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TROPHIC EGG PRODUCTION IN THE IMPORTED FIRE ANT, *SOLENOPSIS INVICTA*

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ABSTRACT

Newly mated queens of the imported fire ant (*Solenopsis invicta* Buren) were observed to lay two types of eggs: the small eggs hatched into larvae; the large (trophic) eggs were fed to the larvae. Prior to this investigation, it was believed that the only source of food for the first workers was regurgitated, reabsorbed body tissue.
Key Words: Insect, Formicidae, food, larvae, tropic eggs, *Solenopsis*.

Some insects have the ability to produce "trophic eggs," that is, eggs that exist only to be eaten. Wilson (1971) reviewed this subject admirably in his book, *The Insect Societies.* He considers trophic eggs a "bizarre effect" of the diverse methods of communication in social insects and judges oophagy (egg cannibalism) to be widespread in the social Hymenoptera. Such behavior is exploitative in the case of the alpha female *Polistes* which eats the eggs laid by a subordinate female so that only her own progeny will be reared, but among the higher social Hymenoptera, oophagy has lost its competitive quality and been transformed into an important form of food exchange among cooperating members of the same colony. Wilson lists the following genera of ants in which trophic eggs are produced by either the worker or the queens: *Myrmecia* (Freeland 1958); *Myrmica* (Brian 1953); *Pogonomyrmex* (Wilson and Regnier 1972); *Leptothorax* (Gosswald 1933; LeMasne 1953); *Atta* (Bazire-Benazet 1957); *Dolichoderus (Hypoclinea)* (Torossian 1959); *Iridomyrmex* (Torossian 1961); *Plagiolepis* (Passera 1966); and *Formica* (Weyer 1929). In addition, he lists a burrowing cricket, *Anurogryllus muticus* DeGeer (West and Alexander 1963) and a bee, *Melipona quadrifasciata anthidioiodes* Lepeleteer (Sakagami and Zucchi 1967, 1968; Kerr 1969).

The present paper reports on our observations concerning the production of trophic eggs by the imported fire ant, *Solenopsis invicta* Buren, formerly included in the *Solenopsis saevissima richteri* Forel complex (Buren 1972).

In December, 1971, newly mated female *S. invicta* were captured from a nuptial flight near Gulfport, Mississippi. Seven queens were placed in 3.75-dr vials with plaster of Paris in the bottom, and six laid eggs in the vials the 1st day; a seventh laid eggs on the 4th day. When we examined the egg clutches from these queens, we noticed two sizes of eggs, large and small, in the egg mass (Fig. 1). However, all the eggs from our laboratory colonies were the same size as the small eggs. Therefore, we allowed the queens from the field to continue to oviposit, and every day we removed the eggs and counted and classified them (Table 1). The average small egg was 0.14 mm wide and 0.21 mm long; the average large egg was 0.22 mm wide and 0.34 mm long. The small eggs weighed, on the average, 0.055 mg; the large eggs weighed 0.033 mg. Thus, the volume

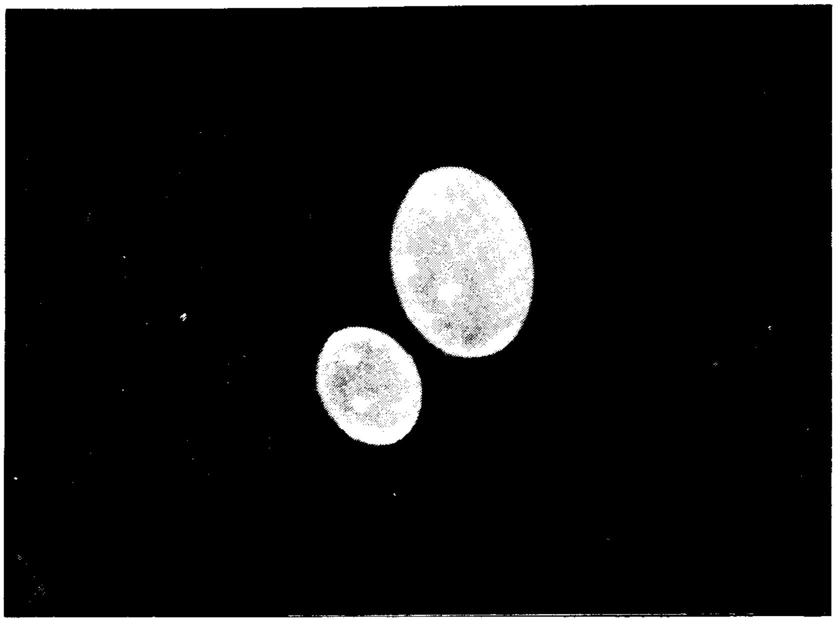

Fig. 1. Eggs of different sizes from the first clutch of eggs of a newly mated imported fire ant queen.

