Hatching plasticity is associated with a more advanced stage at hatching in an *Ambystoma* with terrestrial eggs

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Abstract

Hatching plasticity allows fish and amphibians to initiate hatching in response to environmental cues including predation, flooding, and hypoxia. In species with terrestrial eggs, hatching plasticity often manifests as extended development of embryos when water is not available. Although these effects are taxonomically widespread, little attention has focused on differences in plasticity across closely related species with terrestrial and aquatic embryos. We propose that terrestrial embryonic environment that favors slower and extended development that, together, result in a more advanced stage at hatching than an aquatic embryonic environment. We test this hypothesis by comparing embryonic development between two fall-breeding mole salamanders, Ambystoma opacum and A. annulatum. Most Ambystoma lay eggs submerged in ponds but A. opacum lays its eggs on land, where hatching is triggered when eggs are submerged by rising pond levels. We compared embryonic development of A. opacum with A. annulatum, which lays eggs in water, in a common laboratory environment. Embryos of both species were reared in environments simulating either aquatic or terrestrial nests sites. We found that the A. opacum embryos exhibited slower development and took longer to hatch than A. annulatum embryos. We also found that A. opacum hatched at a more advanced stage, but only when reared in an environment that mimicked a terrestrial nest. This plasticity was absent in A. annulatum. Our results suggest that the terrestrial-laying A. opacum has evolved a developmental plasticity that allows its embryos to extend development when in terrestrial nests, while retaining the ability to hatch at a stage more typical of congeners when submerged in water.

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