20-19 PROBLEM SOLVING IN COMPLEX SYSTEMS: COLLECTIVE CHAIN FORMATION AND GAP BRIDGING IN THE WEAVER ANT *OECOPHYLLA SMARAGDINA*

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The collective building activities of green tree ants is considered one of the most complex behaviours exhibited by social insects. Individuals join together to form chains to bridge gaps in the canopy, which can then be shortened to bring together foliage in order to construct their arboreal nests. Here we demonstrate that groups of green tree ants are capable of collectively discriminating gap distances and 'choosing' to bridge the shortest gap. We discuss the individual behavioral mechanisms that potentially underlie this group problem-solving capability and the relationship between behavioral subgroups and overall group decision-making efficiency. We also discuss a previously undetected collective group behaviour: column formation, in which ants combine to form living columns in order to bridge vertical gaps.

20-20 DIGGING BEHAVIOUR AND THE CONTROL OF NEST SIZE IN LEAF-CUTTING ANTS

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Leaf-cutting ant nests consist of numerous underground chambers, each housing a fungus garden. It is largely unknown what are the rules used by workers to enlarge the nest, and to what extent both the nest size and the size of a single fungus chamber are regulated. We investigated the dynamics of collective digging and nest enlargement in laboratory colonies of the leaf-cutting ant *Acromyrmex lundi*. Groups of ants varying in number, or provided with different fungus volumes, were allowed to establish a nest in a chamber of insufficient size, and their digging activities quantified. The rationale of the experiments was to create a situation in which workers need to relocate a fungus garden into a pre-given nest chamber of insufficient size. Under such conditions, workers need to enlarge the existing chamber so as to generate enough space for the fungus garden to be relocated. The experimental setup thus reproduced a situation that recurrently occurs during nest ontogeny, when an existing chamber is enlarged because of fungus growth, or new ones are excavated. Ants were observed to dig tunnels and to enlarge the pre-given chamber. The presence of a fungus garden significantly stimulated digging activity. Digging rates were maximal at the beginning of the experiments and continuously declined over time. Total digging activity, and the resulting nest size, positively depended on the number of ants in the group; this relationship could be described with the power law (exponent = 0.5). The chamber size, however, was independent of the number of ants, and was adjusted to the available fungus volume. It is argued that the shape of the fungus garden acts as a dynamic three-dimensional template that determines the final chamber size. New chambers are expected to be excavated around a fungus piece previously relocated in a tunnel, and to be enlarged as soon as the distance between the fungus and the chamber wall becomes reduced because of fungus growth.