Chemosensory explanation for intraspecific tolerance in a supercolony-forming ant

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Territorial boundaries between conspecific social insect colonies are maintained through nestmate recognition systems. However, in supercolony-forming ant species, individuals mix freely among physically separate nests. The underlying mechanism is considered to involve a remarkable reduction of intraspecific aggression, while maintaining interspecific competition.

Formica yessensis in Japan is a unicolonial ant species that constructs supercolonies comprising numerous nests, constituting the largest supercolonies ever found in Japan. We compared the composition of cuticular hydrocarbons (CHCs), the species' nestmate recognition cues, of workers from different localities of a supercolony, as well as the chemosensory discrimination efficiency of worker CHC sensilla. Workers from colonies within the supercolony revealed a greater similarity of profiles compared to workers from colonies outside it. Total response of the active CHC sensilla increased stepwise, suggesting that discrimination of conspecific workers at the peripheral system is limited, particularly among members of the same supercolony, but is fully expressed for allospecific workers.

We demonstrate that low discrimination sensitivity of the CHC sensilla limits these ants' ability to recognize the subtle differences in the CHC pattern that typify members of a supercolony. Thus, the reduction of chemosensory sensitivily is an important factor contributing to the characteristic tolerance exhibited by the supercolony-forming ant.