

Larval attachment organs in six species of ostariophysan teleosts

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Attachment organs are predominantly known from larval stages of freshwater fishes and are used to attach to various substrates. They are functional upon hatching for a few days and usually disappear when the yolk sac is resorbed and the larvae are free swimming in the water column. Attachment organs are reported for the first time in a representative of the Gonorynchiformes (Anotophysi), the African freshwater fish *Kneria* sp., which has a single median, multicellular organ (Ilg's type II) at the front of the head. Larvae of the two southern Asian cyprinid species studied here, *Devario* cf. *regina* and *Pethia padamya*, have very different attachment organs. That in *Devario* resembles the attachment organ in *Kneria*, but that of *Pethia* is much less defined and consists of many scattered cells concentrated on the front and snout area of the head (Ilg's type I). Larval *Pethia* have numerous ciliated cells in the epidermis of their eyes, the only teleost with this feature. Ciliated epidermal cells are otherwise known from larvae of non-osteostean actinopterygians, dipnoans and amphibians.

Attachment organs in the larvae of the three characiforms differ in their position and structure. The South American *Ctenolucius* has double multicellular attachment organs (type II), one situated on top of the head, the other posteriorly in the dorsal midline on the trunk at the end of the abdominal region. The single, multicellular larval attachment organ of the South American *Pyrrhulina* (type II) has an unusual saddle-like shape and is situated on the posterior most part of its head. Larvae of the West African *Rhabdalestes* lack a discrete organ, but have numerous individual attachment cells (type I) at the front of their heads.

Introduction

After hatching from their eggs, larvae of numerous teleosts have the ability to attach to various substrates during the first few days of their life (e.g. Jones, 1937; Ilg, 1952; Barlow et al., 1968; Britz, 1997). Attachment is achieved with the aid of specialized cells or organs that are only present and functional during a short period of the larval phase, between hatching and free-swimming while the yolk sac is resorbed (Britz et al., 2000; Britz & Cambray, 2001). Attachment organs, sometimes called cement organs or cement glands,

have been reported from members of a number of freshwater inhabiting fish taxa: the osteoglossomorph Pantodontidae (Britz, 2004), various Ostariophysi (e.g. Jones, 1938; Ilg, 1952; Merron et al., 1990; Britz et al., 2000; Pottin et al., 2010), Esocidae (Schindler, 1935; Geyer, 1940; Braum et al., 1996), Cichlidae (Lieberkind, 1931; Jones, 1937; Ilg, 1952; Peters, 1965; Arnold et al., 1968; Bennemann & Pietsch-Rohrschneider, 1978; Peters & Berns, 1978a-b, 1982, 1983; Hamlett, 1990; Mejide & Guerrero, 2000; Pottin et al., 2010), Nandidae and Badidae (Barlow et al., 1968; Britz, 1997; Collins et al., 2015), Anabantoidei (Jones, 1940; Ilg, 1952;

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Received 14 September 2018

Revised 5 November 2018

Accepted 26 November 2018

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