Assessing a male sexual signal in different environments

We used a diet treatment (high- and low-nutrient diets) in 9 inbred genetic lines of the decorated cricket Gryllodes sigillatus (top) to manipulate condition among males of distinct genotypes, and measured the sexually-selected trait in each male. Male crickets attract females by creating an acoustic signal via stridulation; female crickets prefer males that call more. We recorded male ‘calling effort’ (the number of seconds spent calling overnight) on a weekly basis from 7 days after reaching adulthood until death. A male’s lifetime calling effort is the total of all measurements made during his life.

Phenotypic plasticity is shown using reaction norms (bottom): a change in the means across environments shows whether the trait is sensitive to environmental effects. The lines represent the reaction norms (± 1 s.e.) for each of our different genotypes.

Despite differing lifespans between males, we found that the genetic correlation for total calling effort across environments is large and positive (above). Total calling could be considered a reliable signal; the genetic correlation indicates that male genotypes that call more in one environment also tend to call more in the other. However, females impact males at timepoints, and relative to other males. For nightly calling effort to be reliable, the pattern of calling over time should also be predictable within environments.

Cross-environment genetic correlations vary with age

While the genetic correlation for total calling effort is strongly positive across environments, the patterns of weekly measurements over time and across diets are far more variable.

Genetic correlations across environments change with age (right), meaning that the value of choice may depend largely upon the timing of choice itself.

Given that the sign of the correlation changes between weeks, if female preferences act consistently then male calling effort would be highly unreliable as a signal of male quality across environments.

Behavioural signals are often complex, plastic, polygenic, and expressed repeatedly over a male’s lifetime. These factors fuel extensive genetic variation, which female choice is unlikely to deplete. However, genetic differences in allocation trajectories both within and across environments surely cause a problem for signal reliability. How does preference evolve and persist under such conditions? Studies of the relative costs and benefits of preference to females, and of the genetic differences in the trajectories of sexual signalling, are required to provide further insights into this topic.