures 0.65-0.7 mm. Mayrian furrows present but not strongly developed. Parapsidal sutures also present but only clearly seen in some lights. In profile, base of the epinotum distinctly concave to almost straight, approximately twice as long as the epinotal declivity and meeting the declivity in a distinct angle. Petiolar node, in profile, distinctly angular. Postpetiole, from above, approximately as broad as long.

Mesopleuron, much of epinotum, especially the base and declivity, dorsal surfaces of petiolar and postpetiolar nodes, and gaster, smooth and shining; most of head and thorax rather delicately sculptured and subopaque, especially in some lights.

Pilosity moderately abundant, of variable length, largely inclined or suberect.

Body blackish to black, with lighter mandibles, antennae and legs. Wings pale, with light brown veins and stigma.

Males from other localities differ from the above described paratypes as follows: Body length 3-3.5 mm; head 1.2-1.3 times as long as broad; frontal area present but not always very distinct; antennal scape (exclusive of the pedicel) 0.2-0.3 mm in length and as long as the combined lengths of the first 2.5-4 funicular segments; mandibles with 2-3 teeth; thoracic length 1.15-1.4 mm; base of epinotum approximately 1.5-2 times as long as the declivity; Mayrian furrows present but varying from weak, scarcely distinct to rather well developed; postpetiole from approximately as broad as long to broader than long; anterior wing venation of some individuals highly aberrant, the discoidal cell lacking in one or both wings, and also the equivalent of an extra (second) cubital cell present in one or both wings.

Type locality.—Rustlers Park, Chiricahua Mountains, Arizona, 8,500 ft., 8- (25-26)-52, Borys Malkin, under stone. Described from a holotype and 53 paratype workers and

14 paratype males, all of which have been deposited in the U. S. National Museum under No. 62394.

Distribution.—This species has been recorded from British Columbia to Lower California (Mexico) and from the Pacific Coast States eastward to Idaho, Colorado, and New Mexico.

SPECIMENS STUDIED: In addition to types, 270 workers, 1 dealate female, 48 alate females, and 82 males from localities other than the type locality.

BIOLOGY

Our records show that males as well as male and female pupae are found in the nest at least as early as late August (25-27). Winged females and males have been captured in flight at Lake Louise near Steilacoom, Washington, on September 21. Other winged females and males have been collected as late as October (29-31), but the conditions under which they were taken are not known; therefore it cannot be definitely said whether these sexed forms were produced during the current year or the year preceding. The species has been collected at altitudes ranging from 700 feet to as high as 9,000 feet. All known colonies are from the soil beneath rocks.

STENAMMA IMPAR Forel

Stenamma (*Stenamma*) *brevicorne* race *impar* Forel, 1901, Soc. Ent. Belg. Ann. 45:347-348, worker, dealate female.

Stenamma brevicorne impar Forel, W. M. Wheeler, 1903, Psyche 10:166-167, worker. M. R. Smith, 1947, Amer. Midl. Nat. 37:555, worker. M. R. Smith, 1951, *In* U. S. Dept. Agr., Monogr. No. 2, p. 795.

Stenamma impar Forel, Creighton, 1950, Harvard Univ., Mus. Comp. Zool. Bul. 104:136-137, worker. Talbot, 1951, Ent. Soc. Amer. Ann. 44:307 (part), Misdet.

WORKER (pl. 2, figs. 6, 6a)

Length 2.3-2.7 mm. Funicular segments 2 through 7 broader than long; last segment of antennal club approximately as long as the combined lengths of the three preceding segments. Eye subelliptical, approximately 0.10 mm in its greatest diameter and with 5-6 ommatidia; all ommatidia distinct and coarse in appearance. Thorax, in profile, with distinct to frequently pronounced mesoepinotal impression, the impression sometimes as much as 0.10 mm long and about half as deep. Base of epinotum meeting the declivity to form a pair of short, but distinct, variable sized, tuberculate spines which are borne on the epinotum as pronounced angles. Petiolar node, in profile, very distinctly angular; viewed from above and behind, the node is slender (often with dorsally converging sides), compressed antero-posteriorly, with truncate or weakly rounded superior border. Postpetiolar node, from above, almost as long as broad and with a subrectangular to subglobular appearance; the anterior two-thirds of the dorsum convex and somewhat anteroposteriorly compressed. Base of gaster bearing weakly developed, longitudinal rugulae which are usually 0.10 mm or less in length.

Frontal region of head with fine, posteriorly diverging, longitudinal striae which are scarcely discernible in some lights. Mandible longitudinally rugulose, with scattered, coarse punctures. Cheeks largely composed of longitudinal rugulae. Most of head bearing fine, rugulose-reticulate sculpture in which the interspaces are punctulate. The sculpturing of the head not always clearly defined because of the nature of the color of the head and the fineness of the sculpture. Thorax above, with a fine sculpture which largely ranges from longitudinally rugulose to rugulose-reticulate, that on the promesonotum usually of a longitudinally rugulose nature. Petiolar and postpetiolar nodes largely finely punctulate except for their dorsal surfaces which are usually shining, especially in certain lights. Frontal area and gaster smooth and shining and also much of the propleuron.

Body usually light brown or yellowish brown, occasionally dark brown; gaster however usually with an infuscated, transverse band near the middle.

The worker may vary in size and color as noted above. The gaster occa-

sionally lacks the infuscated band. The mesoepinotal impression varies from distinct to very pronounced. The epinotal spines although always distinct and tuberculate range from small and fine to moderately large and coarse. The petiolar node, when viewed from above and behind, may have sides which are subparallel or dorsally converging and the superior border of the node may vary from subtruncate to weakly rounded. The postpetiolar node, from above, although subrectangular to subglobular in appearance varies to some extent in proportion but is apparently slightly wider than long. The sculpturing of the body seems to be most variable on the thorax, especially on the epinotum, where it is often irregular although more commonly reticulate or rugulose-reticulate.

The worker of *impar* can in general be distinguished by its small size, slender form, fineness of body sculpturing, and usually light brown or yellowish brown color. Other important characters are: The rather small, coarsely facetted eye which measures approximately 0.10 mm in its greatest diameter and contains 5-6 ommatidia; funicular segments 2 through 7 broader than long; distinct to very pronounced mesoepinotal impression; the distinct but short, tuberculate spines which are angularly borne on the epinotum; the very strikingly angular petiolar node (in profile); and the weakly developed longitudinal rugulae at the base of the gaster.

ALATE FEMALE

Similar to the worker except as described below.

Length 3.2-3.5 mm. Antennal scape lacking its greatest diameter or less of attaining the posterior border of the head. Ocelli small, pale, the anterior ocellus usually located about 0.3 mm posterior to the frontal area. Eye oblong, usually 0.2 mm in its greatest diameter and with 10-12 ommatidia. Thorax from 1.2-1.3 mm in length measured from the anterior border of the pronotal collar to the apices of the epinotal spines, widest just anterior to the wing articulations where it measures from 0.6-0.65 mm. From above, the humeri are subangular. Anterior wings subopaquish, with light brown or yellowish veins and stigma; venation similar to that of *brevicorne*. Base of epinotum, in profile, meeting the declivity in a very broad angle. Epinotal spines highly variable in size and shape, usually ranging from 0.05-0.10 mm in length. Petiole, in profile, pedunculate with very distinctly angular node. Postpetiole, in profile, scarcely longer than high, convex above and highest near its midlength. Petiolar node, from above and behind, usually with dorsally converging sides and weakly rounded or subtruncate superior border.

Mesonotum highly variable in sculpturing, ranging from smooth and shining in appearance with fine longitudinal rugulae and punctate interspaces to subopaque with coarser sculpture. The longitudinal rugulae on the scutellum commonly coarser and more apparent than on the mesonotum. Posterior part of epinotum, above, between, and below the epinotal spines often smooth and shining, occasionally finely sculptured above the spines. Propleuron largely longitudinally rugulose as are also the side of the epinotum, the latter however with more distinctly punctulate interspaces. Mesopleuron, especially the mesoepisternum, often largely smooth and shining. Petiole and postpetiole punctulate or rugulose-punctulate except for the rather smooth and shining nodes.

Hairs moderately abundant, slender, light yellowish, reclinate or suberect for the most part.

Body light brown or yellowish brown to dark reddish brown, with lighter appendages, eyes black, mandibular teeth and often the scutellum and wing articulations dark. Gaster highly variable in color, the apex usually light and the remainder of the gaster light brown to almost blackish, occasionally the gaster bears a dark, transverse band.

As the above description indicates, the female is subject to considerable variation, especially in color and sculpture. The variation in sculpturing

is especially noticeable on the head, mesonotum and mesopleuron. The length and width of the thorax seems to be fairly constant in the small number of specimens studied. I have not seen any individuals in which the base of the epinotum and declivity form a single plane as Forel has described.

The female can be distinguished from that of other forms by its small size (3.2-3.5 mm); commonly light brown or yellowish brown color; funicular segments 2 through 7 as broad as, or broader than long; greatest diameter of the eye usually 0.2 mm and containing therein 10-12 ommatidia; often rather smooth and shining mesonotum and mesopleuron; angular petiolar node (in profile), and a wing venation similar to that of *brevicorne*.

MALE

Length 2.9 mm. Head narrower in front of the eyes than behind the eyes, 0.35 mm in width. Posterior border of the eye approximately 0.25 mm anterior to the posterior border of the head. Eye large, convex, protuberant; from in front, usually more than 0.2 mm in length and 0.10 mm in width. Anterior ocellus located approximately 0.4 mm back of the anterior border of the clypeus. Clypeus convex above, the carinae vestigial or absent, the anterior border arched. Mandible slender, the masticatory border usually with three or four teeth, the first and second apical being the most distinct. Antennal scape (exclusive of the pedicel) approximately 0.3 mm in length and equal to the combined lengths of the first three or four funicular segments. Thorax, from above, 0.9 mm in length from the anterior border of the pronotal collar to the apex of the scutellum and 0.65-0.7 mm in width just anterior to the articulations of the wings. Mesonotal outline forming a broad arch anteriorly. Mayrian furrows distinct. In profile, base of epinotum meeting the declivity in a rounded angle; epinotal spines lacking, represented only by scarcely perceptible angular ridges. Petiole, in profile, pedunculate, with angular node. Petiolar and postpetiolar nodes, from above, rather narrow. Petiolar node, from behind, with subparallel sides and transversely truncate superior border. Postpetiolar node, from above, approximately as broad as long and of a subrectangular appearance.

