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Macropseudogynes (or Pterergates?) in *Formica fossiceps* Buren (Formicidae)

By R. L. KING AND R. M. SALLEE

Large worker ants with vestigial wings were found in certain colonies of *Formica fossiceps* Buren at the Iowa Lakeside Laboratory near Milford, Iowa. This paper deals with one of these colonies (49F), found on the Laboratory grounds, June 15, 1949; vestigial winged workers were present in considerable numbers in this colony. Extensive collections were made: in 1949, a total of 1414 workers, 117 (8.3%) with vestigial wings; in 1950, 9 males and 539 workers, 32 (5.9%) with vestigial wings; the colony was not found in 1951. The total number of workers was 1953, of which 149 (7.6%) had vestigial wings.

A series of measurements was made for comparing the vestigial winged workers with ordinary workers and with females; all the ants except the females were from colony 49F. The females of *Formica fossiceps* are usually no larger than the largest workers, and so are smaller than females of most other species of the rufa group of the genus *Formica*, where the females "are usually 8 mm. or more in length and notably larger than the largest workers." (Creighton, '50). Body length is difficult to measure because of the fact that preserved ants present body postures so variable.

	females	winged workers	workers
Body length	6.5-7.4 mm.	6.5-7.3 mm.	3.7-7.3 mm.
"Thorax" length	2.8-3.5 mm.	2.6-3.1 mm.	1.6-3.1 mm.
Mesothoracic wing	6.6-7.4 mm.	0.3-0.7 mm.	
Metathoracic wing	5.0-6.0 mm.	0.1-0.2 mm.	

In many of the winged workers the wings had broken off, leaving only traces of their former presence. Buren's ('42) figures for *F. fossiceps* are 7.19 - 7.84 mm. for females, and 3.70 - 7.71 mm for workers.

Measurements of other parts were made for comparisons: one of the early collections containing 805 workers (56 vestigial winged) was used. 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 equal to 0.03 mm.) The scape was measured from the funiculus to the neck of the bulb so that comparable measurements could be made on pinned specimens. From the ants of one scape length, a single specimen and an alternate

