Novel insights into the ontogeny of *Polistes* nestmate recognition

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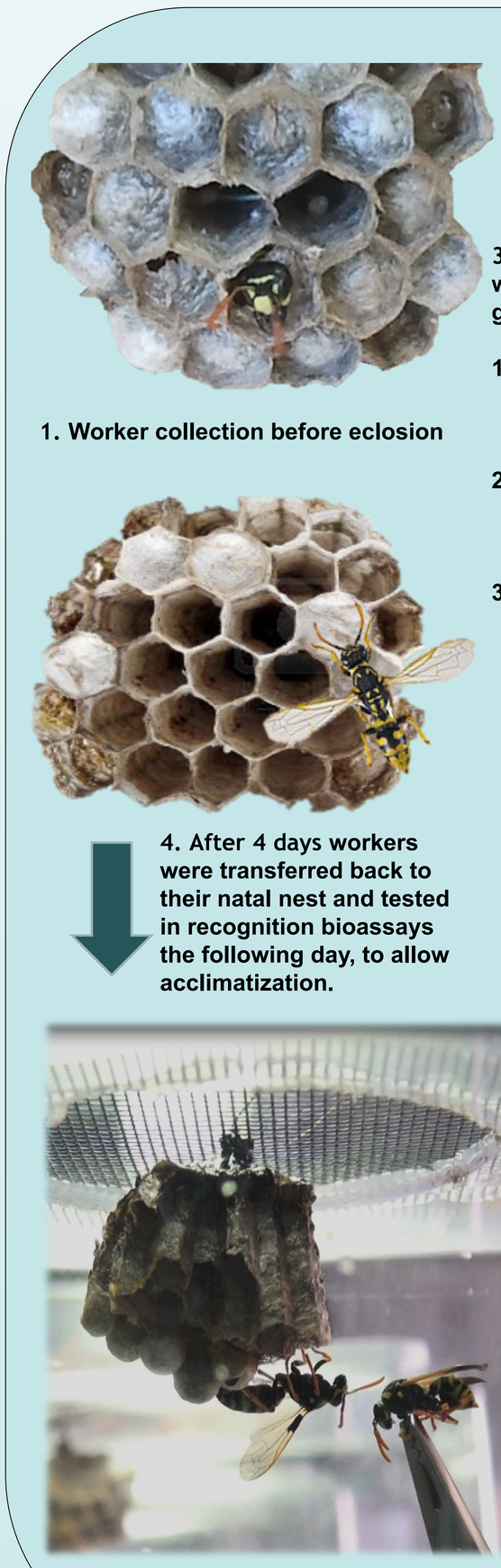
INTRODUCTION

Early experiences in life can have significant consequences on the behaviour of animals and on their survival. The restriction of learning to an early sensitive temporal window during ontogeny allows the acquisition of biologically relevant information while reducing the risk of evaluation errors. In social insects, early learning appears to influence important social behaviours such as nestmate recognition. It is currently believed that *Polistes* social wasps are able to discriminate nestmates from non-nestmates following the perception of olfactory cues on the paper of their nest, which are learned during a strict sensitive period, immediately after emergence (Gamboa et al. 1986).

MATERIALS and METHODS

We investigated whether in *P. dominula* wasps the early olfactory experience, through contact with nest material, is a fundamental prerequisite for the development of correct recognition abilities. We experimentally exposed pre-eclosing workers to their natal nest material, to foreign nest material, or to neutral filter paper, for the first four days after eclosion. Afterwards, the experimental wasps were transferred onto their original nests and bioassays were performed to assess their recognition abilities towards different lure wasps



1. Worker collection before eclosion

2. Transfer to petri dish (end of pupal stage)

3. Experimental workers divided in 3 groups:

1) "N" = Neutral, Petri dishes containing a piece of filter paper
2) "C" = Control, Petri dishes containing own nest material
3) "F" = Familiarized, Petri dishes containing nest material from a foreign unrelated nest

4. After 4 days workers were transferred back to their natal nest and tested in recognition bioassays the following day, to allow acclimatization.

5. Recognition Bioassays
All the resident wasps were removed from each nest except the experimental individual. Each experimental wasp was left undisturbed on its nest for 15 min.
To evaluate the recognition abilities of experimental individuals, we presented each wasp with three different kinds of lures (i.e. dead wasps killed by freezing), and we recorded their behavioural responses. For the "N" and "C" experimental wasp lures were represented by 1 nestmate and 2 alien wasps from foreign colonies. For the "F" group, 1 lure was represented by a nestmate, 1 by a wasp belonging to the colony that provided nest fragments for the exposure phase (familiar), and 1 by an alien, completely unfamiliar wasp.

