Lab experiments show why medium-sized ants can't crawl out of antlion larvae pits

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A small team of researchers affiliated with several institutions in France has discovered why medium-sized ants have more trouble climbing out of sand pits than larger or smaller ants. In their paper published in the

journal *Physical Review Letters*, the researchers describe experiments involving glass beads and metal disks and what they learned.

Antlions (also known as doodlebugs or lacewings) are insects that very strongly resemble dragonflies. They are known mostly for the predatory skills of their larvae, which look like small beetles—the larvae create sandpits by digging and pushing sand around. The pits take the shape of a bowl, which helps the larvae capture prey, usually ants. The ants walk into the pit, but are prevented by backsliding sand material from climbing back out. Eventually, they fall to the bottom of the pit, where the larvae wait for them.

Intrigued by the antlion larvae and its pit, the researchers wondered about the specific factors that led to some ants becoming stuck in the pit while others escaped. Prior research had shown that the walls of the antlion pits were poised at a point just prior to an avalanche, which would, of course, make it more difficult for an ant to climb out. Any movement it made would cause tiny avalanches, preventing it from ascending the wall.

To learn more, the researchers created artificial pits out of glass beads and mimicked ant activity by using metal disks covered with cardboard. They ran multiple tests to learn more about the conditions that led to the disks sliding into the bottom of the pit. The tests consisted of changing factors in the pit such as bead and disk size to assess the impact each had on disk friction and sliding.

In looking at their results, the researchers found that the main factor leading to a disk sliding down into the pit was its mass—those that were very light did not dislodge beads, thus there were no small avalanches. Those that were large, on the other hand, hand enough mass to push some of the beads ahead of them as they began to slide, creating a dam of sorts, which caused the sliding to cease.

The team then compared what they had found to the results of a prior study that involved learning which sorts of ants made it out of pits and which did not. That team had also found that it was medium-sized ants that wound up at the bottom of the pit.

More information: Jérôme Crassous et al. Pressure-Dependent Friction on Granular Slopes Close to Avalanche, *Physical Review Letters* (2017). DOI: 10.1103/PhysRevLett.119.058003