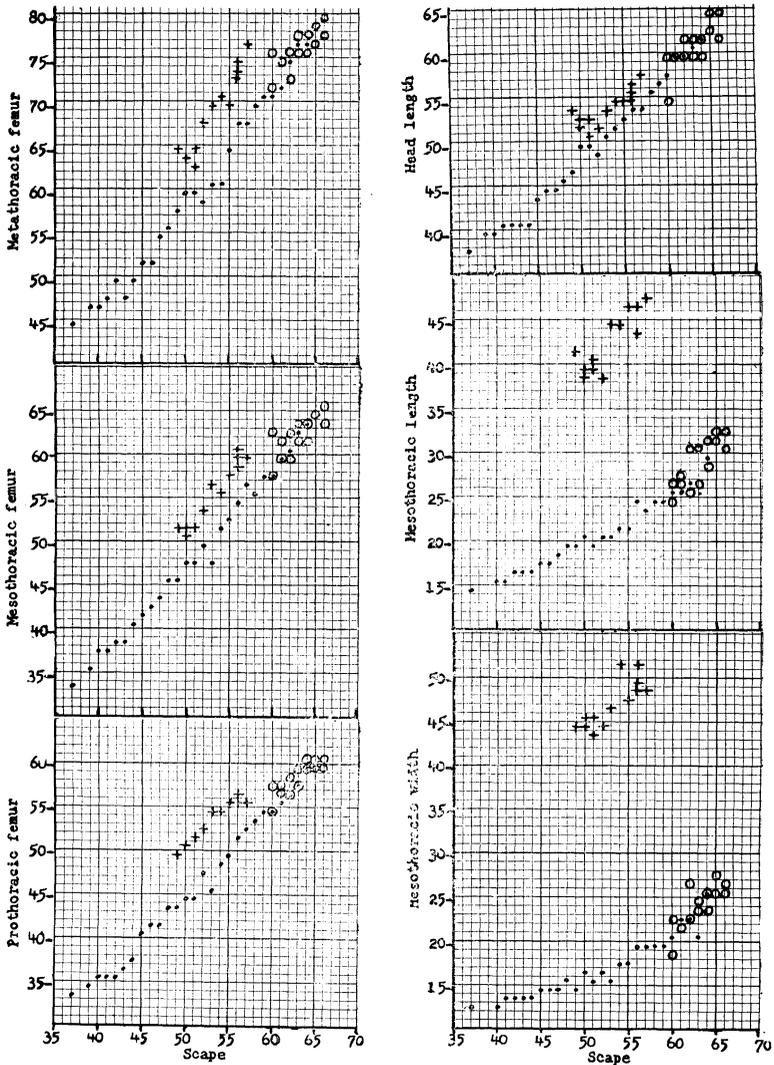


Figure 1. Dimensions of the various parts plotted against scape length. Females, +; winged workers, O; ordinary workers, •.

Regression equations for ordinary workers:

$$\text{Prothoracic femur} = 1.00 \text{ scape} - 4.60$$

$$\text{Mesothoracic femur} = 1.11 \text{ scape} - 7.62$$

$$\text{Metathoracic femur} = 1.25 \text{ scape} - 3.82$$

$$\text{Mesothoracic width} = 0.46 \text{ scape} - 6.02$$

$$\text{Mesothoracic length} = 0.51 \text{ scape} - 5.13$$

$$\text{Head length} = 0.93 \text{ scape} + 2.27$$

were mounted on a small piece of card; these were measured using the same equipment and a turntable. There were 27 sets of measurements for workers (scape length: 37 to 64 divisions), 31 sets for winged workers (scape length: 60 to 66 divisions), and 13 sets for females (scape length: 49 to 57 divisions).

	females	winged workers	workers
Scape	49-57	60-66	37-64
Prothoracic femur	50-57	55-61	34-60
Mesothoracic femur	51-61	58-66	34-64
Metathoracic femur	63-75	72-80	45-77
Head width	50-56	54-63	35-61
Head length	51-58	55-65	38-62
"Mesonotum" length	39-48	25-33	15-30
"Mesonotum" width	44-52	19-28	13-26

The "mesonotum" refers to mesonotal scutum; since mesothoracic scutellum and metanotum are not developed, except in the females, no measurements were made of those parts. The other seven measurements were plotted against scape length for regression curves; six of these are presented in figure 1, where the females are represented by +, the winged workers by O, and the ordinary workers by *. In all these the females fall outside the general trend, and are far outside for both dimensions of the "mesonotum". On the other hand, the winged workers seem to fall within the worker range except for the "mesonotum," where there is a very slight tendency for these measurements to be slightly greater than in the ordinary workers. There is no noticeable development of mesonotal scutellum or metanotum, which are so prominent in the females; these parts are essentially the same as in the ordinary workers where they are not present as distinct entities. For these reasons it is believed that the winged workers are only very large workers in which a slight increase in the size of the mesonotal scutum is associated with the presence of vestigial wings; they do not represent deviations toward the functional female type. Other regression curves substantiate this conclusion; the female proportions are very similar to those of the workers, except when compared with the scape and except for the mesonotal scutum, scutellum and the metanotum.

Figure 2 shows the relative frequencies of the different scape lengths of the 805 workers measured from colony 49F, unbroken line; the broken line represents the distribution of worker scape lengths in another colony of *Formica fossiceps* in which no winged workers have been found. The proportion of large workers is much smaller in this colony, as is the case in other similar colonies. The presence of winged workers seems to be associated with an excess of

