HOW ARGENTINE ANTS ESTABLISH A MINIMAL-SPANNING TREE TO LINK DIFFERENT NESTS

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A mathematical model based on the individual workers' simple trail-laying and trail-following behaviour generates collective networks similar to the experimental ones. Certain differences in the case of the square configuration suggest the existence of an additional factor that seems to prevent pairs of nest from becoming isolated from the rest of the network.

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References


Argentine ant societies are not central structures, but are composed of a number of nests (or sub-societies) connected by a permanent network of chemical trails. Workers, larvae and even queens are regularly exchanged between these "outposts", allowing a flexible allocation of the work-force in the foraging area in response to environmental cues.

Recently, we have shown that much of Iridomyrmex humilis' spatial organisation is the result of the workers marking the ground as they move, their direction of movement being influenced by the marks left by preceding workers (Deneubourg et al., 1989; Goss et al., 1989; Aron et al., 1990a). This factor seems also to be central to their inter-nest organisation (Aron et al., 1990b).

The formation of a network of connections between laboratory nests was studied using cardboard bridges in different configurations, in particular branches of equal length arranged in a triangle linking three nests, in a square linking four nests, and two branches of different length linking two nests.

The traffic between the nests, at first evenly distributed over each branch, rapidly becomes asymmetrical. In all the configurations studied so far, the ants use a subset of the available connections that nevertheless links all the nests. For example two branches are used to connect three nests, three branches connect four nests, and one branch (the shortest one) connects two nests.

Different experiments underline the primary role of chemical cues in the establishment of these networks, as opposed to other possible factors such as individual memory or visual cues.