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INSIDE JEB

Male flower beetles' massive femora clamp females in place

A female thick-legged flower beetle (*Oedemera nobilis*) clamped by the male's rear limbs. Photo credit: Malcolm Burrows.

If ever an animal looked like a muscle-bound prizefighter, it has to be the male thick-legged flower beetle (*Oedemera nobilis*). Blessed with an impressive pair of saddlebag femora – thighs – the dazzling green insects look ready to pack an impressive kick. 'For a while now, I have been trying to work out how insects jump so powerfully and quickly', says Malcolm Burrows, from the University of Cambridge, so, when one of the distinctive beetles caught Burrows' eye in his garden, he was transfixed. 'I thought it was a good bet that they were jumping', laughs Burrows, who recalls pursuing the insects as they took off rapidly from the yellow blooms that they preferred to frequent. However, when Burrows realised that another type of green beetle with spindly hind legs was the female of the species, he was curious about the effect that the difference in the amount of muscle packed into each limb might have on their ability to jump.

Filming the insects with a high-speed camera to capture their departures, Burrows remembers that the males and females were cooperative participants, taking off spontaneously with little encouragement during the brief time window late each spring when they visited his garden. 'It took me four years to collect enough data', he says. However, after painstakingly recording take-offs in both sexes, he was surprised when he realised that the powerful-looking male femora contributed little to propelling them into the air. 'The hind leg was often the first to lose contact with the ground', says Burrows, who watched the beetles beating their wings as they rose up. And the female take-offs were equally as swift, despite their slender femora having a volume 40 times smaller than that of the males. The additional muscle power packed inside the males' bulky limbs did not appear to be necessary for their rapid departures.

Having ruled out a role for the massive muscles in propelling the insects into the air, Burrows began puzzling about the insect's lifestyle. 'I then thought what males might do that females did not?' he says, before turning his attention to the beetle's mating strategy. However, filming the beetles in the act turned out to be more challenging than catching their solo take-offs; they seemed less at ease under the bright lights. Burrows waited patiently and eventually captured the male flower beetles as they beat their wings after a brief pursuit to ascend on top of the female before tightly clenching their colossal femora around the females' abdomens. And, when Burrows captured the moment, he realised that he had seen something similar before. The males were gripping the females in exactly the same way that a mole wrench – vice grip – holds on to the nut of a bolt without damaging it. 'The big advantage of such a device is that it enables a lot of force of be applied without having to be too careful', says Burrows.

In this case, the males' powerful femora allow them to grip on tightly without damaging the females' abdomens, which Burrows points out would rather defeat the purpose of the exercise. And when he investigated the muscles packed tightly inside the grip-shaped limbs, he realised that the flexor muscle, responsible for closing the joint between the femur and tibia, is much larger than the antagonist muscle, which opens the joint; in contrast to the legs of jumping insects, where the antagonist muscle tends to be larger for powerful push offs.

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