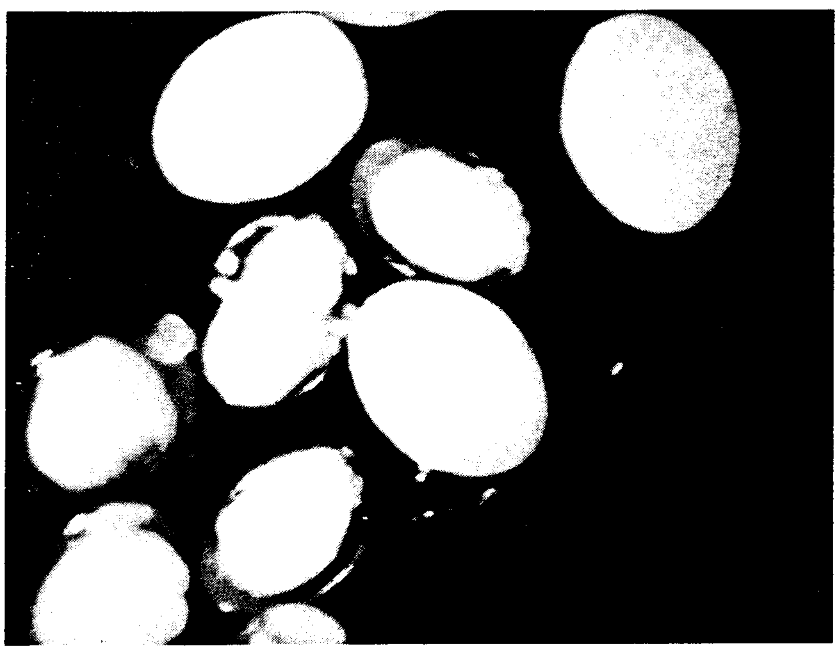

Fig. 2. Small embryonated eggs and trophic eggs cleared in a 1:1 chloroform-methanol mixture.

of the larger eggs was 4X that of the smaller, but the smaller eggs were heavier.

Several tests were conducted to determine the nature of these large eggs. When samples of both the large and small eggs were placed in a mixture of chloroform-methanol (1:1) for fixing, the small eggs cleared,

Table 1. Production of trophic and normal eggs by newly mated *S. invicta* queens confined in shall vials.

Queen no.	Type of egg		Percentage of total eggs in trophic category
	Trophic	Normal	
1	119	83	58.9
2	153	149	50.6
3	55	73	42.9
4	83	76	52.2
5	80	58	57.9
6	54	150	26.4
7	55	93	37.1

revealing the embryos; the large eggs remained opaque (Fig. 2). Also to determine whether there was any form of embryo or chromatin material in the large eggs, we made the Feulgen test for nucleic acids (Schmuck and Metz 1931): the eggs were fixed overnight in Carnoy's solution (equal parts chloroform, absolute alcohol, and glacial acetic acid), packed into an empty *Drosophila* pupal skin, and carried through the staining technique. No large eggs showed any stain. In another test, large and small eggs were placed on a glass slide inside a petri dish containing moist cotton. Ten days later, the small eggs had either hatched or shriveled up, but the large eggs remained intact.

Other observations showed that as the larvae from normal eggs hatched, they rotated their head until they located a large egg and began to eat it. However, the queen was never observed placing the trophic eggs or the larvae next to each other.

Subsequently, we collected 19 queens from field colonies and placed them in vials with 25-50 of their workers. Only two of these queens produced large eggs: one laid 99 large eggs over a nine-day period, and the other laid 67 large and 14 small eggs over the same period. The remaining queens laid from three to 1939 eggs, all of which were small. We believe that the two queens which laid the large eggs were newly mated queens that had been accepted as additional queens by the colony. This hypothesis is supported by our recent findings (Glancey *et al.* 1973) that some colonies of *S. invicta* have more than one fertile queen.

On the basis of our observations and tests, we conclude that the large eggs produced by newly mated queens are, in fact, trophic eggs that serve as food for the first (minim) workers of the queen. To this time, the only reported source of food for these workers has been the secretions regurgitated by the queen from reabsorbed body tissues (Green 1967). We do not want to imply that our findings negate oral secretions as a source of food for the minim workers; however, more studies are needed to resolve the importance of each food source for larval development.

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