
Importance of plasticity for divergence of threespine stickleback (*Gasterosteus aculeatus*) in the dynamic Lake Mývatn, Iceland

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Abstract

Lake Mývatn is one of the best studied ecosystems in Iceland showing strong environmental gradients (e.g. in temperature, depth, substrate) and spatial and temporal differences in invertebrate composition. Many invertebrates, in particular chironomid midges and benthic cladocerans, are important prey for threespine stickleback (*Gasterosteus aculeatus*). As adaptive divergence in response to natural selection is frequently related to diet and/or habitat use, the spatial and temporal variation in prey type and abundance in lake Mývatn may facilitate resource mediated diversification. Along this line, lake Mývatn stickleback show phenotypic differences in i) feeding morphology and ii) body size, likely mediated by responses to prey and temperature. However, it is not known to date whether these phenotypic differences are due to genetic or plastic responses. We performed a laboratory common garden rearing experiment to test for the relative contribution of plastic and genetic effects on key phenotypic traits in stickleback from two habitats in the lake (mined and warm). Full-sib offspring from artificial crosses were raised at a combination of two different diets (midge vs. artificial pellets) and temperatures (13 and 23C) up to nine months. We found consistent differences between the two habitat types in gill raker morphology, body size and age at sexual maturation, but also strong plastic responses and genotype x environment interactions. Our results strongly indicate a mixture of genetic divergence and phenotypic plasticity and support the existence of two morphs in the lake. Our study indicates an interplay between plastic and genetic responses in diversification

Keywords: Iceland, Stickleback, phenotypic plasticity, genetic divergence

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