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A New *Formica* from Northern Maine, with a Discussion of its Supposed Type of Social Parasitism (Hymenoptera: Formicidae)¹

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While on a short visit in northern Maine during the summer of 1946, I collected a new and interesting ant of the *Microgyna* group of the genus *Formica*. The description follows below:

***Formica dirksi* sp. nov.**

Deålale queen, total length 5.1 mm. Head, maximum width through eyes 1.2 mm., at base of mandibles 0.78 mm., length to anterior border of clypeus 1.3 mm. Thorax, Weber's (1938:155, footnote) measurement 2.1 mm. General characters of the *Microgyna* group. Mandibles 7-toothed. Clypeus evenly rounded in front, with uneven surface and carina just barely distinguishable as a line anteriorly, but becoming a low blunt ridge through the mid-region and disappearing posteriorly. Head, excluding mandibles and eyes, somewhat longer than broad; narrower in front than in behind, with posterior corners evenly rounded, posterior border and sides slightly convex. Antennae of medium size, scape slightly stouter apically than basally, bent slightly and gradually in basal half, joints 2 and 3 of funiculus distinctly longer than broad; the apical joints only slightly longer than broad. Frontal area distinct, subtriangular, and about twice as broad at base as high. Frontal carinae diverging posteriorly, about as long as width of frontal area. Eyes black, more or less oval, strongly convex, remote from mandibular insertions and close to posterior corners of head. Ocelli medium-sized, round, white and forming an isosceles triangle with a base, which is situated posteriorly, equal to 0.24 mm. Ratio of base to the shorter sides is 10 to 7. Maxillary palpi long and slender, antepenultimate joint longest (0.23 mm.), penultimate joint shortest (0.11 mm.) and terminal joint exclusive of hairs intermediate in length (0.15 mm.). The ratio of the lengths of these three segments taken in the order given above is about 30:15:20. Thorax narrower than head, the prothorax distinctly narrower, the mesothorax only slightly so, measuring 1.0 mm. just before the point of insertion of the fore wings. In profile thorax appears strongly convex. Pronotum, shallowly concave anteriorly, convex posteriorly; promesonotal constriction distinct. Scutum rising sharply from promesonotal constriction, strongly convex anteriorly, but only moderately so posteriorly. Prescutum represented dorsally by only a furrow. Scutellum in profile very slightly convex; metanotum more or less flat. The constrictions between scutellum and metanotum and between metanotum and epinotum distinct. Epinotum convex anteriorly, but sloping down to base of petiolar scale as a straight line when viewed in profile. Petiole stout, both its anterior and posterior surfaces convex, upper border blunt and evenly rounded. Small postero-laterally directed lobes located ventrally at point of juncture with gaster. As viewed from in front, petiole is narrow below and broadest about midway from base to upper edge. Gaster in profile appearing flat anteriorly, evenly and strongly arched above and moderately convex below.

Body opaque, finely and densely shagreened. Clypeus and cheeks subopaque and more sparsely shagreened. Mandibles subopaque, striate and with piligerous punctures. Frontal area smooth and shining.

¹I wish to express my thanks to Dr. M. R. Smith of the Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture for his many kindnesses to me on my recent (September, 1948) trip to Washington, D.C. Dr. Smith offered several suggestions on the preliminary manuscript which helped to improve it. I wish to thank Dr. T. B. Mitchell and Miss Doris Sharpe of this institution for their kindness in reading the preliminary manuscript and making several suggestions as to its improvement. Thanks are also due Prof. C. O. Dirks of the University of Maine for his kindness in placing the facilities of his laboratory at my disposal for the period of my stay in Maine. I wish also to thank my wife for her kindness in typing the final manuscript.

Body and appendages, exclusive of antennal funiculi, covered rather densely with long, more or less uneven yellowish hairs, those of the thoracic dorsum being mostly spatulate and erect, while the others are largely simple and suberect. These hairs are especially numerous and long on the anterior and posterior surfaces of the head, the thoracic dorsum, the petiole, the gaster and the legs. On the cheeks these hairs are shorter, more delicate and very few in number, as the longer hairs stop rather abruptly at the lower level of the eyes. Hairs numerous on maxillary palpi. There are a few long hairs basally, but otherwise the hairs are short, yellowish and suberect. The hairs of the terminal segment extend apically so as to give this segment the appearance of being somewhat longer than it actually is. Hairs on scape less numerous than on the legs, simple, very delicate, suberect, yellowish and of uneven length. The hairs of the antennal funiculus are very short, distinctly yellow, not very numerous and mostly appressed. The eyes are sparsely covered with short, delicate, yellowish, erect hairs. Entire body and appendages covered with a fine, closely-appressed pubescence, which is most noticeable on the gaster where it is very dense and rather silvery in appearance. Elsewhere the pubescence is of a yellowish color. Pubescence is more or less lacking on the under side of the head and on the cheeks.

