Communicating at a katydid's jungle cocktail party

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As darkness descends upon the tropical rainforests of Malaysia, male chirping katydids of the *Mecopoda* complex are just getting warmed up for their usual nightly concerts to woo the females. These nocturnal suitors are favoured for chirping in synchrony as a chorus; however, singing in time with one another is no easy task as they have to co-ordinate in the presence of the noisy serenades from a very closely related katydid species. This is particularly difficult, as Manfred Hartbauer from Karl-Franzens University, Austria, explains: 'This species uses almost the same frequency spectrum [2–80 kHz] in their acoustic signal [as the chirping katydid species], but produces this signal in an ongoing train of syllables, so it's a trill, and we wondered how the chirping species could establish chorus synchrony in the presence of such a noisy masker.' With the help of PhD student Marian Siegert and colleague Heiner Römer, Hartbauer decided to find out and publishes his results in *The Journal of Experimental Biology*.

First the team wanted to check that 'chirper' katydids could indeed synchronize chirps in the presence of a masking trill. To do this, they recorded chirps from a 'chirper' katydid and played it back to isolated males. Once the male had joined in and synchronized with the periodic signal, Hartbauer and Siegert then introduced the trill soundtrack, gradually increasing its loudness until the 'chirper' could no longer synchronize with the playback. 'It turns out that the chirpers are able to tolerate a high noise level', says Hartbauer. 'All tested males were able to entrain their chirps to a conspecific pacer in the presence of a trill broadcast 8 dB louder than the conspecific signal.'

But how exactly can they do this? When the team compared the chirps and trills, they noticed something rather unusual, as Hartbauer recalls: 'Chirps had a rather strong frequency component at 2 kHz that the trills didn't have. This seemed very unusual because we knew that all auditory neurons known so far in most katydids are tuned to 10 kHz and ultrasonic frequencies.' So could the chirpers even detect this 2 kHz component? Sure enough, when the duo made this frequency component undetectable, the male 'chirpers' could no long synchronize their chirps, a good sign that males could detect this low-frequency component.

Next, the duo moved on to seeing whether an auditory neuron with T-shaped morphology (TN1) was involved in detecting the chirps in the presence of background noise. To test this, Hartbauer and Siegert first carefully inserted tiny hook electrodes into the katydid's neck and saw neuronal activity from the TN1 neuron during chirp presentations. They then wanted to see whether the TN1 neuron could detect the low-frequency component, and so exposed the katydids to 2 kHz pure tones. To their surprise, however, the threshold of detection was very high, meaning the pure tone had to be quite loud to elicit a response in the TN1 neuron. 'But as soon as we turned on the masking noise, this threshold decreased by about 10 dB. This is surprising because normally if you turn on a noise source, you have to increase the intensity of the signal in order to elicit a response in the neuron, but in this katydid it was the opposite way around', says Hartbauer. 'This is really exciting news, because it means that if there is a heterospecific male around it helps [the chirpers] detect the species-specific signal at 2 kHz somehow.' So, all in all, it seems that the cocktail party environment of the nocturnal jungle actually aids communication in chirping katydids rather than hindering it.

More information: jeb.biologists.org/content/216/24/4655.abstract

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