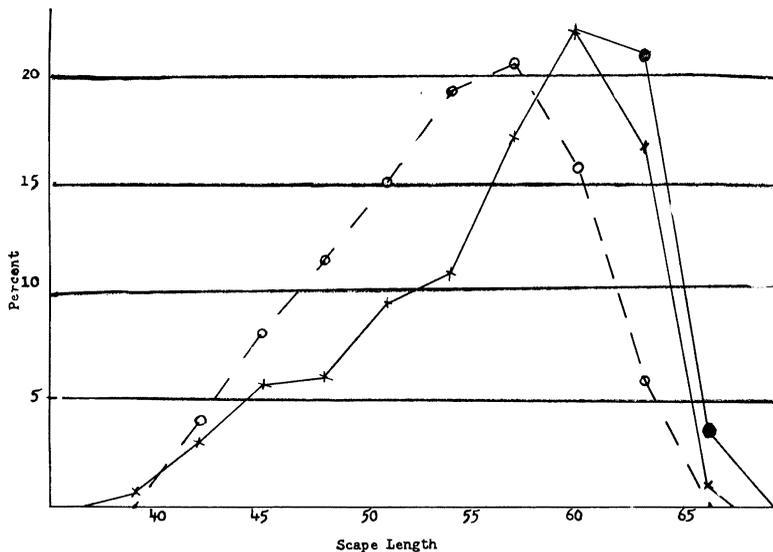


Figure 2. Workers plotted against scape length; continuous line, 805 workers (including 56 winged workers) from colony 49F. The winged workers are represented by the line on the extreme right. The discontinuous line represents the distribution of 172 ordinary workers from a colony which contained no winged workers.

largest workers; some incomplete observations on winged workers in mixed colonies (King and Sallee, '51), where winged workers are present only in the species with excess numbers of large workers, is in line with this conclusion.

The anomalous forms which are often present in ant colonies are called by "Greek names which are often long and awkward, but English equivalents would be even more cumbersome." (Wheeler '37). The winged workers described in this paper would be classed as pterergates or as ergatoid macropseudogynes in this wierd terminology.

The term pterergate (Wheeler, '05) is applied to a worker with vestiges of wings, but with the thorax of a normal worker. This very scarce anomaly has been found in several species of the subfamily Myrmicinae; however only a single example has been found in the Formicinae: a pterergate of *Acanthomyops flavus*, mentioned by Donisthorpe ('27, p. 259): "a large dark worker . . . 4.8 mm. in length . . . has a pair of vestigial wings, one on each side of the mesonotum, measuring about 0.4 mm. in length".

The term pseudogyne was introduced by Wasmann ('95) to include the apterous worker-like individuals of *Formica sanguinea* which combine the size and gaster of the worker with certain thoracic

characters of the female. Later, Wasmann ('09) classified three groups of pseudogynes: micro-, meso- and macropseudogynes. In most of his pseudogyne-containing colonies of *Formica sanguinea*, only the micro- and mesopseudogynes were present. These are small (micro-) and medium sized (meso-) ants with a hump-like hypertrophy of the mesonotum, but without trace of wings. There is a great variability in the degree of development of the dorsal thoracic parts: usually the metanotum is well developed, and the scutellum of the mesonotum is represented by a narrow strip. Macropseudogynes, which are present in only about ten percent of the pseudogyne-containing colonies of *Formica sanguinea*, are of three kinds: the usual type which intergrade with and are similar in thorax structure to the mesopseudogynes, the gynaecoid type which has distinct wing vestiges and approaches the female in thorax development, and the ergatoid type which is only slightly different from the largest workers, with only faint, if any, indications of the female type of thorax. According to Wasmann these anomalies result from attempts by the workers of colonies infested with parasitic beetles, to convert female larvae into workers (micro- and mesopseudogynes), or worker larvae into females (macropseudogynes). Pseudogynes have been recorded in about 20 species belonging to the sub-family Formicinae (Wheeler, '37). Many of these are only records and so do not make it clear that most of these are the usual humpbacked variety rather than ergatoid macropseudogynes.

The absence of the more usual humpbacked pseudogynes in *Formica fossiceps* would seem to indicate that the term pterergate is a more suitable name for the winged workers rather than pseudogyne which implies deviation toward the female type. In his review of Wheeler's ('37) book, Whiting ('38) inclines toward the environmental theory of caste determination; his paper should be consulted by those interested in this fascinating but still undecided problem.

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