

polymorphism cannot be said to be linked to polyethism in any simple, consistent way among the ant taxa.

ERGONOMICS

The term "ergonomics" is borrowed here from human sociology to give some formal recognition to a trend of research which is destined to become increasingly important in the study of social insects. In our context it is intended to mean the study of labor productivity and efficiency in the insect colony. A great deal of information of this kind is, of course, already available for the honey bee, and a start has been made in the social wasps with Deleurance's analyses (41) of work in the *Polistes* colony. No firm principles have yet emerged pertaining to ants, but data are accumulating to this end. Pickle's measurements of territories, biomass, and earth-moving in British ants [(125) and contained references] have been frequently cited in the general ecological literature. Some of his figures suggest nicely the large amount of work performed by ant colonies; for instance, single *Lasius flavus* colonies, while occupying average areas of about 50 square yards, used about 330 g of earth per year in nest building. Holt (76), in an analysis of foraging activity of a mature *Formica rufa* Linnaeus colony, calculated that on one typical day, 60 to 70 thousand workers, weighing 700 g, made 300 thousand foraging trips to collect at least 800 g of food, of which 44 per cent was honeydew. Stumper (159) measured the crop content of a replete *Proformica nasuta* as 10 mg; in laboratory colonies this supply is doled out to about 100 sister workers over 30 days, or at the estimated energy rate of 0.04 calories per worker per day.

In three novel and stimulating papers, Brian (14, 16, 17) has set out to measure the efficiency of brood rearing in *Myrmica rubra*. Three causes of inefficiency were demonstrated: (a) large larvae so monopolize food input from the workers that they cause a suboptimum distribution; (b) the larvae are massed in such a way that they prevent the most direct servicing by the greatest number of available nurses; (c) the larvae receive food through a trial and error method rather than by transmitting a "hunger" signal. Given the first two suboptimal relations as stable conditions, Brian calculated the optimal worker-to-larva ratio and found it to be close to the natural ratio. Inefficiency was defined by the author in this system without reference to other biological phenomena. The possibility remains that the "defects" described provide advantages to the colony in other unforeseen ways that outweigh the disadvantages in larva rearing, and it cannot be concluded that larva rearing is perfectable without other alterations in social structure. Brian has pointed the way for making such estimates in a quantitative manner.

NEST MICROCLIMATE REGULATION

The ant colony has very marked environmental preferenda and attains them by two primary means: nest construction effective in regulating the