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Gynandromorphism in ants.

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Forty-nine gynandromorphs have been described (1851—1927) in ants, eleven of them being British records. They include all combinations of a female form with male — queen-male (gynandromorph), worker-male (ergatandromorph), and soldier-male (dinergatandromorph). The combination may be half-and-half longitudinally, or transversely, or in patches (mosaics). It may also be incomplete — a very small part one sex and the rest the other. A combination of male, female and worker is also known.

Professor W. M. WHEELER¹ considers that the existence of a dinergatandromorph proves that the worker and soldier forms are predetermined in the egg. My own experience is opposed to this conclusion, for a colony of *Myrmecina graminicola*, which I have had under observation for over 18 years, has always produced winged females since 1915, except in two years when no food was provided in the winter. [For a complete account of the life of this interesting little colony see "British Ants", 2nd Edition, pp. 85—88 (1927)].

Furthermore, the production of pseudogynes in ants and the existence of a complete series of intermediates between perfect females and ordinary workers strongly support the hypothesis of a trophic rather than a germinal cause of the different female castes. SANTSCHI², also, points out that the absence of an individual exactly half female and half worker, or half female and half soldier in ants is greatly in favour of the alimentary hypothesis.

¹ *Psyche* 26, 7—8 (1919).

² *Bull. Soc. Vaud. Sci. Nat.* 53, 177 (1920).

WHEELER³ suggests that the possible cause of gynandromorphism in ants may be one of the following:

1. A gynandromorph may, perhaps, arise from two eggs which have fused to form a single egg with two nuclei. These eggs may originally have been of different sex, or may have become different through the non-fertilisation of one and the fertilisation of the other.

2. It is possible that the nucleus of a single egg may either undergo cleavage prematurely, or receive the spermatozoa too late, so that, in cases of polyspermy, so general in insects, the resulting cleavage nuclei may unite with different sperm-nuclei, or in part develop parthenogenetically and in part after fertilisation.

3. It is conceivable that the somatic peculiarities, at least of unisexual gynandromorphs, may be the result of trophic disturbances during the post-embryonic, i. e. larval or pupal development. These disturbances may, perhaps, be analogous to those which cause viragoism, etc., in other animals and may depend on pathological changes in the chromosomal conditions of certain tissues.

WHEELER puts forward these suppositions as working hypotheses and maintains that we can have no real understanding of gynandromorphism until it can be produced experimentally.

This, we are now aware, has been done in the Lepidoptera by Dr. V. G. L. VAN SOMEREN. He found that in cases where the pupae had suffered a severe shock just when the larvae had changed to pupae and were still soft the resultant butterflies were gynandromorphs of greater or less extent. The period at which the shock was given in these experiments was at the time during which the larval skin is being cast, and the pupae still soft and unset. The nature of the shock consisted of a sudden vibration caused by knocking several times on the receptacle containing the larvae with the knuckles or a mallet of medium weight. Thus the degree of vibration is uncertain and variable.

It is my intention to try similar experiments with my colonies of ants in observation nests; and also to examine wild colonies whose nests are situated on railway banks, etc., where they would experience considerable vibrations from passing trains.

As in several papers on gynandromorphous ants the number of known examples, at the date in question, has been incorrectly

³ Bull. Amer. Mus. Nat. Hist. **19**, 681 (1903).

stated, I have compiled the following list of all the cases which have been described to date:

1. *Formica sanguinea* LATR.
1851. TISCHBEIN, Stett. Ent. Zeitschr. **12**, 295 (1851).
2. *Tetramorium simillimum* SMITH.
1857. ROGER, Berl. Ent. Zeitschr. **1**, 15 (1857).
3. *Tetramorium simillimum* SMITH.
1861. MEINERT, Kong. Danske. Vidensk. Selsk. Skrift. **5**, 331 (1861).
4. *Myrmica lobicornis* NYLANDER.
1861. MEINERT, Kong. Danske. Vidensk. Selsk. Skrift. **5**, 327 (1861).
5. *Myrmica ruginodis* NYL.
1874. FOREL, Denks. Schweiz. Ges. Nat. **26**, 142 (1874).
6. *Formica exsecta* NYL.
1874. FOREL, Denks. Schweiz. Ges. Nat. **26**, 140 (1874).
7. *Formica rufibarbis* F.
1874. FOREL, Denks. Schweiz. Ges. Nat. **26**, 141 (1874).
8. *Formica truncicola* NYL.
1874. FOREL, Denks. Schweiz. Ges. Nat. **26**, 140 (1874).
9. *Polyergus rufescens* LATR.
1874. FOREL, Denks. Schweiz. Ges. Nat. **26**, 142 (1874).
10. *Polyergus rufescens* LATR.
1874. FOREL, Denks. Schweiz. Ges. Nat. **26**, 137 (1874).
11. *Myrmica laevinodis* NYL.
1874. SMITH, Ent. Ann. **1874**, 147.
12. *Leptothorax tuberum* F.
1886. ADLERZ, Bih. Sv. Vet. Acad. Handl. **11**, 82 (1886).
13. *Myrmica laevinodis* NYL.
1890. WASMANN, Stett. Ent. Zeitschr. **51**, 299 (1890).
14. *Myrmica scabrinodis* NYL.
1890. WASMANN, Stett. Ent. Zeitschr. **51**, 298 (1890).
15. *Stenammina westwoodi* WEST.
1891. PERKINS, Ent. Mo. Mag. **27**, 123 (1891).
16. *Azteca instabilis* SMITH.
1892. FOREL, Bull. Soc. Vaud. Sci. Nat. **28**, 268 (1892).
17. *Camponotus ligniperdus* LATR.
1896. KLAPALEK, Sitz.-Ber. Böhm. Ges. Wiss. **2**, 28. 1—4 (1896).
18. *Formica microgyna* WHEELER.
1903. WHEELER, Bull. Amer. Mus. Nat. Hist. **19**, 659 (1903).

