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# Complex call can't stop katydids singing in sync

A *Mecopoda* katydid in the Kudremukh National Park, South India. Photo credit: Kasturi Saha.

Singing in harmony is one of those pleasures denied many during the global Covid-19 pandemic; but not crickets and bushcrickets (katydids). They have continued to chirp in sync regardless of the restrictions placed on human choristers. 'Synchrony is a window into how different animals might perceive or fall into rhythm', says Vivek Nityananda from Newcastle University, UK, explaining that some male katydids cheat, chirping infinitesimally ahead of the crowd, to catch a female's attention, while others add their voices to the throng in the hope of luring the ladies. But Nityananda explains that many investigations into this phenomenon have focused on the simple individual chirps produced by the majority of serenading crickets. So, when Nityananda and his thesis advisor, Rohini Balakrishnan from the Indian Institute of Science first encountered the complex call of the elusive *Mecopoda* 'Two-part caller' katydid in the Kudremukh National Park, South India, the pair were stunned. 'Hearing their loud and eerie calls for the first time in the pitch darkness of the forest was pretty scary', Nityananda recalls. The pair also realised that the calls were far more sophisticated – combining a whirring trill with two or more chirps – than the individual chirps produced by most crickets. Could these katydids coordinate to sing in sync?

Venturing into the park after dark, Nityananda located each katydid by ear before trapping it in a container. 'Focusing on acoustic localisation meant that sometimes other visual cues had less priority. After returning from one successful capture, I found a pit viper on the path I hadn't noticed', he shudders. And when he returned to Balakrishnan's lab to record the katydids' calls in a soundproof chamber he discovered that the insects were keen to serenade, but only around 3 a.m. 'I spent many nights just waiting so that I could begin recording and playback experiments', he chuckles.

Placing an individual katydid in the soundproof chamber, Nityananda found that each call was composed of a lengthy trill (~1.92 s), followed by two or more brief chirps (~68 ms). Most impressively, when he isolated pairs of serenading males together, their trills fell in step almost perfectly, lagging only by ~37 ms, although their brief chirps weren't quite so tightly coordinated. And each individual recital (a trill followed by chirps) was a little longer when the males duetted than when performing solo. Either way, the katydids were able to synchronise their serenades, even though they are more sophisticated than the individual chirps that most other insects coordinate.

Then, Nityananda tried playing fast and loose with the katydids in the lab by replaying different trill and chirp sections from a male call recording to find out which features they latch on to for coordination. A male hearing the trill portion of the recorded song trilled later when the recording occurred early in his own call but advanced his subsequent trill when he heard the other suitor during the latter part of his own call. However, chirp replays had no impact on the timing of trills. In contrast, after hearing the recording of the trill or chirp, males adjusted the timing of their chirps; 'chirp synchrony is modified by external chirps and also by trills', says Nityananda.

So singing *Mecopoda* 'Two-part caller' katydids are capable of coordinating their calls, even though they are more complex than those of other insects, and Nityananda and Balakrishnan suspect that the katydids depend on a sophisticated control system incorporating two separate timers to keep their calls in sync.

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