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GYNANDROMORPHOUS ANTS DESCRIBED DURING THE DECADE 1903-1913

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IN 1903 I described six gynandromorphous ants and reviewed the previously recorded cases, seventeen in number. Although many thousand ants have since passed through my hands, I have failed to find any additional cases. Other observers, however, have been more fortunate and have described seven within the past decade. As these are all very interesting, it seems advisable to give a brief account of them as a sequel to my former paper.

1. LATERAL GYNANDROMORPH OF *CARDIOCONDYLA BATESI* FOREL. VAR. *NIGRA* FOREL.—SANTSCHI (1903, p. 324, Fig. 5, *i*)

This specimen is female on the right and partly male on the left side. The male portions are sharply marked off from the black female portions by their testaceous red color. The line of demarcation, very clear in front, starts at the anterior clypeal border and divides the head into two nearly equal parts, but leaves the median ocellus on the male side. It then divides the pronotum down the middle and the three anterior quarters of the mesonotum. Thence the line fades out on the right side so that the whole posterior border of the mesonotum is male. Three quarters of the prescutellum and the anterior half of the scutellum are male. The epinotum and the abdomen are female throughout, but the female genitalia are slightly asymmetrical on the left side. The fore and middle legs on this side and a portion of the mesosternum are male. There are wings on both sides, but the anterior one on the female side was lost after capture. Those on the left

side are well-developed, with distinct venation and pale pterostigma, and are inserted in a distinctly male area. The specimen was not dissected.

Santschi found this ant in a nest with females at Kairouan, Tunis, but without males, either of the winged or of the ergatomorphic type, which is peculiar to this and some of the other species of *Cardiocondyla*. His attention was attracted by the bizarre movements of the specimen, as it turned around rather quickly in circles about 10 cm. in diameter, with the male portion inside. In other words, owing either to the asymmetry of its brain and visual organs or to differences in the length of the legs on the two sides of the body, it made circus movements like a normal insect which has had one of its eyes or optic ganglia injured.

2. LATERAL GYNANDROMORPH OF *ANERGATES ATRATULUS*
SCHENCK.—ADLERZ (1908, p. 3, Fig. 1, *a, b, c, d* and *f*)

An imperfect lateral gynandromorph, with the head largely male on the left, female on the right side, the light color of the male being sharply marked off from the dark color of the female only anteriorly. Thorax in front female, with wings equally developed on both sides (the male *Anergates* is wingless and pupoid!), but with pale (male) coloration on the left and dark (female) coloration on the right side, the line of division between the two neither sharp nor straight and the whole postscutellum blackish brown. Abdomen with irregular arrangement of color. Petiole black on the right, grayish yellow on the left; postpetiole mostly blackish brown, but with a large grayish yellow spot on the left side of its anterior surface. Third dorsal tergite blackish brown on the right, grayish yellow on the left side. Remainder of gaster grayish yellow, tinged here and there with pale brown. Third tergite with a median longitudinal groove which runs back on to the succeeding segment as in the virgin female. The left side of the abdomen has seven complete segments and well-developed genitalia; the right

side has only six complete segments and a membranous, incomplete seventh. The genitalia on the right side are imperfect, the volsella being represented only by a piece corresponding to its dorsal portion and the stipes is completely lacking. The legs are of the female type, except the left fore leg, which is male, although the tibial spur (strigil) is pectinate as in the female. This spur is known to be nonpectinate in male Swedish, but pectinate in male Swiss *Anergates* specimens.

On dissecting this specimen, which he took from a large *Anergates-Tetramorium* colony near Arkösund in Östergötland, Sweden, Adlerz found on the left side a well-developed vesicula seminalis, receiving a vas deferens half as long. No traces of female reproductive organs nor of the poison gland and vesicle could be detected.

