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SOCIAL PARASITISM AMONG ANTS AT THE E. S. GEORGE RESERVE IN SOUTHERN MICHIGAN

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A mode of life in which one species spends all or part of its existence in close contact with, and at the expense of, another species is rather common among ants. Sudd (1967) stated that about one sixth of all known European species are parasitic to some extent. At the Edwin S. George Reserve in Livingston County, Michigan, 28.7% (25 of the 87 species) fall into the category of forms considered to be in some way parasitic on other ants.

The following types of parasitism are found: (1) Dulosis, a kind of life in which workers of one species raid colonies of another species to bring back larvae and pupae that are reared to form a mixed colony where the imported "slaves" forage for food, build the nest, and care for the young, while the host workers carry on repeated raids. Dulotic ants may be facultative or obligate parasites. In the former the host colony can survive if deprived of its slaves, while in the latter host workers cannot feed themselves or care for their young and so are completely dependent on the slaves. (2) Temporary social parasitism. In this form a newly fertilized queen cannot establish a colony by herself, so she must seek entrance into a nest of a related species and induce the workers to care for her first broods. Normally the host queen is killed, and since no more host workers are produced a pure colony made up of offspring of the invading queen is eventually established. (3) Inquilinism. Here two different species live together permanently with one usually taking advantage of the other in some way. In addition to providing nest shelter, the host ant may feed the inquilines or even take over the rearing of their brood. This may lead to what is considered the ultimate form of parasitism, in which the worker class has been eliminated during evolution and only the alates remain. Females live constantly in the nest of the host species and each year all eggs produced develop into males and females. The only time females face a hostile environment is when they come to the surface to mate and then must seek out and penetrate another host colony. Examples of these types of ant parasitism from the Edwin S. George Reserve are described below.

DULOSIS

The most conspicuous of the slave-making ants are the six species of *Formica* of the *sanguinea* group. These are all considered to be facultative parasites. *F. subintegra* Emery, *F. rubicunda* Emery and *F. pergandei* Emery, which most often live near wood-field borders, raid colonies of *F. subsericea* Say. In addition, *F. pergandei* may venture farther into fields to raid colonies of *F. pallidefulva nitidiventris* Emery or *F. schaufussi* Mayr. *F. creightoni* Buren and *F. subnuda* Emery usually live in woods and enslave *F. subsericea*, but *F. subnuda* may have few or no slaves. *Formica* sp. undescribed (*sanguinea* group), an ant of open fields, plunders nests of *F. vinculans* Wheeler which lives in the same habitat. Only occasionally does it also take brood of *F. lasioides* Emery that sometimes lives in low spots in fields.

Polyergus lucidus Mayr raids colonies of *F. pallidefulva nitidiventris* and *F. schaufussi* and their mixed colonies are not uncommon (Talbot, 1967). *Leptothorax duloticus* L. G. Wesson, which is relatively rare in Michigan, has been found in mixed colonies with *L. curvispinosus* Mayr, occasionally with additional workers of *L. longispinosus* Roger or *L. ambiguus* Emery (Talbot, 1957). Raids have been studied by Wesson (1940) and Alloway (in press).

TEMPORARY SOCIAL PARASITISM

At the George Reserve 14 species of ants probably start their colonies as temporary parasites. Examples are not easily come by since mixed colonies are small and the condition

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lasts for only a short time. In 1972 a colony of *Formica dakotensis* Emery and *F. subsericea* occupied a nest in tall vegetation near a pond. The small grass-thatch mound was typical of *F. dakotensis* and not of *F. subsericea*, and the former workers outnumbered the latter by about four to one. In 1973 no *F. subsericea* were seen and in 1974 the pure colony of *F. dakotensis* moved to a more open place and expanded into two grass mounds. A mixed colony of *Formica ulkei* Emery and *F. subsericea* occupied a *F. subsericea* type mound and consisted of about equal numbers of the two species (Talbot, 1961). The next year *F. ulkei* was still there but there were no *F. subsericea*. *F. exsectoides* Forel, a known temporary parasite, was also present on the Reserve.

All the *Formica* of the microgyna group are believed to be temporary parasites. *F. nepticula* Wheeler and *F. sp?* (microgyna group) occur at the Reserve, and since they live in places of scattered trees or shrubs or at wood-field edges they probably seek colonies of *F. subsericea*, *F. pallidefulva nitidiventris* of *F. schaufussi*.

One colony of *Acanthomyops latipes* (Walsh) with *Lasius neoniger* Emery was discovered (Talbot, 1963). A number of such colonies have been reported by Wing (1968). The invasion of *A. murphyi* (Forel) into *L. neoniger* nests was seen once (Talbot, 1973). It was a rather spectacular sight with large numbers of dealate females pushing into *L. neoniger* nest openings. Sanwald (1964-65) reported a similar invasion and also found mixed colonies of *A. murphyi* and *L. neoniger*. There is little doubt that *A. claviger* (Roger) is also a temporary parasite. Its flights take place very late in the year (September, October, November) and dealate females "overwinter above ground in considerable numbers, either singly or in aggregates" (Wing, 1968). The females are more active at low temperatures than are most ant species and so would be capable of penetrating *Lasius* colonies while they are still dormant. It seems probable that *A. interjectus* (Mayr) and *A. subglaber* (Emery) also start their colonies by invading *Lasius* nests but complete evidence has not been reported.

It is generally thought that *Lasius* of the subgenus *Chthonolasius* start their colonies in nests of species of the subgenus *Lasius* because their queens are considered too small to rear a first brood alone. *Lasius umbratus* (Nylander), *L. speculiventris* Emery and *L. minutus* Emery are of this type. At the Reserve a mixed colony of *L. umbratus* and *L. alienus* (Foerster) was found in a log and Wilson (1955, 1971) gave accounts of mixed *L. umbratus* colonies in Europe. Kanno (1959), working with bog ants of the Reserve, found evidence that an ant of the subgenus *Chthonolasius* may be a temporary parasite of a species in the same subgenus. He discovered dealate females of *L. speculiventris* attempting to invade openings in mounds of *L. minutus* or to form chambers in the loose soil on the mound surface. He also found mixed colonies of *L. speculiventris* and *L. minutus*.

The *Aphaenogaster tennesseensis* (Mayr) queen's small size is characteristic of ants which start colonies by temporary parasitism. W. M. Wheeler (1910) found two mixed colonies of this species with *A. rudis* Emery, near Rockford, Illinois. If mixed colonies of *A. tennesseensis* are found at the Reserve they will probably be with *A. rudis*.

INQUILINISM

One colony of *Leptothorax hirticornis* Emery was discovered among the numerous mounds of *Formica obscuripes* Forel. The little cluster of workers, alate females, ergatomorphic (having worker-like bodies) males and worker and female pupae (18 June) were 17 inches down in the nest in slightly moist thatch. Three colonies of *Monomorium minimum* (Buckley) were parasitized by an unnamed workerless species of *Monomorium*. Alate females, males and dealate females were scattered through the colonies (30 June, 4 and 13 July). Males looked much like females and were about the same size. One colony had a *M. minimum* queen, the other two did not. Another workerless parasite, *Formica talbotae* Wilson, has been studied in five mounds of *Formica obscuripes* Forel (Wilson, 1976; Talbot, 1976). The small, similar males and females had a long flight period (mid June until early October). In the one colony dug, no *F. obscuripes* queen was found.

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