Head, antennal scapes, most of thorax, petiolar scale and legs all a dull yellowish to reddish brown. Mandibular teeth, antennal funiculi, maxillary palpi, vertex, scutum, scutellum and metanotum deeply and heavily infuscated. Cheeks, sides of prothorax and base of petiolar scale more yellowish and lighter than the legs. Gaster deep blackish brown throughout.

Worker and Male: Unknown.

Dirksi runs to *microgyna microgyna* in Wheeler's Key to the females of this group (1913:395-396). It differs from the typical *microgyna*², to which it is closely related, in a number of characters of structure, pilosity and pubescence of which the following seems to be especially noteworthy: 1) Somewhat larger size. 2) Different relative lengths of the last two joints of the maxillary palpi; the last two joints are nearly equal in length in the typical *microgyna*. 3) Mandibles are 7-toothed; they are 8-toothed in the typical *microgyna*. 4) Superior border of petiolar scale lower and more blunt. 5) The presence of small postero-laterally directed lobes on the ventral part of the petiole where it joins the gaster; these are absent in the typical *microgyna*. 6) Hairs much more numerous and slightly shorter; the hairs of the gaster are much fewer in number dorsally and nearly absent ventrally in the typical *microgyna*. 7) Pubescence on gaster longer, more dense, whiter and with a silvery tinge; the pubescence on the gaster has a yellowish tinge in the typical *microgyna*. 8) Distinctly darker in color, the areas of infuscation deeper and more extensive; the gaster lacking any light areas.

Further collecting and study may well show that the above-listed eight diagnostic characters are not the best for separating *dirksi* from the typical *microgyna*. It would seem that until more is known about the *Microgyna* group in general and about these two species in particular, it will be impossible to avoid the use of at least some characters which are so variable as to be of little diagnostic value. The rather numerous measurements scattered throughout the description represent an attempt on my part to have made at least a few significant measurements.

²Comparisons were made between *dirksi* and the female cotypes 5 to 7 (No. 22720) of the typical *microgyna* in the Wheeler Collection in the M.C.Z. during early September, 1948. I wish to express my thanks to Dr. J. C. Bequaert, Head Curator of Recent Insects in the M.C.Z., for his many kindnesses to me during that brief visit.

Holotype, dealate queen, bearing the data: Daigle (Aroostook Co.), Maine, August 31, 1946 (M. W. Wing) Colony Number 241-46, in the U.S. National Museum collection (Type No. 58955).

I take pleasure in naming this species for my good friend and former teacher, Prof. C. O. Dirks of the University of Maine.

The colony from which this queen was taken was located at the edge of a small clearing in mixed woods (predominantly coniferous) near the main road from Fort Kent to Presque Isle (U.S. Route Number 161). The colony of *Formica fusca subaenescens* Em.³, which harbored this queen, was located under the loose bark and in the wood of a large, erect, partially decayed, dry stump. The galleries of the nest were more or less filled with detritus, which was also apparent externally around the base of the stump. The location of the nest was such that it got the rays of the afternoon sun. The colony was very populous, consisting of several hundred workers and a large number of pupae, most of which were naked. I did not collect the nest queen, but this does not necessarily mean that she was not present in the nest, since I made the collection rather hurriedly and did not search for her carefully. At the time of the collection, which was made with an aspirator, I was completely unaware of the presence of the parasitic queen; she was not discovered until later in the laboratory at the University of Maine. Otherwise I would have made a more careful examination of the nest at the time.

Discussion

As is so often the case in the captures made in this group, there is too little information at hand to infer with any certainty and preciseness the type of parasitic relationship between the two forms. This is especially true in the present case, since the worker caste is unknown. Wheeler (1933:156) in his outline of the methods of colony founding among ants, lists the *Microgyna* group under the Conciliatory Type of Temporary Social Parasitism. This allocation is presumably due, at least in part, to the fact that *Formica difficilis* var. *consocians* Wheeler, one of the few species of the *Microgyna* group about which we know anything concerning its method of colony founding, is taken to be more or less typical of the group in general. In this method of colony foundation, the parasitic queen, after impregnation, seeks out and invades a nest of the host species, usually a small and depauperate colony. In successful cases this parasitic queen is adopted by the workers, presumably after she has acquired the brood- and nest-odor. Some time after the acceptance of the parasitic queen, the host queen disappears, but as to just how this event takes place we are ignorant. The demise of the host queen leaves the parasite with a clear field. The host workers rear her successive broods for as long as they live, and upon their death, a pure colony of the parasitic species occurs, which gives no indication of its questionable origin. In cases of Temporary Social Parasitism, incipient mixed colonies are seldom found. Pure colonies of species in the *Microgyna* group are to be found, but they are rare and sporadic in their distribution, which is, of course, delimited by the availability of suitable hosts. These hosts all belong, so far as we know, to the genus *Formica*; they are recorded from the *Fusca* group (subgenus *Formica*), the subgenus *Neofornica* and the subgenus *Proformica*. These ants are all cowardly and hence more approachable than the more aggressive

