Article: Forager activation and food availability in harvester ants

Abstract: We investigated how foragers are activated in colonies of the red harvester ant, Pogonomyrmex barbatus. Each day, a harvester ant forager makes many trips out of the nest to gather seeds and bring them back

to the nest. The rate at which foragers return to the nest is linked to food availability: when food is

easy to find, foragers return more quickly. We examined how the return of successful and unsuccessful

foragers influences the rate at which inactive foragers are stimulated to leave the nest on subsequent trips.

In field experiments, successful or unsuccessful returning foragers were removed before they reached the

nest. Foraging activity in response to removals was compared to that in computer simulations modelling

the effect of returning foragers on departure rate. Field experiments showed that forager departure rates

were not affected by the return of unsuccessful foragers, but depended strongly on the return of successful

foragers. The results corresponded to the model in which inactive foragers were instantaneously stimulated

to leave the nest by the return of each successful forager, and not to three other models that required

inactive foragers to remember elapsed time or events. The results of field experiments were thus consistent

with a simple behavioural rule that is sufficient to adjust foraging intensity to current food availability.

Notes:

* the ant species examined was poconomyrmex barbatus, a species which lives in the deserts of the southwestern US and mexico. (p2c1p2)
  + Its food sources are dispersed and partially buried, distributed at random by wind and floding,
  + Food availability increases after rainfall has lead to seet production or in other wether conditions which premote distribution of seeds
* The cost of foraging is related to desiccation (p2c1p3)
  + Ants obrain most of their water from metabolizing fats in seeds so foragers use more water
  + Seeds are stored inside the nest for months-years
  + If there is too little food available too many foragers would waste water therefore making it inefficient to forage
* Foraging stimulation (p2c1p4)
  + Foraging is begun in response to stimulation by patrollers (the first ants to leave the nest)
  + The patrollers search the nest mound and foraging area and choose the days foraging directions
  + Foraging begins after the patrollers return to the nest
  + Note the reference to the experiment regarding the ant mimics coated with cuticular hydrocarbon extracts which demonstrated Gordon could reproduce this nest stimulation.
  + “once a forager leaves the nest it travels in a stream of foragers (a ‘foraging trail’) and then stops to search the ground for food. As soon as it has picked up a seed or other bit of food it goes directly back to the foraging trail and returns to the nest.”
* Forager streams (p2c1p5)
  + Foragers are stimulated to leave and search for dispersed seeds not to collect food at a specific location
  + Streams of foragers can be very broad spanning more than a metre and often occupy a fan shaped region of many square meters (reference the pictures in Gordon 1995)
  + Individuals “meander” around on their own in a large area and we can thus draw the conclusion that this particular ant species do not ordinarily follow a chemical trail recently created by another ant However read next
  + In Gordon 1984 patrolers but not foragers clearly lay a pheromone trail and recruit foragers to an abundant food source (not usual and really only occurs if they catch an insect not claimed by another species
  + Through a foraging season a colony uses the same set of foraging directions which do however change from year to year (for more on the marking of these see Holldobler et al. 2001) (Gordon thinks they are wrong as the trails stick around after flooding so the trails should follow a visual clue.)
* Returning foragers (p2c2p1)
  + “most foragers do not return to the nest until they have found food; about 90% of returning foragers are successful (Gordon 1991).” This means that rate of return of foragers is linked to food availability
  + The rate at which inactive foragers leave the nest is related to the rate at which active foragers return.
  + In Gordon 1991 food was collected from successful foragers and the foragers returned to the nest withought any food which caused foraging to slow down.
  + In Gordon 2002 all returning foragers were removed and after an hour all foraging had stopped
  + Foragers have task specific cuticular hydrocarbon profiles and it is likely that contact with hydrocarbonds of returning foragers stimulates inactive foragers to leave the nest.
* Read (P2c2p2) as it basically describes Gordon as doing what we are doing