The Meek Shall Inherit the Earth

If you have a household ant problem, it’s probably Argentine ants. These invasive ants threaten the persistence of native species. They are numerically and behaviourally dominant; they mass-recruit 24 h a day to secure and defend resources against other species. Part of their success can be attributed to the lack of intraspecific aggression. They form vast supercolonies – the single ‘California large’ colony stretches 900 km up the coast. They do especially well near human habitation. They seem invincible. Enter a second invasive species, the Asian needle ant. These ants form small colonies, do not mass-recruit and are not behaviourally dominant at resources. So how is it that in some areas of the Mid-Atlantic States of the U.S.A. the Argentine ants are being displaced by these newcomers?

In this issue (pp. 497–506), Eleanor Spicer Rice and Jules Silverman from North Carolina State University investigate the role that behavioural adaptations play in interspecific competition. Behavioural interactions can be key to understanding how an invader can become established in a new environment and whether it persists. In one-on-one staged encounters (Fig. 1), the Argentine ants exhibited a range of behaviours from ignoring the Asian needle ant to attacking and biting it. The most common response of the latter to low and moderate levels of aggression was to become immobile or retreat. However, the Asian needle ant possesses a lethal sting and when faced with a biting Argentine ant would use it. In staged small-group encounters, the Argentine ants provoked stings and many did not survive the 24 h test. However, in these small-group encounters, significantly more Argentine ants survived if they had been collected from a site at which both species were from nests within 1 m of each other than if the two colonies were from a greater distance (>20 km). The outcome for the Argentine ant was the same whether the Asian needle ant had been collected from an area of species overlap or not. Thus, survival of the Argentine ant depended on its behaviour towards the Asian needle ant, which in turn depended on its familiarity with the latter.

Spicer Rice and Silverman went on to investigate interactions at the level of larger colony fragments and the role that familiarity and habituation might play in aggression between these two ant species. They especially sought to understand the basis of the variability in the Argentine ants’ aggressiveness. The Asian needle ant is about twice the size of the Argentine ant but the latter outnumbers the former in nature by as much as 10:1. In asymmetrical colony-level interactions, the Asian needle ant faces mortality. To determine whether continuous contact between the two species was necessary for the Argentine ant to display low aggression, asymmetrical colony fragments that had been collected from overlapping colonies were either placed together immediately after collection or 14 days after collection. Asian needle ant survival was significantly higher when interspecific contact was unimpeded. Habituation played a role in the aggressive response by the Asian needle ant but not by the Argentine ant. The former showed a lower threshold to sting with a second exposure to an Argentine ant; however, aggression by the Argentine ant was initially high and remained so for initial and repeated exposures to individuals from nonoverlapping locations. Even the continuous exposure for 7 days to the Asian needle ant confined in a mesh cage did not reduce the level of aggression of the Argentine ant.

This work demonstrates how understanding behaviour can illuminate community-level interactions. The Argentine ant is a formidable invader, dominating native ants in disturbed ecosystems worldwide. Yet the Asian needle ant first coexists and then comes to displace the Argentine ant. To its advantage the former establishes new colonies in the spring when Argentine ant populations are low. They appear to express conflict avoidance behaviour such as escape and immobility and habituate to the more aggressive Argentine ant after repeated exposures. But why are they successful in displacing populations of the Argentine ant? Spicer Rice and Silverman suggest two hypotheses. Although it is usually applied to conspecifics, the ‘dear enemy’ effect is suggested by the finding that Argentine ants from populations that closely coexist with the Asian needle ant are less aggressive towards the latter. However, the group assays in this study suggest that true dear enemy
behaviour is unlikely. Argentine ants collected from nonoverlapping regions did not habituate or become less aggressive towards the Asian needle ant after repeated exposures. The second hypothesis is that the Argentine ant is expressing errors in its kin recognition system and is more accepting of the Asian needle ant owing to recognition mediated through shared environmentally derived cues. Argentine ant colonies are huge and noteworthy for the lack of aggression among conspecifics even those from very disparate locations. This flexible but shared cuticular hydrocarbon recognition system may also be responsible for the reduced aggression towards the genetically different but ecologically similar Asian needle ant.

