



Searching behaviour of two desert ants from contrasting visual environments

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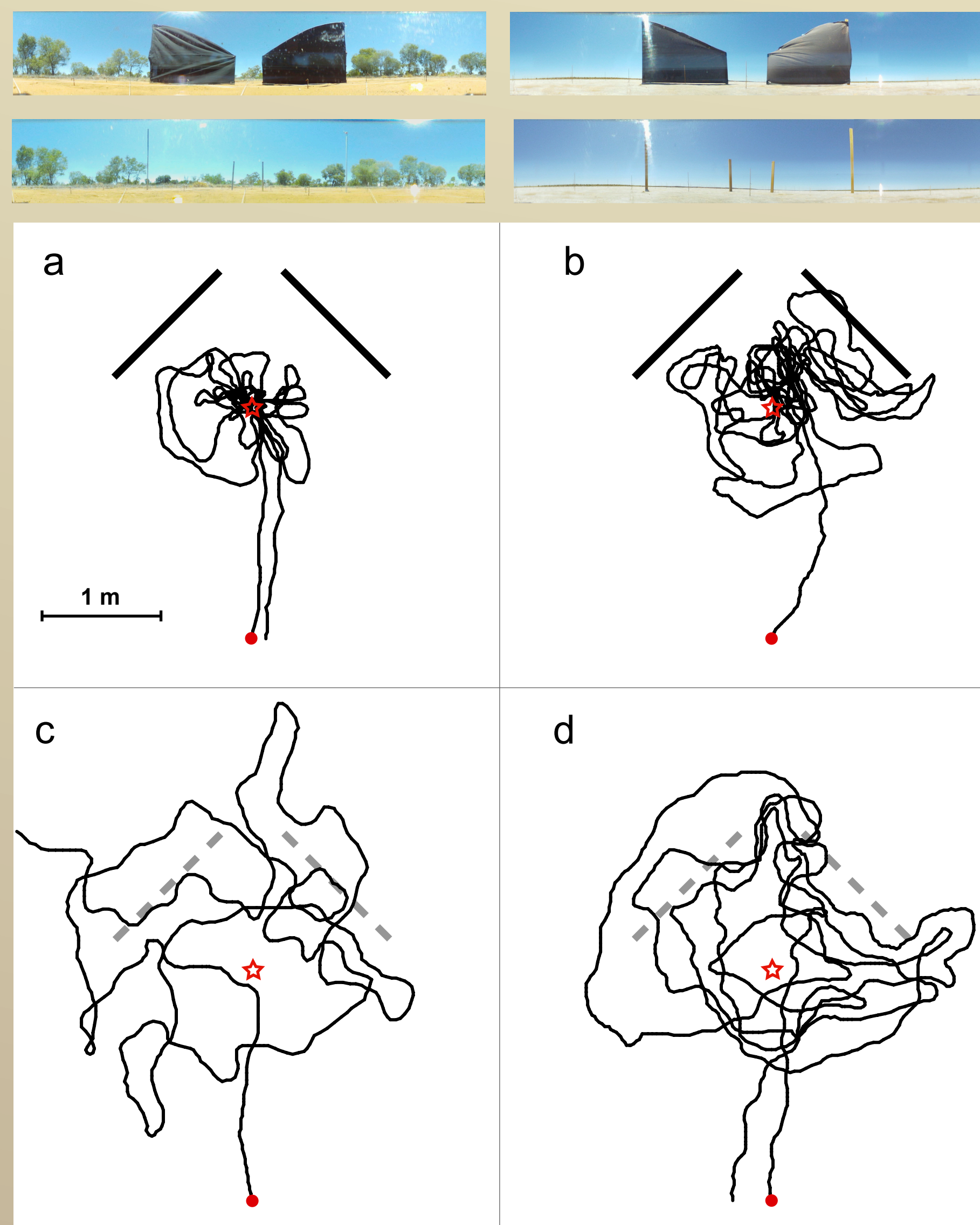
Introduction

Ant species of the genus *Melophorus* are distributed all over Australia. We investigate the nest searching behaviour of two solitary foraging species that occupy vastly different visual environments: *Melophorus bagoti* inhabits cluttered grassland deserts of Central Australia, and the as yet unnamed *Melophorus* sp. inhabits featureless dry salt-pans (Fig. 1). *Melophorus bagoti* is well known to rely heavily on visual navigation, and to a lesser degree on path integration (NARENDRA 2007). *Melophorus* sp. has been shown to employ path integration (SCHULTHEISS *et al.* 2012), but our study is the first to investigate its visual navigational capabilities. We here focus on the question whether the navigational strategies of closely related desert ants are adapted to the visual complexity of their habitual environments.



Fig. 1: The ant *Melophorus bagoti* and its cluttered desert environment (left), and the ant *Melophorus* sp. and its featureless salt-pan environment (right).

Site 1: *Melophorus bagoti* Site 2: *Melophorus* sp.



Methods

One field site was located in the vicinity of Alice Springs, Australia (site 1, *Melophorus bagoti*), another in a dry salt-pan close to Woomera, South Australia (site 2, *Melophorus* sp.). At each site, two prominent landmarks were set up close to the entrance of one nest, and a feeder installed (see Fig. 2). After two or more days of training, we recorded the paths of homing ants under one of two conditions: (1) with the landmarks in place, and (2) with the landmarks removed. The nest entrance was obstructed, so that the ants displayed a systematic search, after having run of their path integration vectors.

Fig. 2: Set-up of the experiment and examples of search paths. Black bars show the location of the landmarks in relation to the nest (red star). Experienced foragers were released at the feeder (red dot), and their paths were recorded. (a,b) Search with landmarks in place, (c,d) search with landmarks removed. Top shows the panoramic view from the nest entrance.

Results and Discussion

The two species displayed some interesting differences in their reliance on path integration (PI; Fig. 3a-d). With the familiar landmarks in place, both species ran off their entire PI vector, which was well oriented. When the landmarks were removed, *M. bagoti* ran only about 80% of its PI vector, which was less well directed. *Melophorus* sp. continued to rely on PI for the entire homeward journey. In both species, the size of the subsequent search was much smaller (thus more accurate) when the familiar landmarks were in place, showing that both rely on these visual cues for locating the nest (Fig 3e-f). However, *Melophorus* sp. appears to rely on these landmarks to a lesser degree than *M. bagoti*. When the landmarks were removed, the searches of both species had a similar size.

Taken together, our findings show that *M. bagoti* relies more strongly on visual navigation, while *Melophorus* sp. relies more strongly on path integration. As the two species are phylogenetically closely related, we suggest that these differences reflect their respective visual environments. Studies of a similar species pair from the well-studied North African desert ant genus *Cataglyphis* (see WEHNER 2003) should prove revealing.

Fig. 3: (a,b) Length of the path integration (PI) run, and (c,d) its absolute angular deviation from the straight direction. (e,f) Size of the search, centred on end of PI. Dashed line shows the nest location, and asterisks mark significant differences (*t*-tests). LM: landmarks in place, No LM: landmarks removed.