Most of head finely punctulate, scutellum very finely longitudinally rugulose, side of epinotum irregularly sculptured, with the punctulation apparently dominating. Mandibles, much of mesonotum and mesopleuron, dorsum of petiolar and postpetiolar nodes, and gaster, smooth and shining.

Pilosity moderately abundant, slender, largely suberect or reclinate.

Body sordid light brown with lighter appendages.

The most notable variations were the length of the body, which ranged from 2.6-2.9 mm; the scape length 2.66-3 mm; length of thorax 0.8-0.9 mm; and width anterior to the articulations of the wings from 0.6-0.7 mm; eye, from in front, usually more than 0.2 mm in length, occasionally less, and usually more than 0.10 mm in width, occasionally less; color of body ranging from a pale, sordid brown to a much darker, sordid brown; wings subopaquish to hyaline. One individual had an unusually small discoidal cell in one wing and none in the other.

Type locality.—Described from workers collected by A. Forel and Theodore Pergande on the Virginia bank of the Potomac River near Washington, D. C., while sifting damp leaves; also from a dealate female unassociated with other castes collected by Forel in Franklin Park, Boston, Massachusetts. I hereby designate Virginia as the type locality and have selected as a lectotype, a cotype worker from the Museum d'Histoire Naturelle, Geneva, Switzerland.

Location of types.—Museum d'Histoire Naturelle, Geneva, Switzerland, American Museum of Natural History, U. S. National Museum.

Distribution.—Massachusetts to Georgia, west to North Dakota, Illinois, and Missouri.

SPECIMENS STUDIED: One cotype worker from each of the museums mentioned above; also 423 workers, 12 dealate females, 11 alate females and 6 males from localities other than the type locality. I have not seen the dealate female cotype.

BIOLOGY

In her population studies of soil-nesting ants in the Droste Woods, St. Charles County, Missouri, from September to March during the years 1948 to 1953, Miss Mary Talbot found *impar* to be the most common *Stenamma, schmittii* second, and *meridionale* third. It is surprising that no individuals of *brevicorne* were taken. She is positive that in many instances she did not collect entire colonies of *impar*. Colonies or portions of colonies were collected at depths from 4 to 16 inches. Usually only one chamber was found, occasionally there were two. The largest number of workers collected from a colony was 109, the least 5. Only one mother queen was found per colony in 4 colonies. It appears from these and other records that most if not all colonies have only a single mother queen. Miss Talbot found that it is common for the larvae to overwinter in the nest; however, a half dozen or less eggs were found in 2 colonies as late as the middle of October. At the time of collection colonies were taken from both dry and damp soils. In the Edwin S. George Reserve in Livingston County, Michigan, Miss Talbot collected winged females and males from a colony on August 13, 1949. In the same locality K. Bohnsack collected 33 workers, 3 alate females and 1 male from a colony on August 19, 1949. Although Miss Talbot commonly found the species nesting in the soil, one of our records may indicate that *impar* also nests in rotten or faulty wood. This species has been collected at altitudes up to 4760 feet.

Stenamma huachucanum, n. sp.

WORKER (pl. 2, figs. 8, 8a)

Length 2.2-2.5 mm. Second to sixth funicular segments broader than long, the last funicular segment lacking very little of being as long as the combined lengths of the three preceding segments. Eye subelliptical, small for a *Stenamma*, approximately 0.10 mm in its greatest diameter, and with five to seven ommatidia. Mesoepinotal impression, in profile, distinct but not long or deep (less than 0.10 mm in length). Base of epinotum, in profile, sloping posteriorly to meet the declivity and forming a pair of extremely small (almost vestigial), tuberculate spines, a weakly developed but yet distinct carina usually leading from the mesoepinotal impression to each spine. Thorax, from above, with an obsolescent promesonotal suture. Petiolar node, from above and behind, unusually high, much compressed anteroposteriorly. Postpetiolar node, from above, as broad as, or broader than long, usually slightly wider anteriorly than posteriorly. Gaster often with a faint indication of basal humeri. Base of gaster either destitute, or almost destitute of longitudinal rugulae, the rugulae when present, less than 0.05 mm in length.

Body remarkable for its highly characteristic, unsually fine type of sculpturing. Front with extremely fine, scarcely discernible, longitudinal striae. Cheeks with longitudinal rugulae. Ground surface of head covered with extremely fine, rather dense punctures over which there is borne the scarcely apparent rugulose-reticulate sculpturing. Thorax above, also covered with extra fine punctures and in addition scarcely discernible longitudinal rugulae. Base of epinotum with fine, transverse striae in addition to the very small punctures. Petiole and postpetiole largely covered with very small punctures. Frontal area, clypeus, mandibles, propleura and gaster shining. In some lights the legs are even shining and there are also small, scattered shining areas on the thorax, petiole and postpetiole.

Hairs of variable length, light yellowish or grayish, moderately abundant and suberect to erect.

Body brownish black to black with lighter antennae and legs, the two colors contrasting to such an extent as to give the worker a bi-colored appearance. Gaster brownish at the base and apex with a blackish, transverse band in the middle.

The worker of this species varies in the following characters: Proportions of the head; number of ommatidia in the greatest diameter of the eye; shape and number of teeth of the mandible; development of the mesoepinotal impression and the epinotal spines; color of the gaster, the base often being blackish instead of brown.

The species is distinguished by the following characters: Small eye for a *Stenamma,* the greatest diameter of which is approximately 0.10 mm and has 5-7 ommatidia; very weakly developed clypeal carinae and mesoepinotal impression; pair of extremely small (almost vestigial) tuberculate epinotal spines; the unusually high petiolar node which is much compressed anteroposteriorly; base of gaster almost destitute of longitudinal rugulae, these when present or well developed apparently never exceeding 0.05 mm in length; bicolored appearance, and the delicate sculpturing of the body.

Type locality.—Head of Carr Canyon, Huachuca Mts., Ariz., 8,000 ft., 7-24-50, W. S. Creighton. Described from a holotype and 14 paratype workers.

Location of types.—The holotype and eight paratype workers are in the collection of the U. S. National Museum under No. 62393. The remaining paratypes are in the collection of W. S. Creighton.

Distribution.—In addition to the type locality this new species has also been collected at Webber's Cabin, Mt. Lemon, S. Catalina Mts., Ariz., 7,500-8,500 ft., 7-27-17 by the Cornell University Expedition of 1917.

SPECIMENS STUDIED: In addition to types, five workers from the Cornell University collection referred to above.

STENAMMA HEATHI W. M. Wheeler

Stenamma brevicorne heathi W. M. Wheeler, 1915, Amer. Mus. Nat. Hist. Bul. 34:410, worker. W. M. Wheeler, 1917, Amer. Acad. Arts and Sci. Proc. 52:520. Mallis, 1941, South. Calif. Acad. Sci. Bul. 40:66. M. R. Smith, 1947, Amer. Midl. Nat. 37:555, worker. M. R. Smith, 1951, *In* U. S. Dept. Agr. Monogr. No. 2, p. 795. Cook, 1953. Ants of California, Palo Alto, p. 103, worker.

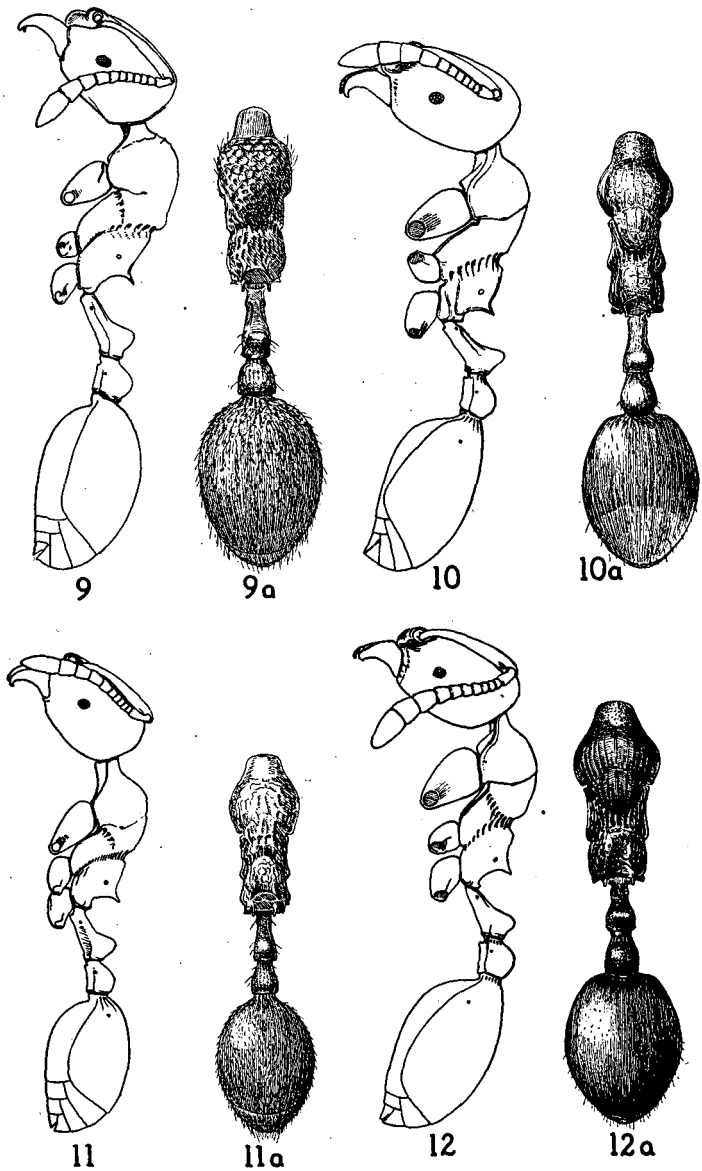
Stenamma heathi W. M. Wheeler, Creighton, 1950, Harvard Univ., Mus. Comp. Zool. Bul. 104:136-137, worker.

