

# Investigation of Bio-Adhesion Through Powder Barrier Experiments on Ants

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Strong adhesion of insects to a variety of surfaces has been documented over many centuries, often with great fascination. However, it has been demonstrated that particulate barriers can adversely affect the adhesion and locomotory ability of various insects [1, 2, 3, 4]. In our experiments, ant workers from the species *Polyrhachis dives* and *Myrmica scabrinodis* were presented with powder barriers of both hydrophobic and hydrophilic materials to establish if adhesion in the insect order *Hymenoptera* is adversely affected by the tarsal pads (arolia) becoming contaminated. This 'contamination hypothesis' was first proposed by Gorb & Gorb [2] to explain the reduced adhesion in the beetle *Chrysolina fastuosa* on plant surfaces coated with epicuticular waxes. To this end, powder barriers with different inter-particle adhesive forces (arising from either van der Waals or capillary forces) were prepared. Particles of the hydrophobic polymer polytetrafluoroethylene (PTFE), as well as soda-lime and silica glass were used to form powder barriers which the ants had to cross in order to escape the experimental arena. A range of particle diameters was studied (1 – 900 µm). Loss of adhesive ability was observed following the crossing of barriers composed of particles smaller than the tarsal claw dimensions, and was independent of hydrophobicity of the particles and relative humidity. Ants with contaminated arolia display no obvious change in behaviour whilst walking on a horizontal surface, consistent with the hypothesis that arolia are not deployed to a significant extent in this case. Ants were also observed to be repelled by the powder barriers prior to eventually crossing them, suggesting that insect antennae are used in probing the properties of substrates. SEM images of antennae indicate that contamination of these appendages leads to the repulsion of the insect from the barrier. This suggests a strong correlation between physical adhesion and behaviour.

## **References:**

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