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Winged workers in the ant, *Formica obscuriventris clivia* Creighton.

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In our studies of the ants found in the region around the Iowa Lakeside Laboratory in northwestern Iowa, we have encountered two species of Formica with deep clypeal fossae. One of these is almost hairless, and has been called *Formica fossaceps* Buren in our papers on mixed colonies; the other species is very hairy, with hairs also on the scapes. The hairs on the scapes led to the misidentification of this form as *Formica oreas comptula* Wheeler; we now consider this hairy form to be *Formica obscuriventris clivia* Creighton. For help in unravelling this snarl we must thank Dr. Marion R. Smith of the United States Department of Agriculture, Prof. Robert E. Gregg of the University of Colorado, and Prof. William S. Creighton of the College of the City of New York. These eminent myrmecologists have shown almost unlimited patience in dealing with the admittedly difficult problems which have arisen in the studies of mixed colonies of these two forms.

In the Proceedings for 1952, King and Sallee have reported workers with vestigial wings in *Formica fossaceps*. In the course of our investigations we have encountered such workers in the closely related *Formica obscuriventris clivia*. The 16 "hairy" workers with vestigial wings were found in four nests; two in a now unidentifiable nest (1946), two in nest G2 (one in 1947, one in 1951), one in nest IN (1950), and 11 in nest 48K (six in 1951, five in 1952). More than four thousand ants have been examined from these known colonies in the last nine years, and the number of winged workers is, indeed, small.

A series of measurements was made so that the vestigial winged workers could be compared with winged females and with ordinary workers. Workers of *clivia* are very similar to those of *fossaceps* but slightly larger; the females, however, are much larger in the former species. If we take metathoracic wing length as a measure of body size in females, this varies from 8.1 to 8.7 mm in *cliva,* and from 6.6 to 7.4 mm in *fossaceps*. Measurements of the parts listed below were made similarly to those made for *fossaceps*. The right scape of each ant was removed, mounted under a cover glass, and measured under a binocular microscope with an ocular micrometer, (one division equals 0.03mm). The scape was measured from the funiculus to the neck of the bulb; from the ants of each scape length a single specimen with two alternates, when available, were mounted on cards. One ant of each scape length was then measur-

ed, using the same microscopic equipment and a turntable. There were 28 sets of measurements for ordinary workers, 16 sets for winged workers and ten sets for females. The extreme measurements for *clivia* are tabulated below, with those of *fossaceps* in parentheses for camparison.

	females	winged workers	workers
Scape	58-62(49-57)	65-69(60-66)	38-65(37-64)
Prothoracic femur	60-63(50-57)	63-66(55-61)	38-61(34-60)
Mesothoracic femur	62-65(51-61)	65-71(58-66)	42-65(34-64)
Metathoracic femur	75-81(63-75)	80-89(72-80)	52-80(45-77)
Head width	57-62(50-56)	62-67(54-63)	41-64(35-61)
Head length	59-62(51-58)	62-66(55-65)	44-66(38-62)
"Mesonotum" length	51-55(39-48)	31-36(25-33)	18-32(15-30)
"Mesonotum" width	54-60(44-52)	24-29(19-28)	11-24(13-26)

"Mesonotum" refers to the mesonotol scutum; since mesonotal scutellum and metanotum are not developed in workers or noticeably in winged workers, no measurements are given for these. However, they are very much in evidence in functional females.

Comparison of females in the two species shows almost no overlapping in the various parts measured; likewise for the winged workers except for the "mesontal" width, the smallest and, perhaps, the most difficult measurement made. In the ordinary workers, the smallest *clivia* are slightly larger than the smallest *fossaceps,* and the largest are also larger, excepting again the "mesonotal" width.

The other measurements were plotted against scape length: regression equations were calculated and the regression lines drawn. Six of these are presented in Figure 1, where females are shown by plus marks, winged workers by circles, and the ordinary workers, of course, by the line. In all of these the dimensions of the winged workers are greater than those of the females, except, naturally, for the mesonotum, which is fully developed in the females. The winged workers fall into line with the ordinary workers, as in *fossaceps,* and there is no evidence of marked deviation toward the functional female type of thorax. There is almost no development of the mesonotal scutellum or metanotum in the winged workers.

In Figure 2, the regression head width against scape length is plotted for both species. There is, indeed, little difference between the regression lines for the workers, but the females of *fossaceps* (represented by solid squares) are the smallest of the other types represented. Then come the females of *clivia* (open squares), next the winged workers of *fossaceps* (solid circles) and, finally the winged workers of *clivia* (open circles).

