

## INSIDE JEB

## Elderly bees compensate for tongue damage by sipping faster



A honey bee sipping nectar. Photo credit: Wu lab.

If you have a sweet tooth, a spoonful of honey can be a guilty pleasure. Used for thousands of years to sweeten food and drinks, the sticky fluid may even have some medicinal powers. Yet, the sheer scale of the labour that underlies the precious liquid is quite mindboggling. ‘Honey bees have to visit 3000 flowers to produce one gram of honey’, says Jianing Wu from Sun Yat-Sen University and Tsinghua University, China, explaining that the insects partially digest and concentrate the nectar that they sip to transform it into honey. But Wu and his colleagues wondered how much of a toll the bee’s industrious sipping might take on their delicate mouthparts. Bees extend their tongues, coated in hairs, through a tube formed by the labial palpi mouth structures up to 5 times per second as they

essentially lap up nectar. Surely the delicate hairs must experience some wear and tear as the tongue continually rasps back and forth?

Intrigued by the possibility, Wu, Yue Chen and Chuchu Li fed bees with either dilute (35%) or stickier (45%) sugar solutions and monitored the state of the insects’ tongue hairs every 2 days from 17 to 25 days of age. As Wu had suspected, the hairs became increasingly worn down over the course of the 2 weeks and the bees on the stickier diet suffered more, with the hairs shortening by almost 15% 8 days later.

Realising that the loss could impair the insects’ ability to sip nectar, Wu and Chen decided to film the bees feeding to find

out whether they adapted to their impaired tongues. ‘Capturing high-speed videos of the living honey bee’s tongue was difficult’, says Wu, describing how focusing on the tongue as the insect dipped it in and out of a drop of sugar water was challenging. Eventually, the team built a tiny chamber to hold the insect’s head in place as they filmed it feeding. However, instead of slowing down as the insects aged, their tongues speeded up, dipping in and out of the sugar solution up to 6.5 times per second when the hairs were at their shortest (105  $\mu\text{m}$ ) in contrast to 4.25 times per second when the hairs were 145  $\mu\text{m}$  long. And when Yungqiang Yang and Shaoze Yan calculated the impact of this speed increase on the amount of nectar the insects could consume, they were impressed to see that the elderly bees were imbibing as much as the slower youngsters.

Elderly bees compensate for the damage accrued by their tongue hairs during their foraging career by dipping their tongues into sweet liquids even faster, and Wu is keen to learn more about honey bee feeding in the hope of designing a new generation of bee-inspired micropumps.

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