

ARTIFICIAL MIXED NESTS OF ANTS.

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Mixed nests of ants are rarely found in nature, and the ants associated in such nests are always of the same subfamily if not of the same genus.¹

There are two ways of causing ants of different genera, or even of different subfamilies, to live peacefully together. One way is that of destroying the sense of smell in the ants by depriving them of a portion of the antennæ. Forel discovered, in the seventies, that the funicles were the organs of smell. I have had representatives of three subfamilies of ants, all without funicles, living amicably together through several consecutive weeks, although the members of the group varied in size, from the huge *Camponotus pennsylvanicus* to the small *Stenamma fulvum*; in form, from the shark-like *Stigmatomma pallipes* to the chubby *Lasius umbratus*; in color, from the jet-black *Cremastogaster lineolata* to the amber-yellow *Lasius latipes*; and in character, from the truculent *Myrmica rubra* to the patient *Formica subsericea*.

In 1901, using *Stenamma fulvum* for the experiments, I located² the appreciation of the nest-aura in the distal segment of the funicle, the eleventh; that of the colony, in the tenth segment; that of the individual track, in the ninth segment; that of the inert young, in the eighth and seventh segments. I have lately located the appreciation of the odor of enemies in the sixth and fifth segments.

I cut off the five distal segments of the antennæ from seven queens³ of *Stenamma fulvum*, seven queens of *Cremastogaster lineolata*, five queens of *Myrmica rubra*, five queens of *Lasius*

¹ E. Wasmann, "Die zusammengesetzten Nester und gemischten Kolonien der Ameisen," 1891. William Morton Wheeler, "The Compound and Mixed Nests of American Ants," *American Naturalist*, 1901.

² A. M. Fielde, "Further Study of an Ant," *Proceedings of the Academy of Natural Sciences of Philadelphia*, November, 1901.

³ Among the Myrmicine ants, queens only were used for these experiments, because of the abnormal irritability of myrmicine workers lacking parts of the antennæ.

umbratus, seven workers of *Lasius latipes*, five workers of *Camponotus pennsylvanicus*, four workers of *Formica sanguinea*, four workers of *Formica subsericea*, and three workers of *Stigmatomma pallipes*, and when these ants had recovered from shock-effect, with healed wounds, I placed them all in an artificial nest, roomy for their number, having thirty-two square inches of floor-space. Duels were constant, and in two hours there were but twenty-three survivors from the forty-seven ants. Several of the survivors were disabled.

I then formed a new group, with other ants, having the four proximal segments of the funicle intact. This group included representatives of the Camponotines, *Camponotus pennsylvanicus* and *Formica sanguinea*; of the Myrmicines, *Stenamma fulvum* and *Cremastogaster lineolata*, and of the Ponerines, *Stigmatomma pallipes*. These lived peacefully together many days, in one of my small Petri cells, and ants of different subfamilies often huddled together. In this cell I saw a queen of the *Stenammæ* lapping regurgitated food from the mouth of a *Camponotus* worker.

In another mixed group, made up of ants retaining from three to six segments of a funicle, I removed and examined every ant that attacked one of another species, and found that all such ants retained more than four segments of the funicle.

We may, then, secure peaceful mixed nests by depriving the inmates of certain segments of the antennæ.

I have lately created many mixed nests by another method, that of educating the ants in ant-odors unlike their own.¹ If one or more individuals, of each species that is to be represented in the future mixed nest, be sequestered within twelve hours after hatching, and each ant so sequestered touch all the others with its antennæ during the three ensuing days, these ants will live amicably together thereafter, although they be of different colonies, varieties, species, genera or subfamilies. For sequestering the ants, I used artificial nests, made in watch-glasses so small that the natural movement of the newly-hatched ants would bring each of them into contact with all the others. In no case did the callows quarrel, and those of most diverse lineage some-

¹The experiments were made at the Marine Biological Laboratory at Woods Hole, Mass., in July, August and September, 1903.

times snuggled one another. The ant's sense of smell appears to be perfectly acquired, and its standards of correct ant-odor to be established during the first three days after hatching. Any two species or any number of species that I captured for use in these experiments, became accustomed to each other's odor, and therefore friendly, if the early association was close and continuous. This association is more perfect when no inert young distracts the attention of the callows from one another, and when the arrangement of the nest offers no place of seclusion for any of its inmates. Air, humidity and nourishment were provided as in large nests of the Fielde pattern. When the ants had been thus segregated for five days or more, the inmates of several like nests were transferred to a more spacious habitation, and newly hatched ants from the same colonies could be safely added thereafter; but no ant of other lineage nor of greater age was amicably received in any of the mixed nests.

Each of the groups mentioned in the following list existed under my care for a month or more after the cessation of additions of newly hatched ants to their mixed nest.

MYRMICINE ANTS.