WORKER (pl. 3, figs. 9, 9a)

Length 2.5-3.3 mm. Second to 6th funicular segments broader than long, the last funicular segment almost as long as the combined lengths of the three preceding segments. Eye subelliptical, approximately 0.10 mm in its greatest diameter which contains from four to six ommatidia. Thorax, in profile, with variable sized mesoepinotal impression which is sometimes well pronounced and approximately twice as long as deep. Base of epinotum distinctly sloping posteriorly. Epinotal spines well developed, slender, with acute apices, approximately 0.25 to 0.33 the length of the base of the epinotum. Petiolar node, in profile, angular; from above and behind, varying from subrectangular to subconical, with truncate or weakly emarginate superior border. Postpetiolar node, from above and behind, as broad as long or broader than long, with subparallel sides except in the anterior third or fourth where the sides converge anteriorly.

Much of the head reticulate-punctate but the sculpturing not always easily seen because of the color of the head. Frontal striae present but also not always clearly discernible. Thorax above coarsely and rather irregularly reticulate, many of the interspaces often

PLATE 3



Figs. 9-12.—Lateral view of worker with all segments of legs omitted except the coxae and (a) dorsal view of worker with head and legs omitted. 9. *S. heathi* Whlr.; 10. *S. diecki* Emery; 11. *S. sequoiarum* Whlr.; 12. *S. impressum* Emery = (*diecki*).

quite broad; rugulae on the anterior portion of the prothorax quite often transverse and the rugulae on the promesonotum frequently with a longitudinal trend. Petiolar node rugulose-punctate to rugulose-reticulate, punctate; dorsal surface of postpetiolar node similarly sculptured. Longitudinal rugulae at the base of the gaster not as long and prominent as in *sequoiarum*. Much of the first gastric segment with a shagreening and scattered punctures which gives this region a subopaque effect, especially in certain lights. Frontal area, clypeal furrow, epinotal declivity and gaster, except at noted, smooth and shining.

Hairs light yellowish or grayish, moderately abundant, but not obscuring the ground surface of the body; apparently most abundant on the gaster.

Body and appendages varying from yellowish brown or light reddish brown to dark reddish brown; the gaster usually scarcely darker than the remainder of the body.

The most notable variations in the worker are: The proportions of the head; the number and shape of the teeth on the mandible; the number of ommatidia in the greatest diameter of the eye, this ranging from about 4-6; the mesoepinotal impression often pronounced, about twice as long as deep but occasionally smaller and less well defined; petiolar node when viewed from above and behind commonly subrectangular but occasionally subconical; post-petiolar node from about as broad as long to broader than long; sculpturing on the thorax highly variable as is also the color of the body. The single Nevada worker is dark reddish brown with a blackish, first gastric segment; this segment is also more opaque than ordinarily because of the nature of the sculpturing.

The worker of *heathi* can be distinguished by the following characters: It is commonly smaller (2.5-3.3 mm) than that of some of the other forms; the body and appendages including even the gaster are an almost uniform yellowish brown or light reddish brown to dark reddish brown; the eye is approximately 0.10 mm in its greatest diameter and with 4-6 ommatidia; the base of the epinotum slopes posteriorly; the epinotal spines are well developed, rather slender and with acute apices; the petiolar node is distinctively angular in profile; the postpetiolar node is usually as broad as, or broader than long; the coarse and rather irregular reticulate sculpturing of the thorax, especially of the promesonotum; the shagreening and coarse scattered punctures of the first gastric segment which gives this region a subopaque effect, especially in certain lights.

Type locality.—Kings River Canyon (Fresno County), California. Described by W. M. Wheeler from 25 workers taken from a single colony by Professor Harold Heath.

Location of types.—American Museum of Natural History, Museum of Comparative Zoology at Harvard College, U. S. National Museum.

Distribution.—California and Nevada. In addition to the type locality this species is known from the Yosemite and Sequoia National Parks of California and from Washoe County, Nevada.

SPECIMENS STUDIED: Nineteen cotype workers; also 36 workers from localities other than the type locality.

Stenamma sequoiarum W. M. Wheeler, new status

Stenamma brevicorne sequoiarum W. M. Wheeler, 1917, Amer. Acad. Arts and Sci. Proc. 52:520, worker, dealate female. Mallis, 1941, South. Calif. Acad. Sci. Bul. 40:66. M. R. Smith, 1947, Amer. Midl. Nat. 37:555, worker. M. R. Smith, 1951, *In* U. S. Dept. Agr. Monogr. No. 2, p. 795.

Stenamma diecki sequoiarum W. M. Wheeler, Creighton, 1950, Harvard Univ., Mus. Comp. Zool. Bul. 104:136-137, worker, dealate female.

WORKER (pl. 3, figs. 11, 11a)

Length 3-3.5 mm. Eye rather small for a *Stenamma,* subelliptical, usually composed of four or five ommatidia in its greatest diameter, which is approximately 0.10 mm. Second to fifth funicular segments broader than long, the last funicular segment not as long as the combined lengths of the three preceding segments. Thorax, in profile, with distinct but variable sized mesoepinotal impression, the impression most often about twice as long as deep. Epinotum bearing two well developed spines which are approximately one-fourth to one-third the length of the base of the epinotum. Petiolar node from above and behind, usually somewhat subconical. Postpetiolar node, from above, subcampanulate, usually with the appearance of being longer than broad.

Sculpturing of head appearing rather weak and indistinct, probably due in part to the general color of the head, frontal striae fine but perceptible. Thorax, from above, very coarsely rugulose-reticulate, the sculpturing on the promesonotum often taking a longitudinal trend, the interspaces often very wide (sometimes as wide as 0.10 mm or more) and rather smooth and shining. Front coxa with distinct oblique or transverse rugulae. Postpetiole bearing sharply defined, longitudinal rugulae. Base of gaster with prominent, longitudinal rugulae, some of which are frequently as long as 0.2 mm or more. Rugulae on postpetiole and gaster sometimes not very distinct due to the color of these parts. Frontal area, clypeal furrow, epinotal declivity and gaster, smooth and shining. Rear of head, thorax, petiole and postpetiole weakly to rather strongly shining, according to the nature of the light.

Hairs on body moderately numerous but not obscuring the ground surface, apparently more abundant on the head and gaster than on the thorax. Appendages with distinct but rather closely appressed pubescence.

Head and thorax light brown or yellowish brown to reddish brown. Petiole, postpetiole and legs yellowish. Gaster brown or blackish, usually with an even darker, transverse, median band.

Variations are as follows: The head varies from 1.10 to 1.25 times as long as broad; the basal teeth of the mandible vary in size and number, usually being from four to six; the mesoepinotal impression is usually distinct and approximately twice as long as deep but occasionally may be smaller; sometimes there is a small transverse welt at the base of the epinotum following the mesoepinotal impression, color of the head and thorax ranges from a light brown or yellowish brown to a reddish brown.

The worker can be distinguished by the following characters: Eye rather small for a *Stenamma,* approximately 0.10 mm at its greatest width and with four or five ommatidia; epinotum with two well developed spines which are from one-fourth to one-third the length of the base of the epinotum; petiolar node slender and high, subconical; postpetiolar node subcampanulate, with the appearance of being longer than broad and bearing sharply defined, longitudinal rugulae; thorax above very coarsely rugulose-reticulate, the sculpturing on the promesonotum often taking a longitudinal trend, the interspaces variable in size but often 0.10 mm or more in width and rather smooth and shining; base of gaster with prominent, longitudinal rugulae, some of which are as long as 0.20 mm or more; head and thorax light brown or yellowish brown to reddish brown.

DEALATE FEMALE

Similar to the worker except as described below.

Length 4.3 mm. Eye slightly exceeding 0.2 mm at its greatest diameter and with 14 ommatidia. Thorax 1.65 mm in length from the anterior border of the pronotal

collar to the apices of the epinotal spines; widest slightly anterior to the wing insertions where it measures approximately 0.8 mm. Prothoracic humeri lacking. Epinotal spines, from above, stout, with blunt tips, the space between the tips about three times as long as the length of the spines. Petiolar node, from above and behind, not so slender or subconical as in the worker. Postpetiole subcampanulate, about as broad as long.

Propleuron with coarse, widely spaced oblique rugulae which have a posteroventral trend. Mesopleuron and side of epinotum with similar but longitudinal rugulae, those on the mesopleuron however not as coarse as on the side of the epinotum. The rugular interspaces are so finely sculptured that they are all rather shining. Pronotum and dorsal surface of epinotum coarsely and transversely rugulose, with the interspaces similar to those on the side of the thorax.

Color similar to worker except for darkened areas around the ocelli and wing insertions.

Wheeler gave the length of the dealate female which he described as 3.6 mm.

Type locality.—Muir Woods on Mt. Tamalpais (near San Francisco), California. Wheeler described the dealate female and numerous workers from several colonies that were found nesting under stones among the large redwood trees.

Location of types.—American Museum of Natural History, Museum of Comparative Zoology at Harvard College, U. S. National Museum and the personal collection of W. M. Mann.

Distribution.—Known from the types and from three individuals collected from the Sam P. Taylor State Park, Marin County, California on October 24, 1953 by Vincent D. Roth, these individuals having been obtained from redwood litter.

SPECIMENS STUDIED: Twenty-two cotype workers; also the two workers and one dealate female collected by Vincent D. Roth.

STENAMMA DIECKI Emery

Stenamma (*Stenamma*) *westwoodi diecki* Emery, 1895, Zool. Jahrb. Abt. f. System. 8:300, worker, dealate female.

Stenamma brevicorne diecki Emery, Forel, 1901, Soc. Ent. Belg. Ann. 45:347, worker, dealate female. W. M. Wheeler, 1903, Psyche 10:165-168, all castes. W. M. Wheeler, 1917, Amer. Acad. Arts and Sci. Proc. 52:519-520. Falconer Smith, 1941, Pan-Pacific Ent. 17:24. G. C. and E. W. Wheeler, 1944, N. Dak. Hist. Quart. 11:244. M. R. Smith, 1947, Amer. Midl. Nat. 37:555, worker. M. R. Smith, 1951, *In* U. S. Dept. Agr., Monogr. No. 2, p. 795.