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Olfactory Cues of Social Familiarity Mediate Group-joining Decisions in Predatory Mites

Group-joining decisions are usually associated with fission–fusion societies of vertebrates, such as primates, elephants, dolphins or fish, which are characterized by a frequent change in size and composition because of splitting, merging or exchange of members particularly when on the move. However, joining the appropriate group has important fitness consequences across taxa, and individuals in many invertebrate group-living species frequently have to make a decision about which group to join and when to leave it. Group-joining decisions are likely to be based on interrelated individual and group-level traits such as life stage, body size, group size and density, genetic relatedness or social familiarity. For the latter, individuals need to be able to discriminate between those with whom they have interacted before and those with whom they have not interacted before. The potential advantages of joining a socially familiar group include benefits associated with group cohesion and effective information transmission.

In the present issue (pp. 507–512), Muluken Muleta (University of Natural Resources and Life Sciences, Austria and Haramaya University, Ethiopia) and Peter Schausberger (University of Natural Resources and Life Sciences, Austria) present results from experiments on the influence of social familiarity on group-joining decisions by the predatory mite *Phytoseiulus persimilis*. This involves a fascinating system because *P. persimilis* is a highly specialized predator on other mite species. One of them is the two-spotted spider mite *Tetranychus urticae*, which produces a dense web and feeds on vegetation. It is patchily distributed on its host plants. Hence the predator mite also forages, reproduces and develops on these plant patches (Fig. 2). Its distribution within and between plants is dynamic. Earlier studies have shown that the prey patch residence and leaving decisions by the predatory mite depend on prey availability and the presence of competitors. However, although previous work had shown that social familiarization, which is facilitated by predator encounters on the prey patches and imprinting through contact during early development, plays a role in the context of cannibalism, within-group associations, foraging, reproduction and dispersal, until now it was not known whether social familiarity affects the predatory mites’ decisions to join or leave a group of their own species.

Muleta and Schausberger carried out two experiments. The first binary choice experiment aimed to establish whether females about to lay their eggs prefer to join familiar groups and whether this depends on the number of prey eggs. Females reared from egg to adulthood in the same arena were considered familiar and marked with the same colour while females reared in different arenas were considered unfamiliar and marked with different colours. The experimental set-up consisted of two similarly sized bean leaflets connected by a wax bridge. The authors tested seven ratios of prey egg densities between the leaflet with familiar females and the leaflet with unfamiliar females. One of these ratios was balanced and there were two of each of the little, moderately and strongly biased ratios, depending on whether the bias was towards the familiar or unfamiliar females. A test female, about to lay her eggs, was allowed to join one of two groups. She was familiar with one of the groups and unfamiliar with the other. The balanced design was replicated 30 times while each biased design was replicated 20 times. The results clearly demonstrate that predatory mite females about to lay their eggs prefer to join groups with familiar females independently of the degree of bias in their prey egg densities. Not only was the preference to join the familiar group the same for the seven prey egg density ratios but it did not change over the 24 h of the experiment.

To elucidate the possible mechanisms underlying this preference, the authors carried out a second binary choice experiment to test whether gravid predatory mite females can distinguish between the odours of familiar and unfamiliar groups. The experimental set-up consisted of a choice cage clamped on top of a group cage with gauze separating the two allowing for the diffusion of volatiles from the group cage to the choice cage but at the same time preventing any direct contact. The group cage consisted of two unconnected cells, each containing a group of three females. One of the groups was familiar and the other unfamiliar to the tested female in the choice cage, where the two cells were connected by a T-shaped channel to the release site. This experiment was replicated 30 times. The results clearly demonstrate that predatory mite females about to lay their eggs strongly prefer the odour of the familiar group. This preference did not change over the 2 h of the experiment.

The overwhelming preference of the predatory mite females for familiar groups, which outweighed even the attraction to higher prey egg densities, is most likely to be adaptive because of the benefits of social familiarity such as faster reaction times to predator attacks, enhanced reproduction, more effective foraging, patch exploitation and dispersal. This suggests that social familiarity is a significant selective force for group living.

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Figure 2. A *P. persimilis* predatory mite mother with her egg in the background (oval shaped, salmon coloured) inside a spider mite patch (the white globes are spider mite eggs). Photo: Peter Schausberger.