Of particular interest was the behavior of this gynandromorph, because, as Adlerz says, it evidently felt itself to be a male but was treated by the normal males in the colony as a female. Its movements were somewhat livelier than those of normal males, and it at first made feeble attempts to copulate with the females and was treated with indifference by the males. A few days later it became more energetic and persistently attempted to copulate, especially with one particular female, although always unsuccessfully while it was under observation. It was evidently inflamed with the insatiable sexual appetite so characteristic of the normal *Anergates* males, which, being wingless, always mate with their sisters before they fly out of the parental nest. On the following day, however, a normal male made the most persistent efforts for several hours to mate with this same gynandromorphous individual. Adlerz concludes that

this indicates that the males regarded it as a female. Of course, we may suppose that its wings made it seem like a female and attracted the male, but from the fact that males attempt to mate even with female pupae and therefore with a stage which has not yet developed wings, it is more probable that the male was attracted to the gynandromorph by some female odor. At any rate the double nature of the gynandromorph

is even more strongly indicated by the facts just recorded than by its morphological peculiarities.

3. LATERAL GYNANDROMORPH OF *ANERGATES ATRATULUS*
SCHENCK.—ADLERZ (1908, p. 5, Fig. 2, *a, b, c, d* and *e*)

An imperfect lateral gynandromorph, male on the left, female on the right side, resembling the preceding specimen, but with the dark female color more pronounced on the male side of the head. There were well-developed wings on both sides of the thorax, which was of the female form though dark on the right and pale on the left side, except the epinotum, which was grayish yellow throughout. Abdomen in color and form almost typically male, with the genitalia well-developed on both sides, but with a feeble mid-dorsal impression recalling the condition in the virgin female. Legs of the female type, except the left fore one, which is somewhat shorter and thicker as in the male and with the tibial spur (strigil) cleft but not pectinated.

Dissection showed the reproductive organs to be in the same condition as in the preceding specimen; *i. e.*, they were present only on the left side and consisted of a rather large vesicula seminalis with its vas deferens. No traces of female reproductive organs, nor of a sting or poison apparatus were to be found.

This specimen was taken from the same nest as the preceding.

4. LATERAL GYNANDROMORPH (ERGATANDROMORPH) OF
FORMICA SANGUINEA LATREILLE.—DONISTHORPE (1909,
p. 464, Fig. 1)

A nearly complete lateral ergatandromorph, with the right antenna, mandible and eye, and right and median ocellus male and the left antenna, mandible, eye and ocellus of the worker type. Head black, except the left mandible, left half of clypeus, left cheek and a small patch in front of the eye, which are red. Thorax and petiole

male on the right, worker on the left, the line of division running to the left of the median line so that the black of the right side of the mesonotum encroaches on the red color of the left side. Petiole and gaster sharply divided into black right and red left halves, the right half of the latter also with male pilosity and sculpture. External male genitalia and anal sternite on the right side. The red and black coloration is sharply divided on the venter, but the coxæ are all black and red as on the male, and the legs on both sides are somewhat infuscated. Tarsi longer on the right (male) side. Wings well developed, on the right side only, with pale veins and stigma and more like those of the female. Length 7 mm.

This specimen was taken by Mr. Donisthorpe July 20 or 21 from a large colony in Bewdley Forest, England.

5. LATERAL GYNANDROMORPH OF *FORMICA SANGUINEA* LATREILLE.—DONISTHORPE (1909, p. 464, Fig. 2)

A nearly complete lateral gynandromorph, male on the left, female on the right side. The head is of the female type, rather small, with both of the antennæ and the ocelli female and the left eye a little larger than the right. Head black, clypeus and right mandible red; thorax evenly divided into a black left and red right half, but only the upper right corner of the epinotum red. A piece of the scutellum and postscutellum red on the left side where the wing is inserted. Petiole sharply divided into a red right and left black half. Gaster black, the pilosity and sculpture on the right half female, on the left half male, the color being sharply defined on the venter. Legs and coxæ female on the right, male on the left side. External genitalia of the male type present on the left side. Both pairs of wings fully developed, but the stigma and veins darker as in the male. Length 9 mm.

This specimen was taken from the same colony as the preceding.

6. FRONTAL GYNANDROMORPH OF SOLENOPSIS FUGAX
LATREILLE.—SANTSCHI (1910, p. 649)

The head and thorax in this specimen are female, the pedicel and gaster male. The head is somewhat smaller than in normal females. The copulatory organs are those of the normal male. Santschi remarks that it "would be interesting to observe the sexual behavior of such an individual possessing a female brain and male genitalia."

