

Genetic Evidence to Clarify the Systematic Status of the Genera *Zacco* and *Candidia* (Cypriniformes: Cyprinidae)

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Hung-Yi Wang, Sin-Che Lee and Ming-Jenn Yu (1997) Genetic evidence to clarify the systematic status of the genera *Zacco* and *Candidia* (Cypriniformes: Cyprinidae). *Zoological Studies* 36(3): 170-177. Genetic relationships among species of the genera *Zacco* and *Candidia* were analyzed using allozyme data from sampled specimens collected from 6 rivers in Taiwan. A total of 78 alleles were resolved for 26 loci from 13 enzyme systems. Nei's genetic distance between 2 congeneric species (*Zacco pachycephalus* and *Z. platypus*) was 0.285, which is within the range for the same genus. A slightly larger mouth cleft, smaller lateral line scales, and fixed alleles at *mMDH*100*, *ME-1*100*, *PGI-B*100*, *PGM-1*100*, and *PGM-2*100* in *Zacco pachycephalus* can be used to distinguish it from *Z. platypus*. Comparison with *Aphyocypris kikuchii*, *Candidia barbatus* showed more distant relationships with these 2 *Zacco* species, suggesting that *Zacco* and *Candidia* are 2 distinct genera. In addition, a barbel at mouth corner, and fixed alleles at *sAAT-1*120*, *CK-A*93*, *FH-1*80*, *FH-2*82*, *G₆PDH-1*80*, *IDHP-1*113*, *IDHP-3*120*, *ME-1*103*, *ME-2*50*, *PGM-1*120*, and *PGM-2*120* in *Candidia* can also be used to distinguish it from the genus *Zacco*. The colonization and speciation event of the genus *Zacco* in Taiwan was discussed in detail.

Key words: Allozyme comparisons, *Zacco* and *Candidia*, River habitats, Taiwan.

Species of the genera *Zacco* Jordan and Evermann 1902, and *Candidia* Jordan and Richardson 1909 (Cyprinidae: Rasborinae) are common minnows in western Taiwan rivers. Several species of the genus *Zacco* occur in Japan, Korea, China, and Taiwan (Banareescu 1968), while the genus *Candidia* containing only 1 species is unique to Taiwan. Some external features of these 2 genera are similar, such as in an elongated body, medium or small-sized scales, a lateral line profile running along the lower flank of the body, the origin of the dorsal fin inserted opposite to the base of the ventral fin, maxillae reaching or behind the front margin of the orbit, tubercles present on both sides of the snout, and elongated anal fin rays appearing only in mature males (Regan 1908, Banareescu 1968). However, the single species of the genus *Candidia* differs from species of the genus *Zacco* by having barbels at the mouth corner, and a longitudinal stripe on the body sides, and by the

anterior 4 branched anal rays not extending to the caudal base in sexually mature males.

According to recent studies, the genus *Zacco* in Taiwan contain 2 valid species, *Z. pachycephalus* and *Z. platypus* (Shen et al. 1993). *Zacco* species which appear in older literature, such as *Zacco evolans*, would be a junior synonym of *Z. pachycephalus* (Oshima 1919). The record of *Z. temmincki* in Taiwan by Oshima (1919) and the subsequent record by Chen and Yu (1986) were misidentifications of *Z. pachycephalus*. Actually, *Z. temmincki* (Temminck and Schlegel 1846) is only found in Korea, Japan, and Mainland China. The distributions of the 2 previously recognized *Zacco* species in Taiwan are different. *Z. platypus* is restricted to northern Taiwan, while *Z. pachycephalus* is distributed throughout Taiwan except on the eastern side. The recent occurrence on the latter species in eastern Taiwan is a result of artificial introduction from release of fish fry.

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