Stenamma diecki Emery, Creighton, 1950, Harvard Univ., Mus. Comp. Zool. Bul. 104:133-136, worker, female. G. C. and J. Wheeler, 1953, Ent. Soc. Wash. Proc. 55:50-51, pl. 1, figs. 1-13, larva. Procter, 1938, Biol. Survey of the Mt. Desert Region, p. 433, male, Wistar Inst. Anat. and Biol., Philadelphia (misdet.).

Stenamma (*Stenamma*) *westwoodi diecki impressum* Emery, Emery, 1895, Zool. Jahrb. Abt. f. System. 8:301, worker. New Syn.

Stenamma (*Stenamma*) *brevicorne diecki impressum* Emery, Forel, 1901, Soc. Ent. Belg. Ann. 45:347.

Stenamma brevicorne diecki impressum Emery, W. M. Wheeler, 1903, Psyche 10:165, 167, worker. Dennis, 1938, Ent. Soc. Amer. Ann. 31:284, 304. Cole, 1940, Amer. Midl. Nat. 24:14, 15, 18, 19, 29, 48, worker. M. R. Smith, 1947, Amer. Midl. Nat. 37:555, worker. Cole, 1950, Tenn. Acad. Sci. J. 25:297.

Stenamma brevicorne impressum Emery, Buren, 1944, Iowa State Col. J. Sci. 18:284, worker. Gregg, 1946, Amer. Midl. Nat. 35:749. M. R. Smith, 1951, *in* U. S. Dept. Agr. Monogr. No. 2, p. 795.

Stenamma impressum Emery, Creighton, 1950, Harvard Univ., Mus. Comp. Zool. Bul. 104:134, 138, worker.

WORKER (pl. 3, figs. 10, 10a)

Length 2.7-3 mm. Funicular segments 2-7 broader than long; last funicular segment approximately as long as the combined length of the two preceding segments. Eye rather small, oval, approximately 0.10 mm at its greatest diameter and with four or five ommatidia. Thorax 0.9-0.966 mm in length from the anterior border of the pronotal collar to the apices of the epinotal spines; broadest through the prothorax (0.40-.045 mm), narrowest through the epinotum (0.3 mm). Thoracic humeri subangular. Epinotal spines, from above, small, with acute apices, the spines approximately 0.05 mm in length but shorter than their interbasal distance. Epinotal spines, in profile, distinct but not large, subtriangular, with their apices not especially directed dorsally. In profile, mesoepinotal impression distinct but not large, scarcely 0.10 mm in length and hardly half as deep. Base of epinotum sloping posteriorly. Petiolar node, from above and behind, with dorsally converging sides and weakly rounded or almost straight superior border. Postpetiole, from above, subcampanulate, approximately 0.25 mm in length and 0.20 mm in breadth. Petiole, in profile, with rather short pedicel and a subangular node. Postpetiole, in profile, varying from about as long as high to not noticeably longer than high. Gaster, 0.9 mm in length, with the first segment occupying most of the dorsal surface.

Sculpturing of head rather weakly defined, consisting of a number of small longitudinal rugulae in front which extend to the occiput or very near it, areas to the side of this more rugulose-reticulate with weakly punctulate interspaces, which are subopaque to opaque; below and median to the eye the longitudinal rugulae are very coarse. Mandible longitudinally rugulose and also with scattered punctures which in some lights appear rather coarse. Promesonotum with rather well defined, distinct and rather widely spaced longitudinal rugulae, the interspaces so feebly sculptured as to appear shining or only weakly opaquish, this depending largely upon the nature of the light; some of them form a transverse arch on the anterior border of the pronotum, especially on the pronotal collar and also dorsad of the collar. Pronotal collar largely punctulate. Base of epinotum more irregularly sculptured. Sides of the thorax, especially the meso- and metapleuron, longitudinally rugulose, the punctulate interspaces somewhat coarser on the mesopleuron. Propleuron more weakly sculptured and in some lights rather shining. Most of the dorsal surface of the postpetiolar node rather smooth and shining, the sides and extreme posterior border with rugulae and punctulate interspaces. Petiolar node a little more sculptured and therefore slightly more subopaquish than the postpetiolar node. Base of gaster with longitudinal rugulae of variable length, the longest of which are approximately 0.10 mm but which are best seen only in certain lights. Frontal area, declivity of epinotum, and gaster, rather smooth and shining. Occipital region more shining than the remainder of the head.

Body light brown to brown, the antennae and legs even lighter. Some individuals have a slight infuscation on the dorsal surface of the head and gaster (these may be a little faded due to age).

One of the cotype workers has the entire pronotum covered with very distinct, widely spaced, transverse rugulae, the interspaces punctulate but not causing the surface to be dull enough to keep from shining. Some of the cotype workers have the longitudinal rugulae on the promesonotum rather weak, not widely spaced, and the interspaces enough dull so that the entire promesonotal area is not as shining as in other workers.

The worker of *diecki* is perhaps one of the most highly variable of all our species of *Stenamma*. In Michigan, Minnesota, and southeastern Canada, for example, the workers seem to be characterized in general by their stouter body, lighter color and stouter and more shining postpetiolar node. The postpetiolar node is commonly of a subglobular appearance. In the mountains of Tennessee and North Carolina the worker is unusually large, dark in color, and has a postpetiolar node which is less broad in proportion to its length. The mesoepinotal impression although highly variable in size and

shape is usually very large and distinct. Had I not seen so much variability in the worker of *diecki* throughout its general range and even in individuals from the same colony, I might be inclined to call these two variants subspecies.

Variations in workers other than cotypes from throughout the general range of *diecki* are as follows: Body length from approximately 2.7-3.5 mm; head longer than broad to about as broad as long, with the posterior border straight or weakly emarginate; eye approximately 0.05-0.10 mm in its greatest diameter and usually with 4-6 ommatidia; basal teeth of mandible varying considerably in size and number but commonly with from 4-5, occasionally with 7; mesoepinotal impression highly variable in size and shape, often of a V or U shape and ranging from less than 0.10-0.166 mm in length; epinotal spines highly variable in size and also in the direction which they point, more commonly directed posteriorly than upwards, approximately 0.05-0.10 mm in length; pedicel of the petiole variable in length, often short in appearance; postpetiole generally subcampanulate to subglobose in appearance; rugulae on the pronotum although usually longitudinal in direction, occasionally arched anteriorly, transverse, or irregular in direction; the density of the rugulae also highly variable; body color light brown through reddish brown to almost black but never black, appendages lighter; sides of thorax with the longitudinal rugulae and punctulate interspaces varying a great deal with regard to density and coarseness.

The characters distinguishing the *diecki* worker are the size and structure of the eye, the shining propleuron, promesonotum and postpetiole. Due to its high degree of variability the worker has less good, stable characters than most species of *Stenamma*.

DEALATE FEMALE

Similar to the worker except as described below.

Length 3.7 mm. Eye oblong, 0.2 mm in its greatest diameter and with 14 ommatidia; anterior border of eye less than 0.2 mm from the base of the mandible. Ocelli distinct, each ocellus approximately 0.05 mm in width. Funicular segments 2-6 broader than long; last funicular segment approximately 0.3 mm in length. Thorax 1.25-1.3 mm in length from the anterior border of the pronotal collar to the apices of the epinotal spines; thoracic humeri not well defined, rounded or broadly subangular. Epinotal spines less than 0.10 mm in length and approximately 0.3 mm apart at their apices. In profile, the thorax appears short and rather high with the base of the epinotum sloping and the epinotal declivity almost vertical. Petiolar node, in profile, subangular; postpetiolar node from the same aspect, convex above, but not strongly so.

The longitudinal rugulae on the front of the head rather fine, extending at least to the region of the ocelli. Pronotum coarsely and transversely rugulose, with weakly punctulate interspaces. Mesonotum and scutellum distinctly but less coarsely longitudinally rugulose, with punctulate interspaces. Area between the clypeal carinae, lower half of mesopleuron, and much of the dorsal surfaces of the petiolar and postpetiolar nodes smooth and shining.

Pilosity on dorsal surface of body rather abundant, grayish, composed of erect and also reclinate hairs of variable length, but largely reclinate.

Body light brown or reddish brown; mandibular teeth, eyes, borders of the ocelli and wing articulations dark.

Described from two cotype females.

Females other than cotypes vary largely in the following respects: Body length 3.4-4 mm; thoracic length 1.15-1.4 mm; head 1.12-1.2 times as long

as broad, with the posterior border sometimes feebly emarginate; greatest width of eye 0.17-0.20 mm, with 12-14 ommatidia; mesonotum commonly with a longitudinal carina throughout its center and also with longitudinal rugulae of variable coarseness, the entire surface of the mesonotum usually subopaque; mesopleuron variable in sculpture but usually more or less shining in appearance; epinotal spines ranging from thin to coarse, and small to fairly large, but apparently never over 0.10 mm in length; postpetiole usually longer than wide, sometimes apparently as wide as long, of a subcampanulate to globular appearance; body light brown or reddish brown to deep blackish brown but not black; antennae and legs often lighter; wings pale to yellowish with usually darker veins and stigma. Venation similar to that of *brevicorne*.

Although highly variable in many respects, the female is fairly constant with regard to a few characters, such as the size of the eye and the number of ommatidia therein, the nature of the sculpturing of the mesonotum and mesopleuron, and the rather smooth and shining dorsal surface of the postpetiolar node.

MALE

Length 2.75-3 mm. Mandible moderately large. Ocelli not large but distinct, not placed on a prominent protuberance above the general surface of the head; anterior ocellus about 0.4 mm from the anterior border of the clypeus. Eye rather large and strongly convex, approximately 0.22 mm at its greatest diameter, the anterior border of the eye about 0.05 mm from the base of the mandible. Antennal scape rather short, about 0.25 mm in length, approximately as long as the combined lengths of the first four funicular segments; the first funicular segment enlarged, subpyriform. Thorax 1.15 mm in length from the anterior border of the pronotal collar to the junction of the thorax with the petiole; widest slightly anterior to the insertion of the wing where it is 0.6 mm; Mayrian furrows present but not always clearly seen in some lights. In profile, base of epinotum meeting the declivity on each side to form an angle or else a very small tubercle. Wings yellowish to sordid in color. In profile, petiole without an especially long peduncle, the ventral surface without a tooth or protuberance; anterior face of node meeting the dorsal surface of the node to form a rather distinct angle. From above, the postpetiole is about as broad as long, somewhat subrectangular in appearance, with the anterior portion of the sides somewhat convergent.