7. LATERAL GYNANDROMORPH (ERGATANDROMORPH) OF
MYRMICA SCABRINODIS NYLANDER.—DONISTHORPE
(1913, p. 44, Pl. I)

A nearly complete lateral ergatandromorph; worker on the right, male on the left side, the former being blackish, the latter reddish yellow. Right half of head larger than the left, but with a smaller eye, striatorugose; right antenna yellow, with a three-jointed club, its scape with the usual strong lateral tooth at the basal flexure. Right half of thorax yellow, its epinotal half with a strong spine; right half of petiole and postpetiole yellow, rugose and punctured; right half of gaster pale fuscous yellow. Legs on the right side of the worker type, yellow. Left side of head blackish, punctate, not striatorugose, with a larger eye and the median and left ocellus; its antenna fuscous, with four-jointed club. Left half of thorax blackish, its epinotal portion unarmed; left half of petiole and postpetiole smooth, fuscous black. The greater part of the left half of the gaster had been eaten away but the remainder was darker fuscous than the right. Legs on left side of the male type, fuscous; wings on the left side only.

Donisthorpe remarks that this specimen, which was picked up dead by Mr. Dollman at Ditchling, England, approaches the var. *sabuleti* Meinert in having the left antennal scape longer than in the typical male *scabrinodis* and the tooth on the right antenna large.

In conclusion I would call attention to a peculiar ant described by Mayr (1868, p. 60) from the Baltic amber

and designated as a "Zwitter" (gynandromorph) of *Hypoclinea constricta* Mayr, or *Iridomyrmex constrictus* as we must now call the species. Through the kindness of Prof. A. Tornquist, of the University of Königsberg, I have been able to examine this specimen in connection with many other amber Formicidæ. The general structure of the head, thorax and gaster is that of a worker, though the thorax is not typical, as the base of the epinotum is less convex and less abruptly elevated, so that the angle between it and the declivity is less pronounced in profile. Mayr does not mention that the eyes are decidedly larger and more convex than in the normal worker and therefore more like those of the male. There are a few small white spots or bubbles on the vertex, which resemble small ocelli, but these organs seem to be actually absent. The antennæ are 13-jointed and very long, as in the male; the scapes, however, are like those of the worker, but extend well beyond the posterior borders of the head, whereas joints 2-11 of the funiculi are cylindrical, subequal and fully three times as long as broad, the terminal joint being somewhat longer than these, the first shorter. In the gaster, which is shaped as in the normal worker, there are five distinctly visible segments, but the tip shows clearly the small, hairy, external genital valves (stipes) of the male. The legs are also more slender than in the normal worker and therefore more like those of the male.

At first sight this singular insect seems to be a gynandromorph, as Mayr supposed, or more specifically, an ergatandromorph of the blended type, with worker characters preponderating in the trunk and those of the male preponderating in the eyes, appendages and genitalia. It is possible, however, to regard this specimen as an ergatomorphic male, like those which occur normally in certain species of *Ponera*, *Cardiocondyla*, *Formicoxenus*, *Symmyrmica* and *Technomyrmex*. Unfortunately we are not in a position to decide between these alternatives, because we are dealing with a single fossil specimen and are not even sure that it belongs to the species to which Mayr

assigned it. Still the case is interesting if only because it suggests the further question as to whether the ergatomorphic males in the genera above cited may be regarded as originally frontal ergatandromorphs, with worker head and thorax and male gaster, that have become the only males of the species. If this is true, the ergatomorphic males may have arisen by mutation from pathological or teratological forms and have been preserved in certain species in which peculiarities of habit rendered the fecundation of the virgin females in the nest by wingless males more advantageous than the type of mating exhibited by the nuptial flight. A moment's reflection shows that the nuptial flight is a highly advantageous institution in common ants that form large colonies, but must be as decidedly disadvantageous in the case of very small, rare ants whose colonies are very sporadic and comprise only a few individuals. This is actually the condition seen in all the species with ergatomorphic males in the genera *Ponera*, *Cardiocondyla*, *Formicoxenus*, *Symmyrmica* and *Technomyrmex*, and may be supposed, therefore, to account for the substitution of the wingless, ergatomorphic for the normal winged males in these species.

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