For Immediate Release

Bees in Space: Will Bees Pollinate an Extraterrestrial Crop?

Summary: Study finds that bumblebees can forage at atmospheric pressures as low as 50kPa, which means they may someday be used during long term space missions to grow plants.

(November 6, 2012) – Guelph, ON

Scientists have spent years studying how to grow plants in controlled environments, anticipating the day when humans grow their own food on long term space missions. Now, a new study published in *Gravitational and Space Biology* has found that insect pollinators may very well play a role in future "self-sustaining" space missions.

A bumblebee foraging on a tomato plant (stock photo)

"Space greenhouses will almost certainly have lower air pressure – this will not only reduce gas leakage and structural weight, it will also be cheaper to operate. Our study answers the question of whether or not insect pollinators can fly and forage in a low pressure environment," says Erika Nardone, a M.Sc. student in the School of Environmental Sciences at the University of Guelph and lead author of the study.

Nardone and colleagues placed a hive of bumblebees, *Bombus impatiens*, in a hypobaric chamber and exposed them to atmospheric pressures ranging from 30 kPa to ambient (about 97 kPa). Bees were videotaped as they foraged on artificial flowers filled with a sugar solution. The amount of time bees spent foraging, flying, walking or remaining stationary at each pressure was recorded.

At 50 kPa or higher, bees spent around 35% of their time foraging, and less than 15% not moving – similar to their activity at ambient pressure. In contrast, below 50 kPa, bees spent less than 10% of their foraging. Bees also had far less control in their flight take-offs and landings at the lower air pressures. At 30 kPa, flight stopped nearly altogether, even when the atmosphere was supplemented with oxygen. "At this low pressure, it appears there are simply not enough air molecules for the bees to push against to sustain flight," commented Peter Kevan of the School of Environmental Sciences, a co-author on the paper and Nardone's supervisor.

Bumblebees are already well established as greenhouse pollinators. Unlike honey bees, they are happy to forage in enclosed spaces. "Many of the crops identified as candidates for space cultivation require insect pollinators, particularly in the absence of wind. NASA currently recommends a pressure of 52 kPa for extraterrestrial facilities; our results show that bumblebees will function well at this level," says Kevan.

This study was a collaboration between the Canadian Pollination Initiative (NSERC-CANPOLIN) and the Controlled Environment Systems Research Facility at the University of Guelph. It is contribution #60 to NSERC-CANPOLIN.

E. Nardone, P.G. Kevan, M. Stasiak and M. Dixon. 2012. Atmospheric pressure requirements of bumblebees (*Bombus impatiens*) as pollinators of Lunar or Martian greenhouse grown food. *Gravitational and Space Biology* 26(2): 13-21.

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