Mesopleuron, dorsal surfaces of petiolar and postpetiolar nodes, and gaster, smooth and shining. Much of head finely punctulate; scutellum with fine, longitudinal rugulae; epinotum punctulate and also finely rugulose; all of these areas subopaque or opaque in most lights.

Body dark brown or blackish brown but not black; mandibles, antennae, legs and apex of gaster lighter.

The description of the male is based on 14 males collected from a colony along with three workers and ten alate females at the Edwin S. George Reserve, Livingston County, Michigan, by Miss Mary Talbot on August 28, 1953, in soil on the north slope of a deep, oak-hickory woods. These individuals bear the No. 53-662.

Variations in individuals from other localities are as follows: Head 1.16-1.2 times as long as broad; anterior ocellus 0.4-0.475 mm from the anterior border of the clypeus; greatest diameter of eye 0.22-0.25 mm; scape 0.23-0.33 mm in length and as long as the combined lengths of approximately the first 4-5 funicular segments; length of thorax 1.1-1.5 mm; greatest width of thorax 0.6-0.75 mm; postpetiole frequently as broad as, or broader than long;

Mayrian furrows and parapsidal sutures present but not always very distinct; prescutum propleuron, and dorsal surface of the epinotum frequently shining; body light brown through brown to black, with the mandibles, antennae, legs and apex of the gaster lighter; wings hyaline to brownish, and of the same venation as in the female.

Type locality.—Of *diecki,* near Yale, British Columbia (Canada). Workers and dealated females collected by Dr. George Dieck; of *impressum,* Richfield Springs (Otsego County), New York. In describing *impressum,* Emery erroneously gave the type locality as Richs Spring, New York and this error was repeated by Creighton in his "Ants of North America."

Location of types.—Of *diecki,* Museo Civico di Storia Naturale, Genoa, Italy, United States National Museum, and the Museum of Comparative Zoology at Harvard College. The holotype worker from which Emery described *impressum* should be in Museo Civico di Storia Naturale but Dr. Delfa Guiglia of this museum writes that she is unable to find the holotype. In the U. S. National Museum there are workers of *impressum* which appear to belong to the original series.

Distribution.—*S. diecki* has been recorded from southeastern and southwestern Canada and most of the United States except the extreme Central States and a few of the Southern States. No doubt the species has a much wider distribution in Canada than present records indicate.

SPECIMENS STUDIED: *Of diecki,* three cotype workers and two dealate cotype females from the Museo Civico di Storia Naturale, Genoa, Italy, one cotype worker from the Museum of Comparative Zoology at Harvard College and one cotype worker from the U. S. National Museum; of *impressum,* two workers in the U. S. National Museum which appear to belong to the original series. The holotype of *impressum* which should be in the Museo Civico di Storia Naturale has apparently been lost. I have also studied 1,279 workers, 26 dealate females, 152 alate females and 96 males from localities other than the type locality.

Mary Talbot (Ent. Soc. Amer. Ann. 44:307, 1951) erroneously recorded as *diecki,* 2 species—*impar* and *meridionale,* both of which had been determined by me. Buren (Iowa State Col. J. Sci. 15:112, 1941) also erroneously recorded individuals of *brevicorne* as *impressum.*

BIOLOGY

This widely distributed species is highly adaptable to various types of ecological habitats. It can be found at altitudes at least as high as 8,000 feet. *S. diecki* appears to be especially common in southern Canada and the most northern tier of our States. In southeastern United States (Virginia, North Carolina, and Tennessee) *diecki* seems to be confined to rather high altitudes. Colonies nest in the soil and in rotting wood. Nests in the soil are usually under cover of stones, logs, humus, moss, etc. Colonies may be found nesting in boggy or swampy areas to rather dry areas and from unshaded conditions through open woods to dense woods. There appears to be only a single queen per colony. The largest colony that has come to my attention contained, on July 31, 97 workers, 98 worker pupae, 1 dealate female, 56 alate females, 28 males and 1 male pupa; the adults alone totaling 182 individuals. Data based on a number of colonies indicate that males and virgin females are produced from midsummer to early fall. Mating flights may take place from spring to fall. In the older colonies it is common for the males and virgin females produced during the current year to remain overwinter in the parental nest and take their nuptial flights in the spring or later the following

year. Nests in the soil are usually shallow, seldom being more than a foot or so from the surface of the soil. There are only a few chambers. The workers are commonly of a timid disposition and on occasion will feign death when disturbed.

Cole (Tenn. Acad. Sci. J. 25:297, 1950) under the name *impressum*, gives an interesting account of the habitats and biology of *diecki*. He studied 18 colonies found in red spruce-balsam fir forest near Newfound Gap, elevation 5,250 feet, in the Great Smoky Mountains National Park, Tennessee. The stands were not dense but the trees close enough to provide continuous dense shade; high soil moisture and low soil and atmospheric temperatures. Underbrush was exceedingly sparse but the ground was covered with decaying logs and a heavy carpet of moss. Each nest consisted of a small superficial chamber in the surface soil just beneath a stone or piece of wood. He found that when disturbed although the workers were sluggish they moved their small batches of brood to cover. Only a single egg mass was noted per nest and this mass contained from 16 to 32 eggs. Eight complete colonies consisting of 12 to 29 workers, a queen and brood were taken to the laboratory for further study. Males emerged from some of the colonies from August 7 to 19, but no females developed in any of the nests. Living collembolans and thysanurans were placed in the nest for food and their internal contents were devoured by the workers.

W. L. Brown and E. O. Wilson, who collected a number of colonies of *diecki* in the White Mountains National Forest of Maine, made the following remarks in a letter to me,

"the *diecki* colonies were taken in rotten wood and under stones at the summit of Evans Notch (a pass through the mountains) and on the east side in both dark beech woods and woods predominantly spruce-fir at somewhat lower altitudes. All localities were shaded and moist; pupae of sexes were present in many nests at this date (mid-August) and eclosed with full pigmentation a few days later in the laboratory. Other White Mountains collections were taken in mixed spruce-fir-birch forest in widely separated localities on the lower slopes on both sides of the Presidential Range. The colonies are quite abundant in many places, though inconspicuous. Few other ants are found in such situations, the most common being *Formica subnuda* Emery, *F. neorufibarbis* Emery, *Camponotus herculeanus* (L.) one or two *Myrmica* spp., and one or two less abundant species.

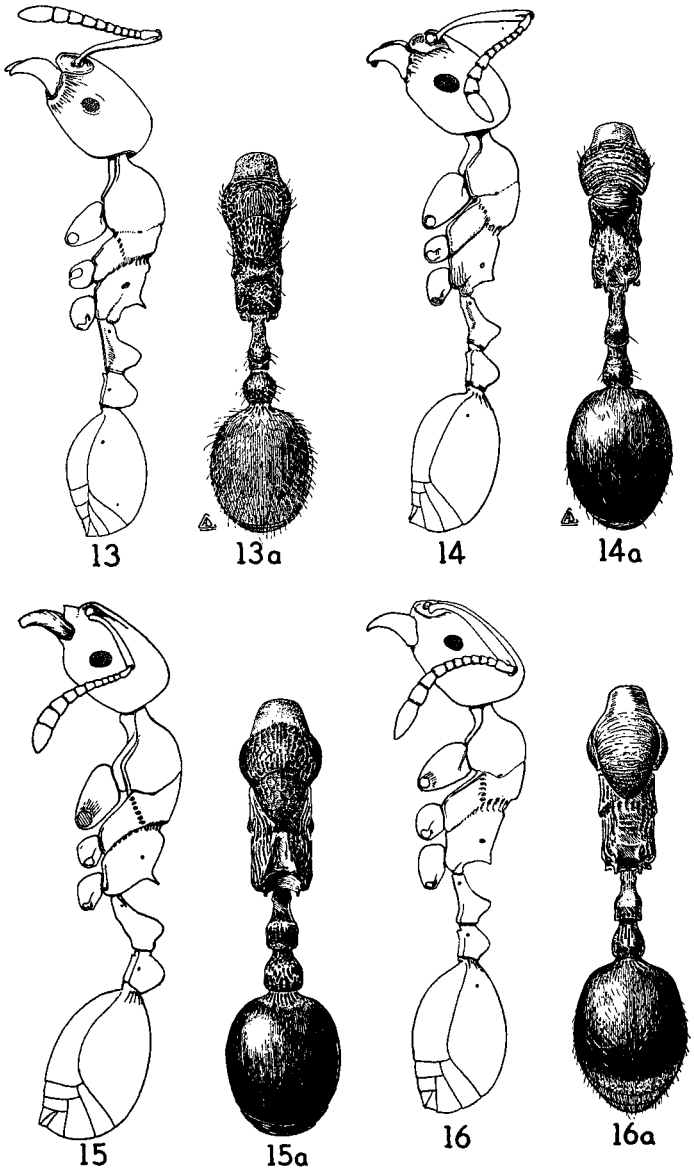
"The *Stenamma* feign death for a short time but are quick and persistent at removing the brood to safety. The nest population of *diecki* are estimated to average about 40 to 60 adult workers each in the White Mountains area. We have not been able to find nests of these or other *Stenamma* species at all in eastern Massachusetts though one can easily find stray workers under stones and in leaf litter during the months at the beginning of the season. We cannot account for the very striking difference in collecting between localities near Boston and those in the White Mountains.

"At Evans Notch Brown and Wilson found larvae of *Stenamma* attached and actually feeding on a dipterous larva which was determined by W. W. Wirth as possibly an empidid. Under the same conditions but in another colony they found what they thought was a *Tomocerus* springtail. Due to the bad condition of the individual when received by Miss Grace Glance she would not confirm the generic determination of the springtail nor even the fact that it was a springtail."

STENAMMA BREVICORNE (Mayr)

Aphaenogaster brevicornis Mayr, 1886, Zool.-Bot. Gesell, Wien, Verh. 36:443, 447-448, worker, alate female. Mayr, 1887, Zool.-Bot. Gesell. Wien, Verh, 37:628, footnote (neoarcticum worker = brevicornis).