Group 1.—Six queens of *Cremastogaster lineolata* with eighty workers of *Stenamma fulvum*. The workers snuggled the queens as closely as if of the same species as themselves. In each of two watch-glass nests, the sole queen died on the third day after hatching. Newly-hatched queens of the same *Cremastogaster* stock were accepted by the bereaved workers,¹ in the

¹ After these ants in group 1 had been established for two days in a Fielde nest, a raid was made upon them by adult workers, of the queens' stock, that had escaped from the hatchery-nest, and hidden in a crevice in the laboratory. Very early one morning, I discovered that these adult *Cremastogaster* workers had entered the nest in considerable numbers through a rift in the towelling. Some of them were clustering around the young queens, while others were busily employed in dragging the *Stenamma* callows out of the nest. My arrival thwarted an apparent design of the *Cremastogasters* to eject the *Stenmmas* and dwell in an unmixed nest with queens of their own.

This first group is noteworthy, because *Stenamma fulvum* and *Cremastogaster lineolata* will each feed their larvæ upon the eggs, larvæ and pupæ of the other. In one of my artificial nests the *Stenmmas* lately took care, with their own young, of a great number of *Cremastogaster* larvæ and pupæ, during two months; but every *Cremastogaster* that hatched was instantly killed and cast upon the rubbish-heap.

one case three days, and in the other case five days, after the death of their first queen. I know no adult ants that will accept a queen from another colony of their own species, much less a queen of a genus not their own.

Group 2. — *Myrmica rubra*, *Stenamma fulvum* and *Cremastogaster lineolata*, workers of each species.

ONE SPECIES OF CAMPONOTINE ANTS WITH ONE SPECIES
OF MYRMICINE ANTS.

Group 3. — *Lasius latipes* with *Stenamma fulvum*; workers of each species.

Group 4. — *Lasius umbratus* with *Stenamma fulvum*; workers of each species.

Group 5. — *Lasius umbratus* with *Cremastogaster lineolata*; workers of each species.

Group 6. — *Formica sanguinea* with *Cremastogaster lineolata*; workers of each species.

Group 7. — *Formica subsericea* with *Cremastogaster lineolata*; workers of each species.

ONE SPECIES OF CAMPONOTINE ANTS WITH TWO SPECIES OF
MYRMICINE ANTS.

Group 8. — *Formica sanguinea* with *Stenamma fulvum* and *Cremastogaster lineolata*; workers of each species.

TWO SPECIES OF CAMPONOTINE ANTS WITH TWO SPECIES
OF MYRMICINE ANTS.

Group 9. — *Lasius latipes* and *Formica lasiodes*¹ with *Stenamma fulvum* and *Cremastogaster lineolata*; workers of each species.

Group 10. — *Camponotus pennsylvanicus* and *Formica sanguinea* with *Stenamma fulvum* and *Cremastogaster lineolata*.

ONE SPECIES OF CAMPONOTINE ANTS WITH THREE SPECIES
OF MYRMICINE ANTS.

Group 11. — *Lasius latipes* with *Stenamma fulvum*, *Myrmica rubra* and *Cremastogaster lineolata*; workers of all four species with one queen of *Cremastogaster lineolata*.

¹ Kindly identified for me by Dr. W. M. Wheeler.

THREE SPECIES OF CAMPONOTINE ANTS WITH ONE SPECIES
OF MYRMICINE ANTS.

Group 12. — *Camponotus pennsylvanicus*, *Formica sanguinea* and *Formica subsericea* with *Stenamma fulvum*; workers of each species.

ONE SPECIES OF PONERINE ANTS WITH ONE SPECIES OF
MYRMICINE ANTS.

Group 13. — *Stigmatomma pallipes* with *Stenamma fulvum*; queens of the former with workers of the latter.

ONE SPECIES OF PONERINE ANTS WITH ONE SPECIES OF
CAMPONOTINE ANTS.

Group 14. — *Stigmatomma pallipes* with *Formica subsericea*; workers of each.

ONE SPECIES OF PONERINE ANTS, ONE SPECIES OF CAMPONOTINE
ANTS AND ONE SPECIES OF MYRMICINE ANTS.

Group 15. — *Stigmatomma pallipes*, queens and workers, with workers of *Formica subsericea* and of *Stenamma fulvum*.

In my artificial mixed nests, there is a close affiliation of ants of different species. Those of different subfamilies sometimes lick one another. Introduced young is carried about and taken care of without regard to its origin. Ants of one genus accept regurgitated food from those of another genus.

Ants appear to associate readily with all harmless familiars. In the wild nests of *Stenamma fulvum* I often see gray sowbugs roaming about, and they do not molest the ants, nor are they molested by the ants. On my putting a sowbug into an artificial nest of these ants, they seemed to treat it sportively, two or three young ants sometimes mounting upon its back and riding there, like children making excursions on an elephant. In my artificial mixed nests, small ants often ride on large ones, or stand on their backs and lick their heads.

Natural mixed nests probably originate among ants that seek in their abodes the same degree of moisture and of warmth. The habitat of each species being determined by the food-supply, the humidity and the temperature, any two species finding the same

habitat a congenial one, might form a mixed nest through an accidentally close association of their newly-hatched members.

Were the occupants of my artificial nests free to seek the habitation most agreeable to each species, they would doubtless soon separate. Perhaps they would never quarrel with each other on meeting; but they would certainly fight with all ants whose age and lineage were not the same as their own, or else the same as that of their quondam associates in the artificial mixed nest.

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