³It is often a problem to know just what name to assign many of the infraspecific forms of *Formica fusca*, as they represent a highly variable and difficult complex. In this case I am referring the host ant in question to *subaenescens* Em., since my specimens agree more closely with the specimens determined as *subaenescens* in the Wheeler Collection in the M.C.Z., than with any of the other infraspecific categories of *Formica fusca* in that collection.

species, and all fertile and therefore abundant. Despite these apparently favorable characteristics of the host species, the type (or types) of colony foundation employed by the *Microgyna* group must be, to say the least, perilous, if we are to judge by the rarity of the nests and the sporadic nature of their distribution. This means that for the population to be maintained, the few successful colony founders of a given area must produce heavily in order to offset the losses entailed by the mass death of so many of the young queens of their species. This, in fact, is done, and probably quite readily, since the queens are so small that no doubt several of them can be produced on the amount of food that it would take to rear one of the bulkier queens found elsewhere in the genus.

If the risks of invading a small, depauperate colony are as great as the evidence presented above would indicate, then it would seem highly probable that entrance into a highly populous colony would mean almost certain death for the intruder, unless she were capable of rapidly overcoming the animosity of the host through means of behavior, odor, taste, touch, etc. There would seem to be little chance of such an invader safely slipping past the ubiquitous workers and reaching an unused corner of the nest, a pile of the brood, etc., where she could gradually acquire the nest- and brood-odor as is apparently the case with *consocians*. If the supposedly more risky invasion of large, populous colonies of the host species is the rule in *dirksi*, then it seems reasonable to suspect the possibility of a method of colony founding that differs somewhat from that found in *consocians*, and probably also from most of the other species of the *Microgyna* group⁴. Permanent Social Parasitism is such a possibility, since this type of parasitism would require a host colony sufficiently strong to rear the parasitic brood for several seasons thus assuring the necessarily heavy production of sexual forms so essential to the perpetuation of the parasitic species. In this connection it is assumed, of course, that the host queen does not remain in the nest, for otherwise a small colony would serve the interests of the parasitic queen as well as a larger colony, and furthermore without the presumably greater risks entailed by a populous colony. Dulosis, not reported up to now for any member of the *Microgyna* group, is assumed to be absent, if only on the basis that again a small colony would be adequate for a dulotic species. The type of colony founding here assumed as possible on the basis of very scanty evidence would, if it exists, be of the *Epimyrma gösswaldi* type (Wheeler, 1933:157). To date no bonafide cases of Permanent Social Parasitism have been reported in the genus *Formica*. However, Buren (1942:401-402) has cited evidence indicating the possibility that *Formica reflexa* Buren may be such a parasite.

The above speculations represent a type of armchair philosophy, which it is sometimes difficult to resist, especially if one happens to be in an armchair. In actuality, only the collection in the field of more information coupled with experimentation on colonies in artificial nests will give us the necessary facts for elucidating the life history of this parasite. *Dirksi* represents the twenty-sixth described form of the *Microgyna* group in the Nearctic region. Smith (1947:623) lists the other twenty-five forms⁵ and points out that very little is known about them biologically. This is not only true for the *Microgyna* group of the genus *Formica*, but also for many of the other North American ant forms, which number approximately 750. Myrmecology is a field which is in need of the efforts of capable and serious students, and a field which has a great deal to offer.

⁴The tacit assumption upon which this statement is based is what might be termed the principle of least risk and least energy expenditure concomitant with individual, and hence ultimately racial, success, which naturalists generally have come to expect of an exquisitely balanced and an infinitely complex nature.

⁵Recently A. C. Cole (1942) has synonymized both *difficilis* var. *consocians* Wheeler and *habrogyna* Cole under *difficilis* Emery. If Cole's synonymies are accepted, then the Smith list is reduced to 23 forms. Cole was apparently justified in this procedure, for these forms were based largely on pilosity, which varies greatly even within a colony series. It is probable that when a serious revisionary study is made of the *Microgyna* group a number of forms will be relegated to synonymy.

such students, particularly those interested in biological investigations. It is hoped that this paper by calling attention to the opportunities for original myrmecological investigations may attract one or more workers to the field. Any interested individual might do well to read Dr. M. R. Smith's (1947) most excellent summary of the taxonomy and biology of our North American ants, if he wishes to gain a clearer insight into the multifarious unsolved problems of Myrmecology.

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