PLATE 4



Figs. 13-16.—Lateral view of worker with all segments of legs omitted except the coxae and (a) dorsal view of worker with head and legs omitted. 13. *S. brevicorne* (Mayr); 14. *S. carolinense* M. R. Sm.; 15. *S. meridionale,* n. sp.; 16. *S. foveolocephalum* M. R. Sm.

Stenamma neoarcticum (Mayr), (Mayr), 1886, Zool.-Bot. Gesell. Wien, Verh. 36:454, worker, (alate female and male misdet.). New Syn.

Stenamma (Stenamma) brevicorne (Mayr), Emery, 1895, Zool. Jahrb. Abt. f. System. 8:299, worker, alate female, male. Forel, 1901, Soc. Ent. Belg. Ann. 45:347.

Stenamma brevicorne (Mayr), W. M. Wheeler, 1903, Psyche 10:166-168, worker. W. M. Wheeler, 1904, Amer. Mus. Nat. Hist. Bul. 20:302 (det. questionable). W. M. Wheeler, 1905, Amer. Mus. Nat. Hist. Bul. 21:382. Gaige, 1914, Mich. Univ., Mus. Zool., Occas. Papers No. 5:3, 9. W. M. Wheeler, 1917 (1916), Conn. State Geol. and Nat. Hist. Survey Bul. 22:585. Davis and Bequaert, 1922, Brooklyn Ent. Soc. Bul. 17:9. W. M. Wheeler, 1926, Ants, p. 150, reprinted, Columbia Univ. Press, N. Y. Bequaert, 1928, *in* Cornell Univ. Agr. Expt. Sta. Mem. 101:997. Talbot, 1934, Ecology 15:420, 423, 425. Wing, 1939, Ent. News 50:162. Wesson and Wesson, 1940, Amer. Midl. Nat. 24:90, 93. Morris, 1943, Ind. Acad. Sci. Proc. 52:208. Buren, 1944, Iowa State Col. J. Sci. 18:284, worker. Gregg, 1944, Ent. Soc. Amer. Ann. 37:454, 456, 464-465, worker. M. R. Smith, 1947, Amer. Midl. Nat. 37:555, worker. Creighton, 1950, Harvard Univ., Mus. Comp. Zool. Bul. 104:136, worker, female, pl. 17, figs. 1-4 (all castes, also wing). Headley, 1952, Ent. Soc. Amer. Ann. 45:435-442.

Stenamma brevicorne brevicorne (Mayr), M. R. Smith, 1951, *in* U. S. Dept. Agr. Monogr. No. 2, p. 794.

Stenamma brevicorne diecki var. *impressum* Emery, Buren, 1941, Iowa State Col. J. Sci. 15:112. (misdet.)

WORKER (pl. 4, figs. 13, 13a)

Length 2.7-3.8 mm. Funicular segments 2-6 as broad as, or broader than long; the four apical segments of the funiculus distinctly enlarged but not forming a well defined club; the length of the club exceeding the length of the remainder of the funiculus. Eye moderately large for a *Stenamma,* oblong, usually with approximately 8-10 ommatidia in its greatest diameter. The promesonotum, in profile, forming a rather long, uninterrupted arch in which the anterior half of the arch is distinctly more convex than the posterior half. Mesoepinotal impression usually strong and approximately twice as long as deep. Epinotum lower than the mesonotum and usually with a prominent, transverse welt near the base following the mesoepinotal impression. Base and declivity of the epinotum meeting to form a pair of short, but distinct, tuberculate spines which are approximately one-fourth to one-third the length of the base of the epinotum. Petiolar node viewed posteriorly with dorsally converging sides and truncate or feebly rounded superior border. Postpetiolar node viewed from above, stout, of variable shape, usually subspherical but occasionally subrectangular or transversely elliptical.

Frontal area and much of the clypeus smooth. Frontal region bearing fine, longitudinal and posteriorly diverging striae. Cheeks mostly longitudinally rugulose-punctate. Promesonotum usually largely, longitudinally rugulose, with the anterior border of the pronotum transversely rugulose. Dorsal surface of the epinotum with variable sculpture but quite commonly irregularly rugulose or rugulose-reticulate. Sides of thorax mostly rather coarsely, longitudinally rugulose with the exception of the lower part of the mesopleuron which is commonly reticulate-punctate. Base of gaster with distinct but short, longitudinal rugulae which are apparently never as long as the postpetiole. Petiolar and postpetiolar nodes mostly punctate or rugulose-punctate.

Head (with the exceptions of the mandibles, clypeus and frontal area), thorax, petiole and postpetiole, subopaque. Gaster smooth and shining. Propleuron occasionally somewhat shining.

Body with rather abundant, suberect to erect, grayish or light yellowish hairs of variable length. Head, and especially the gaster, usually more hairy than the thorax. Hairs on appendages abundant but not always very closely appressed.

Head, thorax, petiole and postpetiole dark brown; antennae and legs light brown or yellowish brown. Gaster brown or blackish with the apex and the base lighter thus causing the dark area to appear as a more or less distinct, transverse band.

The head varies very noticeably in shape; with some individuals it is slender, very distinctly longer than broad whereas in other individuals the

head is almost square but never quite as broad as long. The number of ommatidia in the greatest diameter of the eye is also subject to considerable variation, usually there are approximately 8-10 but one individual had only 4 or 5. Although it is common for the epinotum to bear a transverse welt near the base, the welt may be obscure or even lacking in some individuals. The postpetiolar node although usually subspherical may sometimes be transversely elliptical or even subrectangular. The sculpture on the promesonotum is usually largely longitudinally rugulose, occasionally there are individuals in which the rugulae have an arched or oblique trend or even an irregular, indescribable pattern. The color of the head, thorax, petiole and postpetiole is quite commonly reddish brown but often may be a light brown. Although the gaster is usually darker in the middle than at the base and tip there are individuals in which the base may be as dark as the median area.

The worker of *brevicorne* may be distinguished by its moderately large eye, which usually bears 8-10 ommatidia in its greatest diameter; the strong mesoepinotal impression which is frequently twice as long as deep; base of epinotum usually with a transverse welt following the mesoepinotal impression; the distinct spines which are approximately one-fourth to one-third the length of the base of the epinotum; petiolar node subconical, when viewed from behind; postpetiolar node, from above, stout, as broad as, or broader than long; head, thorax, petiole and postpetiole subopaque; promesonotum largely coarsely longitudinally rugulose; body usually brown with the gaster light at the base and apex and darker medianly.

ALATE FEMALE

Similar to the worker except as described below.

Length 3.4-4.2 mm. Ocelli small, yellowish, not noticeably protruding above the general surface of the head, the anterior ocellus located from 0.3-0.4 mm posterior to the frontal area. Greatest diameter of the eye ranging from 0.2-0.25 mm and with 14-18 ommatidia. Antennal scape failing to attain the posterior border of the head by its greatest diameter or less, funicular segments 2-7 as broad as, or broader than long; last segment of the club not as long as the combined lengths of the three preceding segments. Thorax 1.35-1.6 mm in length from the anterior border of the pronotal collar to the apices of the epinotal spines, widest anterior to the articulations of the anterior wings where it measures 0.65-0.75 mm. Epinotal spines, in profile, variable in size and shape, usually stout and prominent and ranging from 0.10-0.15 mm in length; from above, the spines are approximately one-fourth to one-third as long as their interapical distance. Anterior wing grayish to yellowish depending upon the light, normally containing a closed cubital and a closed discoidal cell and a well developed stigma; without vein r-m but with Mf3 present (Plate 1, fig. 2), occasionally one or both of the anterior wings may have a partly or fully closed second cubital cell. Mf3 is seldom absent but an occasional individual may lack this vein in one or both anterior wings. Upon infrequent occasions the discoidal cell may be only partly closed in one or both wings. Petiolar peduncle, in profile, often rather short and stout, the node subangular, slightly higher than long; postpetiole, in profile, approximately as high as long. Postpetiolar node, from above, convex, wider than long.

Scutellum and much of the mesonotum largely longitudinally rugulose-punctate. Pronotum, exclusive of the collar, largely transversely rugulose-punctulate. Area above the epinotal spines transversely rugulose with punctulate interspaces, the sculpturing often extending well down below the spines, occasionally however the area below the spines may be smooth or almost so.

Head, thorax, petiole, and postpetiole ranging from a light brown or reddish brown through dark brown to almost blackish brown.

Variation occurs mostly in the length, proportion, and color of the body. The variation of the wings is apparently less than other types of variation; it commonly consists in a partly or fully closed extra cubital cell, lack of Mf3 or in the presence of a partly closed discoidal cell.

The female can be distinguished from that of other forms by its large size; stout body; nature of the wing venation; sculpturing of the thorax (especially of the sides and posterior portion); rather prominent and stout epinotal spines; and the shapes of the petiolar and postpetiolar nodes, as well as the nature of their sculpturing.

MALE

Length 3-3.5 mm. Ocelli distinct but not prominent or protruding above the general surface of the head, the anterior ocellus approximately 0.05 mm in width and located 0.2-0.25 mm posterior to the frontal area. Frontal area small but distinct, longer than broad. Frontal carinae short, 0.15-0.20 mm in length, subparallel, with scarcely any lobes. Eye large and prominent, 0.25-0.30 mm through its greatest diameter. Antennal scape (excluding the pedicel) approximately 0.28-0.37 mm in length, approximately as long as the combined lengths of the first four to six funicular segments; last funicular segment approximately as long as the combined lengths of the two preceding segments. Middle of the dorsal surface of the clypeus with a flattened area or impression that is longitudinal in direction. Mandible rather small, subtriangular. Thorax 1.1-1.5 mm in length from the anterior border of the pronotal collar to the apices of the epinotal spines, greatest width 0.6-0.75 mm just anterior to the articulations of the anterior wings. Mayrian furrows well developed, the parapsidal sutures present but best seen only in certain lights. In profile, base of epinotum depressed or flattened but the surface not horizontal, the base and declivity meeting on each side to form a broad tubercle or angle. Petiole, in profile, pedunculate, with a low not strongly convex node, which is approximately as long as the peduncle. Postpetiole, in profile, larger than the petiolar node, approximately as high as long. From above, postpetiolar node as broad as, or broader than long, usually with the appearance of being broader than long.

