インドネシア・スラウェシ島固有のメダカ科魚類（ダツ目）の系統学的および分類学的研究

Abstract

Although the family Adrianichthyidae is broadly distributed throughout East and Southeast Asia, 19 endemic species are distributed in Sulawesi, which is an island in Wallacea. However, it remains unclear how Adrianichthyidae biodiversity hotspot was shaped. Moreover, seven of the 19 endemic species were described within this decade, suggesting that we still do not know the full picture of the biodiversity of this family in this small island of the Indo-Australian Archipelago.

First, I reconstructed molecular phylogenies for the Sulawesi adrianichthyids and estimated the divergence times of major lineages to infer the detailed history of their origin and subsequent intra-island diversification. The mitochondrial and nuclear phylogenies revealed that Sulawesi adrianichthyids are monophyletic, which indicates that they diverged from a single common ancestor. Species in the earliest branching lineages are currently distributed in the central and southeastern parts of Sulawesi, indicating that the common ancestor colonized Sula Spur, which is a large promontory that projects from the Australian continental margin, from Asia by tectonic dispersal c.a. 20 Mya. The first diversification event on Sulawesi, the split of the genus *Adrianichthys*, occurred c.a. 16 Mya, and resulted in the nesting of the genus *Adrianichthys* within *Oryzias*. Strong geographic structure was evident in the phylogeny; many species in the lineages branching off early are riverine and widely distributed in the southeastern and southwestern arms of Sulawesi, which suggests that oversea dispersal between tectonic subdivisions of this island during the late Miocene (7–5 Mya) contributed to the distributions and diversification of the early branching lineages. In contrast, most species in the lineages branched off later are endemic to a single tectonic lake or lake system in the central Sulawesi, suggesting that habitat fragmentation due to the Pliocene collisions (c.a. 4 Mya) among the tectonic subdivisions was the primary factor for diversification of the late branching, lacustrine lineages. *Adrianichthys* and some *Oryzias* in a certain late branching lineage are sympatric in Lake Poso, which indicates multiple colonizations of these distinct lineages into this tectonic lake. Thus, the diversification of Sulawesi adrianichthyids largely reflects the complex geological history of this island.

Second, I examined morphological variation and phylogeny among nine local populations of the *Oryzias woworae* species group, composed of *O. asinua*, *O. wolasi*,

and *O. woworae*, which have been recently described from the southeastern part of Sulawesi, to see if they are really valid species or not. Multivariate analyses using morphometric measurements and phylogeny estimated using mitochondrial DNA sequences revealed that they cannot be separated both in morphology and phylogeny in a manner that is currently classified. Especially, *O. wolasi* from the type locality and that from the locality of paratypes are morphologically distinguished and phylogenetically polyphyletic, suggesting that *O. wolasi* is not a valid species in both morphological and phylogenetic species concepts. I found that morphometries of the nine populations may differ according to their habitat environments, especially to the water currents, probably reflecting local adaptation. These facts suggest that the three species of the *O. woworae* species group may be merely ecotypes.

Finally, I examined morphology of *Oryzias soerotoi*, which I have described from Lake Tiu, Central Sulawesi, during the course of field collections. *Oryzias soerotoi* is distinguished from all other species in the genus *Oryzias* in Sulawesi by combination of brilliant orange coloration in the dorsal and ventral margins of the caudal fins of adult males, 30–32 scales along the lateral midline, 9–10 pectoral-fin rays, head lengths of 21.9–24.9% SL, anal-fin base lengths of 23.7–29.7% SL, and maximum SL up to 32.1 mm. Aquarium observations revealed that the orange margins of the caudal fins of males become more brilliant during courtship.
The estimated phylogenies revealed that male body colorations differed by clade, and that species having maternal care occur in distant clades. These suggest that the evolution of body coloration and maternal care may have played an important role in the intra-island diversification of Adrianichthyidae, although it remains to be seen what has driven the evolution of these clade-specific morphological and reproductive traits. Comparisons with other animal taxa may also help us to understand how the biodiversity hotspot of this "anomalous" island has been shaped.