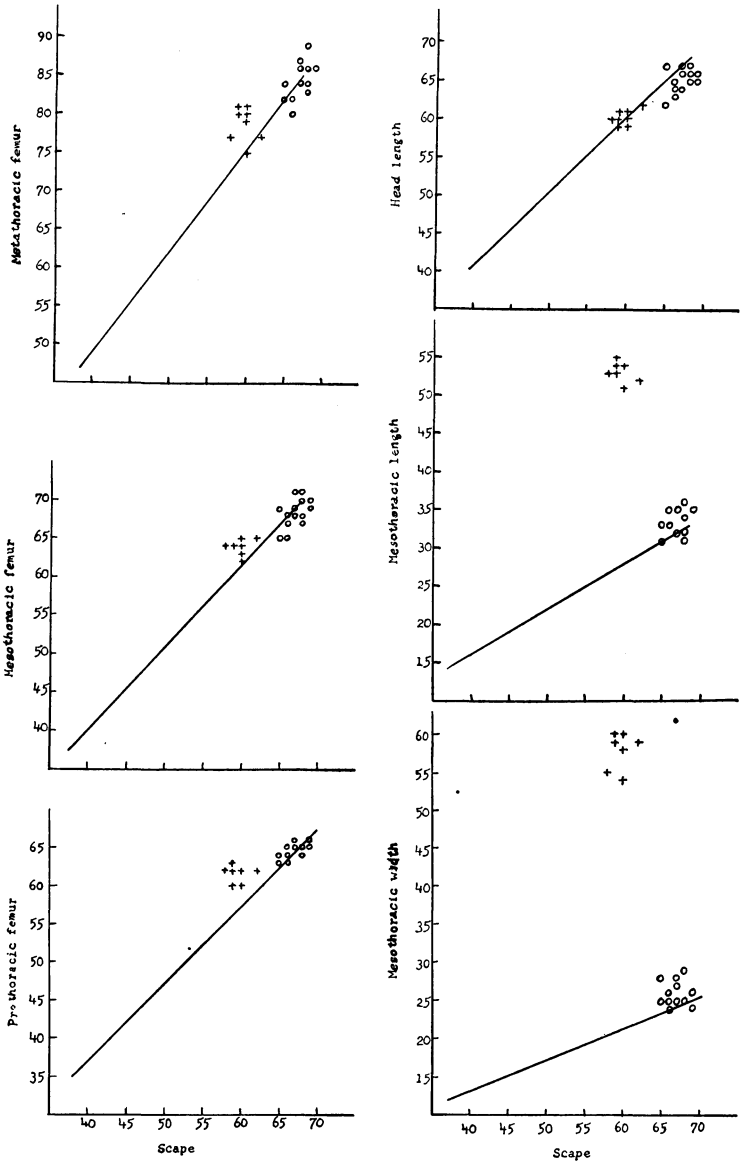

Figure 1. Dimensions of the various parts plotted against scape length in *Formica obscuriventris clivia*. Females: plus marks; winged workers: circles; ordinary workers represented by the regression lines. The equations for the regressions are:

Prothoracic femur = 1.02 scape - 4.38.
Mesothoracic femur = 1.06 scape - 2.51.
Metathoracic femur = 1.30 scape - 3.19.
Mesothoracic width = 0.41 scape - 3.49.
Mesothoracic length = 0.59 scape - 7.64.
Head length = 0.98 scape + 1.59.

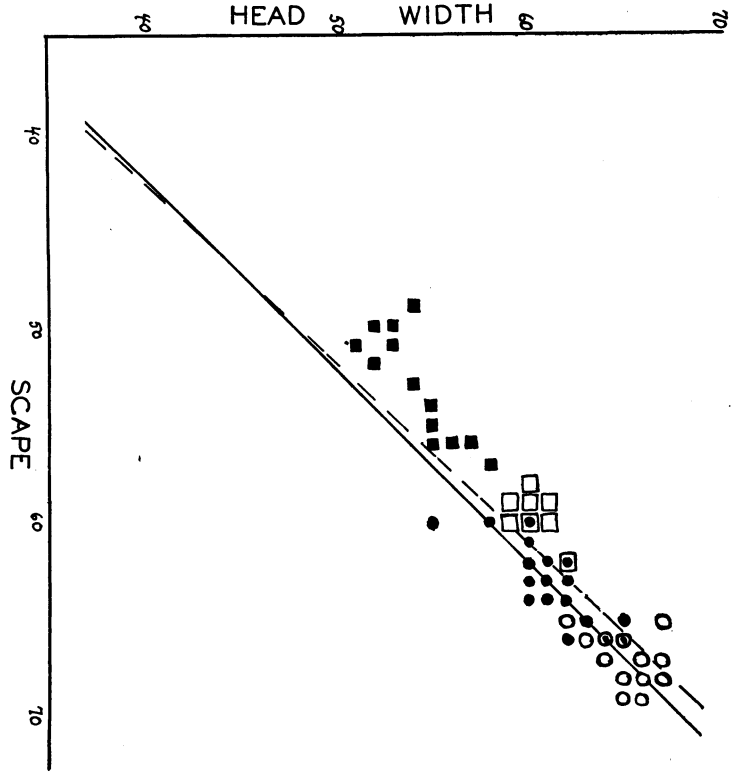

Figure 2. Head widths plotted against scape length. The unbroken line represents the regression for workers of *Formica fossaceps,* head width = 1.02 scape - 3.56; the boken line for *Formica obscuriventris clivia,* head width = 1.08 scape - 6.40. Squares represent females, solid for *fossaceps,* open for *clivia;* Circles represent winged workers, solid for *fossaceps,* open for *clivia.* Neither the regressions nor the size differences among the ordinary workers are significant.

Brian (1955) has recently studied caste differentiation in *Myrmica rubra,* where the females are much larger than the largest workers. In this species "A further possibility can be envisaged for which nevertheless evidence at present is lacking: that an individual, having lost queen-potentiality could - - - - go on to produce a worker form as large or larger than the queen."

Gosswald and Bier (1954) have shown that summer eggs of the small red forest ant normally develop into workers when raised by their own kind, but if raised by the meadow ant (a different sub-species of *Formica rufa*) may result in queens and intercastes. It seems that blastogenic factors are more marked in one of the two subspecies, and trophogenic factors much more marked in the other.

Comparison of females, winged workers and ordinary workers shows that in *Formica obscuriventris clivia* the winged workers are

not deviations toward the female type, but only extremely large workers. This has previously been found in the nearly related but somewhat smaller *Formica fossaceps.*

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