19. *Polyergus rufescens lucidus* MAYR.
1903. WHEELER, Bull. Amer. Mus. Nat. Hist. **19**, 659 (1903).
20. *Stenamamma (Aphaenogaster) fulvum* ROGER subsp. *aquia* BUCK.
var. *piceum* EMERY.
1903. WHEELER, Bull. Amer. Mus. Nat. Hist. **19**, 659 (1903).
21. *Stenamamma (Aphaenogaster) fulvum aquia* var. *piceum* EMERY.
1903. WHEELER, Bull. Amer. Mus. Nat. Hist. **19**, 661 (1903).
22. *Leptothorax obturator* WHEELER.
1903. WHEELER, Bull. Amer. Mus. Nat. Hist. **19**, 662 (1903).
23. *Epipheidole inquilina* WHEELER.
1903. WHEELER, Bull. Amer. Mus. Nat. Hist. **19**, 664 (1903).
24. *Cardiocondyla batesi* FOREL var. *nigra* FOREL.
1907. SANTSCHI, Rev. Suisse Zool. **15**, 324 (1907).
25. *Anergates atratulus* SCHENCK.
1908. ADLERZ, Arkiv Zool. **5**, 1—6 (1908).
26. *Anergates atratulus* SCHENCK.
1908. ADLERZ, Arkiv Zool. **5**, 1—6 (1908).
27. *Formica sanguinea* LATR.
1909. DONISTHORPE, Zool. **1909**, 464.
28. *Formica sanguinea* LATR.
1909. DONISTHORPE, Zool. **1909**, 464.
29. *Solenopsis fugax* LATR.
1910. SANTSCHI, Bull. Soc. Sci. Bucharest **19**, 648 (1910).
30. *Myrmica scabrinodis* NYL.
1913. DONISTHORPE, Ent. Rec. **25**, 44 (1913).
31. *Monomorium floricola* JERD.
1914. DONISTHORPE, Ent. Rec. **26**, 136 (1914).
32. *Formica rufibarbis* F.
1915. DONISTHORPE, Brit. Ants, 1st Ed. 223 (1915).
33. *Myrmica scabrinodis* NYL.
1915. DONISTHORPE, Ent. Rec. **27**, 259 (1915).
34. *Myrmica scabrinodis* NYL.
1915. DONISTHORPE, Ent. Rec. **27**, 259 (1915).
35. *Phyracaces singaporensis* VIEHM.
1915. VIEHMEYER, Arch. Naturg. **81**, 111 (1915).
36. *Myrmica rugulosa* NYL.
1917. VIEHMEYER, Ent. Mitt. **6**, 71 (1917).
37. *Myrmica laevinodis* NYL.
1917. DONISTHORPE, Ent. Rec. **29**, 31 (1917).
38. *Myrmica laevinodis* var. *ruginodo-laevinodis* FOREL.
1918. DONISTHORPE, Ent. Rec. **30**, 22 (1918).

39. *Myrmica sulcinodis* NYL.
1919. DONISTHORPE, Ent. Rec. **31**, 1 (1919).
 40. *Acanthomyops (Acanthomyops) latipes* WALSH.
1919. WHEELER, Psyche **26**, 2 (1919).
 41. *Camponotus (Colobopsis) albocinctus* ASHM.
1919. WHEELER, Psyche **26**, 5 (1919).
 42. *Tetramorium simillimum* SMITH.
1920. SANTSCHI, Bull. Soc. Vaud. Sci. Nat. **53**, 176 (1920).
 43. *Monomorium floricola* JERD.
1920. CRAWLEY, Ent. Rec. **32**, 217 (1920).
 44. *Cataglyphis albicans* ROG.
1921. SANTSCHI, Bull. Soc. Hist. Nat. Afrique Nord. **12**, 76 (1921).
 45. *Myrmica rugulosa* NYL.
1924. LOMNICKI, Bull. Soc. Polonaise Natur. Leopold. **49**, 817 (1924).
 46. *Myrmica rugulosa* NYL.
1924. LOMNICKI, Bull. Soc. Polonaise Natur. Leopold. **49**, 820 (1924).
 47. *Myrmica rugulosa* NYL.
1924. LOMNICKI, Bull. Soc. Polonaise Natur. Leopold. **49**, 822 (1924).
 48. *Tetramorium guineense* F.
1924. WHEELER, Psyche **31**, 136 (1924).
 49. *Bothriomyrmex communista* SANT.
1927. KARAWAJEW, Folia Myrmecol. **1**, 45 (1927).
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