Head varying from rather densely and finely punctulate to reticulate-punctulate, the front with fine longitudinal striae; base of epinotum and sides of the petiole and postpetiole largely punctulate. Mesonotum and scutellum largely longitudinally rugulose-reticulate and punctate or punctulate, the area between the Mayrian furrows less heavily sculptured and therefore more shining than the mesonotum. Mesopleuron usually more weakly sculptured than the side of the epinotum which is irregularly rugulose-reticulate and punctulate. Gaster, and dorsal surface of the postpetiolar node, smooth and shining.

Pilosity light yellowish or grayish, moderately abundant, consisting of hairs of variable length which are suberect to erect.

Body brown to brownish black; mandibles, antennae, legs and apex of gaster light brown to yellowish, usually distinctly lighter than the remainder of the body.

Variations occur in the size of the male as well as in the proportions of the body. Individuals have been noted with the following abnormalities in the venation of the anterior wings: one or both wings with either a partly or else a fully developed extra cubital cell; also one or both wings lacking a closed discoidal cell or else having only a partly closed discoidal cell.

The male is distinguished from that of other species largely by the shape of the epinotum as well as the nature of the wing venation.

Type locality.—Virginia. Described by Mayr from workers and alate females collected by Theodore Pergande from beneath a stone in a locality presumably near Washington, D. C.

Location of types.—The Gustav Mayr collection in the Naturhistorisches Museum in

Vienna, Austria. A cotype worker and female are in the U. S. National Museum as well as two workers and four females apparently belonging to the original series.

Distribution.—This species is distributed from at least Nova Scotia, Quebec, and Ontario south to Virginia and west to Nebraska and Minnesota. W. M. Wheeler records *brevicorne* from workers collected at Friday Harbor, Washington, by Trevor Kincaid and from a single worker collected from the north fork of the Swannanoa in North Carolina presumably by William Beutenmueller. Although I have not seen the specimens from these two localities, I feel quite positive that the Friday Harbor individuals were misdetermined and that the North Carolina record is questionable since no one else has recorded or found *brevicorne* in that State. Wheeler also misdetermined nine males of *diecki* as *brevicorne* which were collected at Dikes Peak, Mt. Desert Region, Maine, on October 2, 1934, by A. E. Brower. Ames and Arnold Park, Iowa individuals of this ant were also misdetermined by Buren (Iowa State Col. J. Sci. 15:112, 1941) as *impressum.*

SPECIMENS STUDIED: Six cotype workers and two alate females from the Naturhistorisches Museum, Vienna, Austria, a cotype worker and alate female in the U. S. National Museum as well as two workers and four females apparently belonging to the original series; also 586 workers, 4 dealate females, 205 females and 214 males from localities other than the type locality.

BIOLOGY

S. brevicorne is not only one of the most widely distributed but the oldest and perhaps best known of our North American species of *Stenamma.* Although apparently preferring to nest in wooded areas, the species is also found in meadows and other places. It usually nests in moderately dense to dense woods of such composition as maple, mixed oaks, oak-maple, red and white oaks, and beech-maple. Here the ants more commonly nest in the soil under stones, logs, humus, moss or other debris, as well as in the rotting wood of logs and stumps. Colonies are small, consisting of only a few dozen to a hundred or so adult individuals. The largest that has come to my attention was found at Tiffin, Ohio, on August 21, 1948, by Talbot and Headley and was composed of 105 workers, 8 alate females, and 12 males. Although no one has made a detailed study of *brevicorne,* random observations indicate that this species is timid and sluggish, subterranean or hypogaeic. The workers are undoubtedly carnivorous, but may also be predaceous. Wheeler, so far as I am aware, was the first individual to advance the theory that, in some colonies at least, winged females and males overwinter in the parental nest, these sexual castes having been produced from late summer to early fall. None of the evidence I have seen disproves this, but no doubt the age of the colony has a great deal to do with whether or not sexual castes can be produced. As the colonies are not large, it is likely that there is only one mother queen per colony. This also seems to be the case in many, if not most of our own species. The overwintering sexual castes apparently start emerging from the parental colony in spring or early summer of the following year. It is believed that it is then that mating and the forming of new colonies are started. H. V. Weems, Jr., captured a copulating male and female on May 14, 1950. Since alate females have been captured at light traps and males taken while flying at dusk, it appears that both castes fly freely at night, like many other ants. Although altitudinal records are lacking for *brevicorne,* it appears that this form lives in low lands or areas of only moderately high elevation.

Stenamma meridionale, n. sp.

Stenamma diecki Emery, Talbot, 1951, Ent. Soc. Amer. Ann. 44:307 (part). Misdet.

WORKER (pl. 4, figs. 15, 15a)

Length 4 mm. Last funicular segment 0.35 mm in length, longer than the combined lengths of the two preceding segments. Eye oblong, placed a little more than its greatest diameter from the base of the mandible, the greatest diameter less than 0.2 mm and composed of 9 or 10 ommatidia. Thorax 1.4 mm in length measured from the anterior border of the pronotal collar to the apices of the epinotal spines; with rather rounded or subangular humeri; widest through the prothorax (0.6 mm), narrowest through the epinotum (0.45 mm). In profile, with a very pronounced mesoepinotal impression which is approximately 0.15 mm in its greatest length and slightly more than 0.05 mm at its greatest depth. Base of epinotum distinctly inclined posteriorly, approximately 0.3 mm in length, the base of the epinotum meeting the declivity to form a pair of well developed, long, finger-like spines which are between 0.05-0.10 mm in length, and are directed posterodorsally and somewhat laterally. From above and somewhat behind, the petiolar node appears compressed anteroposteriorly and has subparallel sides and a weakly emarginate but not sharp, transverse, superior border. Postpetiole, from above, subcampanulate, scarcely longer than broad. Gaster, from above, oblong or subelliptical, without basal humeri.

Head with rather coarse, distinct sculpturing; front of head bearing a number of longitudinal striae which extend to approximately the posterior border of the head; much of the remainder of the head with rugulose-reticulate to reticulate sculpturing, the interspaces punctulate. Thorax, from above, with rather coarse and somewhat widely spaced rugulose-reticulate sculpturing, some of the rugulae on the pronotum, at least, with a longitudinal trend; side of thorax somewhat similarly sculptured except that perhaps the ventral half or more of the mesopleuron is largely reticulate. Pedicel and anterior face of petiolar node punctulate, the dorsal and posterior surface of the node rugulose-punctate; postpetiole sculptured somewhat similarly. Basigastric striae more than 0.1 mm in length. Frontal area, epinotal declivity and gaster smooth and shining. Most of the head, the thorax, petiole and postpetiole subopaque (slightly shining however in some lights).

Hairs moderately abundant, yellowish, of variable length, largely reclinate to suberect; apparently longest on the clypeus and the front of the head.

Body dark brown, to some extent with a blackish cast; anterior portion of the head, antennae, legs and apex of gaster a much lighter or yellowish brown.

Paratype workers vary from the holotype worker in the following characters: Body length 3.4-4 mm; head 1.10-1.12 times as long as broad with the posterior border straight or broadly and almost imperceptibly emarginate; length of thorax 1.25-1.4 mm; greatest width (through pronotum) 0.5-0.6 mm; narrowest width (through epinotum) 0.375-0.45 mm; last funicular segment 0.3-0.35 mm in length and longer than the combined lengths of the two preceding segments; the 1st, and 7th through 11th funicular segments, longer than broad; eye with 8-10 ommatidia in its greatest diameter; mandible usually with five basal teeth but occasionally as many as six teeth; superior border of petiole straight or feebly emarginate; postpetiole, from above, almost as broad as long to 1.2 times as long as broad; head, thorax, petiole and postpetiole from light brown to dark brown with a decided blackish cast.

Workers other than paratypes show the following variations: Body length 2.8-4 mm; head 1.10-1.23 times as long as broad; thoracic length 1-1.4 mm; greatest prothoracic breadth 0.45-0.60 mm; narrowest breadth of thorax (through epinotum) 0.35-0.40 mm; mesoepinotal impression 0.1-0.15 mm in length and usually about 0.05 mm in depth; last funicular segment 0.3-0.35 mm in length; greatest diameter of eye 0.1-0.15 mm with 6-10 ommatidia; petiolar node from above and behind with subparallel to dorsally converging

sides and with the superior border of the node straight or rounded; sculpturing of head not always coarse; epinotal spines from tuberculiform to slender, digitiform; epinotum occasionally with a transverse welt at the base; pronotum and mesonotum often with well defined and rather broadly spaced longitudinal rugulae, the interspaces of which are either smooth or finely punctulate; body varying from light reddish brown to dark reddish brown, the anterior portion of the head, appendages and apex of the gaster usually lighter.

The worker can be distinguished by the following characters: Large size, 3.4-4 mm; large eyes, which have 8-10 ommatidia in their greatest diameter; pronounced mesoepinotal constriction, which is often as much as 0.15 mm in its greatest length and from 0.05 to almost 0.10 mm in depth; the posteriorly sloping base of the epinotum; the long, finger-like epinotal spines; and the anteroposteriorly compressed petiolar node, which when viewed from above and behind is subrectangular and has a straight or weakly emarginate superior border.

DEALATE FEMALE

Length 4.6 mm. Similar to the worker except in the following respects: Head 1.08 times as long as broad; anterior ocellus located approximately 0.4 mm back of frontal area; length of thorax 1.7 mm; greatest breadth of thorax (through the mesonotum anterior to the wing insertions) 0.85 mm; narrower breadth (through the epinotum) 0.55 mm; greatest diameter of eye between 0.25-0.30 mm with approximately 18 ommatidia; epinotal spines well developed, approximately 0.10 mm in length, stout, with blunt apices, from above, at least three times as far apart at the apices as are the length of the spines; mesonotum with well spaced, longitudinal rugulae; base of epinotum with coarse, transverse rugulae; sides of prothorax and epinotum largely with coarse, longitudinal rugulae with punctate interspaces, most of the mesopleuron largely smooth and shining.

