Colour pattern spurs speciation in tropical fish

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McGill researchers discover that coral reef fish colour patterns are responsible for the emergence of new species

A team of researchers from McGill University and the Smithsonian Tropical Research Institute (STRI) has provided the first example of how colour patterns on a coral reef fish species can drive its evolution into many distinct species.

“These fish were the unusual suspects for a model explanation of how new species arise,” said lead author Oscar Puebla, a PhD student in the Neotropical Environment Option (NEO), a collaboration between McGill and STRI. “When investigating ecological speciation, the first reflex is to look at the species’ environmental conditions rather than at its behavioural traits.”

The researchers looked at feeding and mating behaviours based on colour patterns to explain the emergence of several species of hamlet fish (genus Hypoplectrus). Predatory Hypoplectrus fish were observed tracking other non-predatory fish species with similar colour patterns to surprise their prey, which are usually not afraid of non-predatory fish species. They were also observed mating with partners with similar colour patterns. Having identified behaviours that segregate the fish into groups and small but statistically significant genetic differentiation, the researchers concluded that each of the 13 colour morphs of hamlet fish classifies as an incipient species. Their findings appear in the May 22 issue of Proceedings of the Royal Society of London B. Supporting online materials include videos of fish behaviour.

“This group of fish was really a mystery,” said Dr. Frederic Guichard, assistant professor in the Department of Biology at McGill. “Genetic variation alone was not strong enough to identify species among fish of different colour patterns and there were no obvious ecological mechanisms at first. We were at the frontier of our ability to detect new species and speciation.”

Guichard explained that classic cases of ecological speciation offer more straightforward mechanisms of speciation. For example, Darwin’s finches became different species because their beak morphology was associated with specific seed diets and unique mating calls.

In this study, distinct neon colour patterns on Hypoplectrus fish highlighted their distinct behaviour. But patterns of behaviour only became evident to Puebla’s team after scuba diving across 94,000 square metres of reef habitat in Panama, Belize and Barbados. Puebla calculated that “during a one-hour dive, you will observe on average colour-based behaviour for only six minutes.”

Puebla hopes that this study provokes more daring research into ecological speciation. “One of the messages of the paper is that you have to look for the rare behaviours that may have a disproportionate ecological and evolutionary significance. You can’t just take a snapshot of the species; you have to spend long hours in the wild studying them.”

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Supplemental video 1

Supplemental video 2

Source: McGill Unive