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INSIDE JEB

Scratch that tickle like a moulted locust

Adult locusts tethered for a day after moulting to show that they land scratches accurately without practice. Photo credit: Tom Matheson.

Laughter is not obligatory when you're being tickled, but scratching the irritant is. Humans, rats and horses all brush off ticklish contact. Even adult locusts aim a deft scratch when something uninvited rubs against their wings. Tom Matheson from the University of Leicester, UK, also explains that newly moulted adults are particularly vulnerable to cannibalism; they must protect their delicate wings in the hours after emerging, making it even more essential that their scratches hit home precisely. However, the wings of newly emerged adults are five to six times longer than the stubby wing buds that the juveniles had before, which made Matheson and Alexandra Patel wonder whether newly emerged adults have the luxury of learning how to aim scratches at their recently enlarged wings, or do they emerge from their old exoskeletons complete with the ability to land scratches accurately with no need to hone the skill?

'We didn't even know if juveniles had the same behaviour as adults', adds Matheson, who recalls that Patel filmed the young flightless insects during their final incarnation (fifth instar) before becoming adults as she lightly tickled their stumpy wings with a paintbrush. 'Recording the movements themselves was challenging', says Patel, describing how she painstakingly manoeuvred the young insect's rear leg into position before gently stroking the wing bud at different locations; 'the scratches couldn't be compared unless there was a consistent starting point', she explains. Patel then meticulously tracked the movements of the young locust's hind legs as they swatted the irritating paintbrush bristles; 'the locusts were really good at hitting the target… they either grabbed it or pushed it away', chuckles Matheson. Most impressively, the youngsters were able to target scratches at the wing tip and base, which were mere millimetres apart on the stubby wing bud.

Describing how the juveniles slide head first out of their ruptured exoskeleton before inflating their crumpled new wings, Matheson says, 'The actual moult is pretty quick'. So, how accurately would the newly emerged adults land scratches on their recently expanded wings? As soon as the adults had completed their transformation, Matheson stroked different locations on the enlarged wings and was amazed that the locusts successfully targeted their scratches, even on the first attempt. And when he restrained the locusts' limbs for a day after moulting, so that they were unable to practice their aim, the insects were still able to land perfect scratches. 'I really expected the animals to have to "recalibrate" their movement immediately after the moult', says Matheson, but there was no sign that they needed to learn through trial and error. And when Patel compared the adults' scratch manoeuvres with those of the younger juveniles, the adults successfully adjusted their strategy to account for additional changes in the wing's position that occur during the moult.

Matheson says, 'The animal probably can't afford to waste time learning how to properly fend off sources of potential damage… [so] it seems they use a different "hard-wired" solution to account for the developmental change in wing length'. And he is keen to discover how the touch sensors that pepper the adult locust's wing surface map to the insect's central nervous system, to give the insect a sense of their wing locations after their dramatic transformation.

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