Females other than the paratype show the following variations: Body length 3.9-4.6 mm; head 1.08-1.14 times as long as broad; anterior ocellus located from 0.35-0.40 mm back of frontal area; length of thorax 1.35-1.7 mm; greatest breadth of thorax 0.7-0.85 mm; narrowest breadth of thorax 0.40-0.55 mm; greatest diameter of eye 0.2-0.3 mm; with 14 to 18 ommatidia therein; epinotal spines 0.25-0.35 mm apart at their apices; mesopleuron usually more smooth and shining than the remainder of the side of the thorax, although it may be sculptured somewhat; dorsal surface of body often infuscated, with the anterior portion of the head, the appendages and apex of gaster, and some scattered areas on the mesonotum lighter.

The female is distinguished from that of other species largely by the following characters: Large size, large eyes with 18 ommatidia in their greatest diameter; nature of the sculpturing of the body; the large and characteristic shaped epinotal spines and the shape of the petiole and postpetiole, especially the former.

Type locality.—Droste Woods, St. Charles County, Missouri. Described from individuals collected from two colonies by Mary Talbot. The holotype and 15 paratype workers from colony No. 48-2 collected 11-10-48 and a wingless female and 11 paratype workers from colony No. 52-12 collected 10-6-52. All of these have been placed in the U. S. National Museum under U.S.N.M. No. 62392.

Distribution.—Va., Mo. and Ill. south to S. C. and Ark. The most northern locality from which this species has been collected is Oakwood, Vermilion County, Ill., which is slightly above the 40th degree of latitude.

SPECIMENS STUDIED: In addition to types, 77 workers and five dealate females from localities other than the type locality.

Three workers and one dealate female of *meridionale* from the Gustav Mayr collection were found erroneously mixed with types of *brevicorne*.

BIOLOGY

The only collections of *meridionale* made directly from colonies were those of Mary Talbot in the Droste Woods in St. Charles County, Missouri. She described the woods as a small, mixed oak-hickory woods, with large red and white oaks predominating. There was a great variety of other trees such as linden, elm, sycamore, maple, and sassafras. The collections were made in a pawpaw thicket occupying a gentle slope from a ridge to a small stream in the center of the woods. The trees overhead allowed moving patches of sunlight but did not form the continuous deep shade of beech-maple woods. There were scattered shrubs of buck brush, elderberry, sumach, etc., with the herb layers consisting of spring blooming flowers such as spring beauty, mandrake, dentura, and red trillium. The ground cover had a fairly heavy leaf covering mixed with a litter of twigs, acorns, hickory nuts and decaying branches. The soil was very dark and loose for three or four inches, then it became progressively compact and light colored until below six or seven inches it was a very hard-packed clay. Colony 48-2 was collected November 10, 1948, from two chambers in which the ants were hibernating in hard clay in depths of 10 and 15 inches. This colony was found when the air temperature was 43° F and the soil temperature 52° F. In the 10-inch chamber both workers and larvae were found, in the 15-inch chamber only a few workers. Although the ground was dug to a depth of 21 inches, no other immature stages or adults were found. The total content of the nest was 19 workers and 36 medium to large larvae, but no pupae, females, or males. This may not have represented the entire colony. The second colony, 52-12, was found October 6, 1952, in a chamber 13 inches deep which looked like a horizontal crack in the dry, hard clay. There had been no cold weather and the ants were still foraging in the woods. The air temperature at this time was 73° F, and the soil temperature 58° F. From the chamber were taken 11 workers and one dealate female, four larvae but no eggs, pupae, winged females or males.

In localities in other states where collections were usually made with Berlese funnel, single collections usually produced only from 1-13 workers with occasionally a dealate female. These individuals were largely taken from leaf mould, ground cover or top soil, mostly, if not entirely, in the woods. At this time we do not know the maximum size of colonies, the diversity of the nesting habits nor the month or months of the year in which males and winged females are produced.

STENAMMA CAROLINENSE M. R. Smith

Stenamma carolinense M. R. Smith, 1951, Wash. Ent. Soc. Proc. 53:156-158, 2 figs., worker.

WORKER (pl. 4, figs. 14, 14a)

Length 3.8-4 mm. Eye subelliptical, extremely large for a *Stenamma*, with about 10-

12 well defined ommatidia in its greatest diameter which is approximately 0.2 mm. All funicular segments as long as broad or longer than broad, the last four funicular segments forming a rather indistinct club. Thorax, in profile, with the promesonotum rather uniformly convex up to the point where the posterior part of the mesonotum forms a more or less straight incline into the mesoepinotal impression. Mesoepinotal impression strongly developed, apparently more than twice as long as deep. Epinotum, in profile, with a straight, subhorizontal base, which is separated from the declivity by a pair of extremely short, blunt, tuberculate spines, the spines at best not more than 0.2 the length of the base of the epinotum. Petiolar node, in profile, distinctly angular; from above and behind, slender, subrectangular to subconical, with straight or weakly rounded superior border. Postpetiole, from above, subcampanulate, apparently longer than broad. Base of gaster with longitudinal rugulae which are apparently less than 0.2 mm in length.

Cheeks and front of head with longitudinal rugulae; much of the remainder of the head rugulose-reticulate with punctate interspaces. Promesonotum largely smooth and shining, but also with fine, transverse rugulae, which in some lights are poorly defined. Mesopleuron and side of epinotum with rather coarse, longitudinal rugulae. Rear of petiolar node largely punctulate. Petiolar node mostly smooth and shining, even though bearing a small number of longitudinal rugulae.

Body clothed with suberect to erect grayish or light yellowish hairs, those on the head and gaster apparently denser than on the thorax.

Body light brown to brown, with the gaster scarcely darker than the remainder of the body. Vertex of head infuscated.

Very little variation has been noted in the types. The proportions of the head range from approximately 1.1 to 1.2 times as long as broad; the greatest diameter of the eye is approximately 0.2 mm and has 10-12 ommatidia; the petiolar node viewed from above and behind is slender, subrectangular to subconical; the color of the body varies from light brown to brown with scarcely darker gaster, on the paratype however, the median area of the gaster is very slightly darker than the base and apex.

The characters which distinguish the worker of *carolinense* are: The large size (3.8-4 mm); the unusually large eye for a *Stenamma;* weakly bicarinate clypeus; pronounced mesoepinotal impression; straight, subhorizontal base of the epinotum; extremely short, blunt, tuberculate spines; subcampanulate postpetiole; the rather smooth and shining promesonotum with fine, transverse rugulae; the light brown to brown body, with scarcely darker gaster.

Type locality.—A peach orchard on U. S. Highway 1, approximately 1 mile north of Hoffman, Richmond County, North Carolina. Described from two workers collected February 10 and 11, 1937, by William F. Turner from sparsely vegetated sandy soil.

Location of types.—A holotype and paratype worker in the U.S. National Museum.

Distribution.—Known only from the types.

SPECIMENS STUDIED: The holotype and paratype worker.

STENAMMA FOVEOLOCEPHALUM M. R. Smith

Stenamma foveolocephala M. R. Smith, 1930, Ent. Soc. Amer. Ann. 23:564-565, worker.

Stenamma foveolocephala M. R. Smith, M. R. Smith, 1931, Ent. News 42:17.

Stenamma foveolocephalum M. R. Smith, M. R. Smith, 1947, Amer. Midl. Nat. 37:555, pl. 6, fig. 22, worker. M. R. Smith, 1951, *in* U. S. Dept. Agr. Monogr. No. 2, p. 795.

Stenamma foveolocephalum M. R. Smith, Creighton, 1950, Harvard Univ., Mus. Comp. Zool. Bul. 104:136-137, worker.

WORKER (pl. 4, figs. 16, 16a)

Length 3.6-3.9 mm. Eye subelliptical, rather large for a *Stenamma,* with its greatest diameter approximately 0.15 mm and composed of seven or eight ommatidia. Second to sixth funicular segments as long as broad or longer than broad; the last funicular segment not as long as the combined lengths of the three preceding segments. Thorax, in profile, with the promesonotum more convex in the anterior than the posterior half. Mesoepinotal impression pronounced, approximately twice as long as deep. Base of epinotum sloping posteriorly to meet the declivity and forming two distinct tuberculate but acutely pointed spines which are about 0.16-0.2 the length of the base of the epinotum. Petiolar node, from above and behind, subconical, with weakly emarginate superior border. Postpetiole, from above, subcampanulate, approximately as broad as long but with the appearance of being longer than broad. Base of gaster with short, (0.10 mm or less) but in some lights, distinct longitudinal rugulae.

Mandibles rugulose-punctate, the punctures large, coarse and scattered. Cheeks with coarse longitudinal rugulae. Front with posteriorly divergent, longitudinal striae. Much of the dorsal surface of the head coarsely reticulate-punctate. Dorsum of the thorax, especially the promesonotum, rather coarsely and transversely rugulose-reticulate. Sides of thorax with coarse, longitudinal rugulae. Petiolar and postpetiolar nodes rather coarsely rugulose-reticulate. Frontal area, epinotal declivity and gaster smooth. The body and appendages shining in most lights.

Hairs moderately abundant, light yellowish or grayish, suberect to erect.

Body, exclusive of the gaster, dark reddish brown. Vertex of head infuscated. Gaster brownish except at the base and apex. Appendages lighter than the remainder of the body.

The worker of this form can be distinguished by: Its large size (3.6-3.9 mm); rather large eye for a *Stenamma*; pronounced mesoepinotal impression; the two distinct, tuberculate spines which are acutely pointed and about 0.16-0.20 the length of the base of the epinotum; the subcampanulate postpetiole; sculpturing of the dorsal surface of the thorax, especially of the promesonotum; largely rugulose-reticulate petiolar and postpetiolar nodes, and the color of the body.

Type locality—Southern slope of a thinly wooded hildside, two miles south of Ackerman, Mississippi. Described from two workers collected from sandy soil by M. R. Smith.

Location of types.—One cotype worker in the U. S. National Museum which I hereby designate as the lectotype. A second cotype worker in the collection of the Department of Entomology of the Mississippi State College has apparently been lost.

Distribution.—Known only from types.

SPECIMENS STUDIED: A single lectotype worker in the U. S. National Museum.

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