

Larval attachment organs in six species of ostariophysan teleosts

Ralf Britz*

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-teleostean 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 & Pietzsch-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;

* Department of Life Sciences, The Natural History Museum, London, SW75BD, United Kingdom. E-mail: r.britz@nhm.ac.uk

The whole contribution can be purchased as PDF file.

Availability

Generally all our publications are available as PDF files; full publications as a general rule after the printed version is out of print. If you have questions concerning particular contributions please contact us by e-mail:

pdf@pfeil-verlag.de.

The PDF files are protected by copyright.

The PDF file may be printed for personal use.

The reproduction and dissemination of the content or part of it is permitted.

It is not allowed to transfer the digital personal certificate or the password to other persons.

Prices

Books: Prices are to be found in the catalog.

Articles in journals and single contributions or chapters in books:

10 EURO basic price per order (including the first 10 pages),
and

0.50 EURO per page, beginning with the 11th page.

Page numbers are found in the contents of the publications.

Orders

Orders can be sent to us via the online shop, by using the PDF order form, or informally by e-mail (pdf@pfeil-verlag.de). All we need is your name and address for invoicing. You will then receive an order confirmation incl. price and link for the payment processing. For orders via the online shop and immediate payment, the file can be provided without detours.

Completion

As soon as possible, but depending on our office hours and the desired order, we will send you the order confirmation. After payment you will receive the PDF file(s) together with your personal certificate and the corresponding password by e-mail. Larger files are available for downloading. You will receive the invoice for your order by e-mail.

In order to be able to open the encrypted PDF files, the password-protected personal certificate must be installed at the first order, which then remains on the computer. All files encrypted with this certificate can then be opened on this computer.

Dieser Beitrag kann als PDF-Datei erworben werden.

Verfügbarkeit von PDF-Dateien

Prinzipiell sind von allen unseren Publikationen PDF-Dateien erhältlich. Komplette Publikationen in der Regel erst nachdem die gedruckte Version vergriffen ist. Anfragen bezüglich bestimmter Beiträge richten Sie bitte per E-Mail an pdf@pfeil-verlag.de.

Die PDF-Dateien sind urheberrechtlich geschützt.

Ein Ausdruck der PDF-Dateien ist nur für den persönlichen Gebrauch erlaubt.

Die Vervielfältigung von Ausdrucken, erneutes Digitalisieren sowie die Weitergabe von Texten und Abbildungen sind nicht gestattet.

Das persönliche Zertifikat und das Passwort dürfen nicht an Dritte weitergegeben werden.

Preise

Bücher: Die Preise sind dem Katalog zu entnehmen. Zeitschriftenbeiträge und einzelne Kapitel aus Sammelbänden bzw. Büchern:

10 EURO Grundbetrag pro Bestellung (einschließlich der ersten 10 Seiten),
und

0,50 EURO pro Seite ab der 11. Seite.

Den Umfang der Beiträge entnehmen Sie bitte den Inhaltsverzeichnissen.

Bestellungen

Bestellungen können über den online-Shop, das Formular, oder formlos per E-Mail (pdf@pfeil-verlag.de) an uns gerichtet werden. Wir benötigen nur Ihren Namen und Ihre Anschrift für die Rechnungserstellung. Sie erhalten anschließend eine Bestellbestätigung incl. Preis und Link zur Zahlungsabwicklung. Bei Bestellungen über den online-Shop und sofortiger Zahlung kann die E-Book-Datei ohne Umwege bereitgestellt werden.

Abwicklung

So bald wie möglich, aber abhängig von unseren Bürozeiten und der gewünschten Bestellung, schicken wir Ihnen die Bestellbestätigung. Nach Zahlungseingang erhalten Sie die PDF-Datei(en) zusammen mit Ihrem persönlichen Zertifikat und dem zugehörigem Passwort per E-Mail. Größere Dateien bieten wir Ihnen gegebenenfalls zum Herunterladen an. Die Rechnung für Ihre Bestellung erhalten Sie per E-Mail.

Um die verschlüsselten PDF-Dateien öffnen zu können, muss bei der ersten Bestellung das passwortgeschützte persönliches Zertifikat installiert werden, welches anschließend auf dem Rechner verbleibt. Alle mit diesem Zertifikat verschlüsselten Dateien können dann auf diesem Rechner geöffnet werden.