RESULTS

"C" and "N" wasps spent significantly more time biting alien than nestmate lures, but they made no differences between alien lures (Fig. 1A,B). "F" wasps were equally aggressive towards alien and familiar lures, while they were significantly less aggressive towards nestmate (Fig. 1C). Therefore, the pattern of the wasps' response was similar in the three experimental conditions, indicating no detectable effects of early olfactory experience through contact with the nest material on wasps' recognition ability.

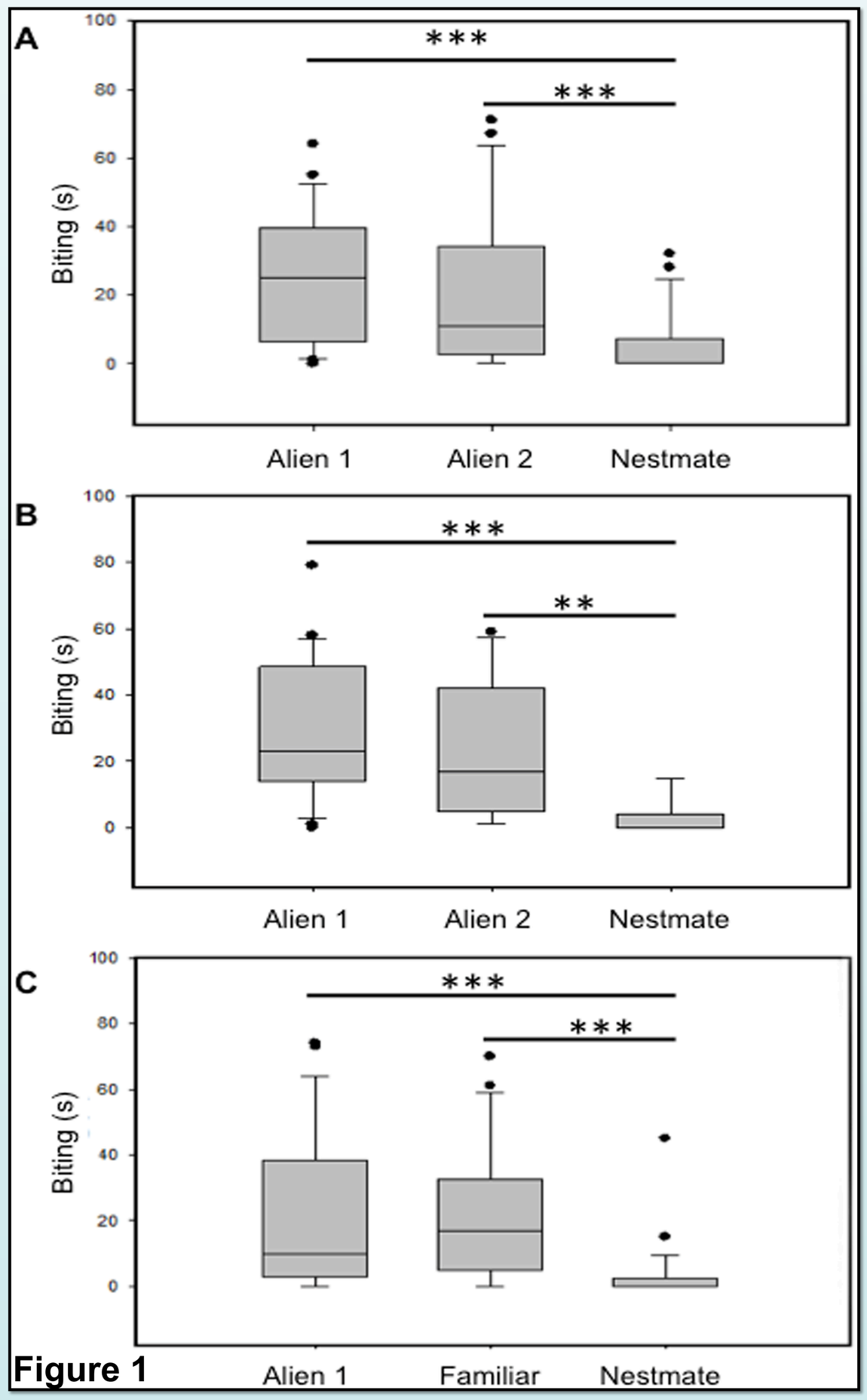


Figure 1

DISCUSSION and CONCLUSIONS

Our results show that in *P. dominula* the nest material is not the primary and fundamental source of recognition cues for the template formation during the first hours after emergence, as suggested by studies on other *Polistes* species [2]. Workers of *P. dominula*, taken from their natal combs at emergence, are able to develop correct discrimination abilities regardless of their olfactory experience during the first four days of adult life. Neither the presence of alien nest fragments nor the total absence of nest material altered the wasps' recognition abilities. Our study shows for the first time that the general mechanisms of recognition proposed for the paper wasps of the *Polistes* genus, which is actually very strict concerning the timing of template formation, is not applicable to all species within this genus and cannot be generalized.