

Phylogenetic position of gastrostomobdellid leeches (Hirudinida, Arhynchobdellida, Erpobdelliformes) and a new family for the genus *Orobdella*

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The leech family Gastrostomobdellidae is characterized by its possession of an agnathous and euthylaematous pharynx, a ventral gastropore and a gastroporal duct. In this study, the phylogenetic position of two gastrostomobdellid genera, *Gastrostomobdella* and *Orobdella*, was investigated using partial nucleic 18S, 28S rDNA and mitochondrial 12S rDNA sequences. Our phylogenetic analyses showed that both *Gastrostomobdella* and *Orobdella* are nested within Erpobdelliformes, but Gastrostomobdellidae is not a monophyletic taxon. *Orobdella* is a sister taxon of the other Erpobdelliformes taxa. The phylogenetic position of *Gastrostomobdella* within the clade of *Gastrostomobdella*, Erpobdellidae and Salifidae still remains uncertain. According to the reconstruction of the ancestral state of the pharynx in Erpobdelliformes, a euthylaematous pharynx is considered to be plesiomorphic in this taxon. Examination of *Gastrostomobdella* and *Orobdella* specimens indicates that the morphology of the gastroporal duct of *Orobdella* is quite different from that of *Gastrostomobdella*. A new family, Orobdellidae fam. nov., was therefore erected for the genus *Orobdella*. Orobdellidae is characterized by its possession of a generally tubular gastroporal duct, lying on the female organ.

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Introduction

The family Gastrostomobdellidae was originally established for two oriental terrestrial macrophagous leech genera, *Gastrostomobdella* Moore 1929 and *Orobdella* Oka 1895 (Richardson 1971). Later the genus *Mimobdella* Blanchard 1897 was placed in this taxon, and thus these three genera were considered to belong to Gastrostomobdellidae (Sawyer 1986). However, the internal anatomy of the type species, *Mimobdella japonica* Blanchard 1897, was not described in the original description (Blanchard 1897). More recent taxonomic work revealed that *Mimobdella* is not placed in Gastrostomobdellidae, but rather in Salifidae, because the holotype of *Mi. japonica* possesses salifid diagnostic characters, for example pharyngeal stylets (Nakano 2011a). Therefore, Gastros-

tomobdellidae now includes the original two genera, *Gastrostomobdella* and *Orobdella*.

The family Gastrostomobdellidae is diagnosed by an agnathous and euthylaematous pharynx, ventral gastropore and gastroporal duct (Richardson 1971). The type genus, *Gastrostomobdella*, consists of four species, which are distributed in South-east Asia and Hawaii (Moore 1929, 1935, 1946; Sawyer *et al.* 1982; Sawyer 1986). Leeches of this genus possess a columnar vertical gastroporal duct, and the canal of the duct is Y-shaped (Moore 1929, 1935, 1946). On the other hand, *Orobdella* includes eight species, which are distributed in East Asia (Oka 1895; Gilyarov *et al.* 1969; Richardson 1971, 1975; Lukin 1976; Nakano 2010, 2011b,c). *Orobdella* leeches are characterized by a generally tubular gastroporal duct and the duct lies on a