

## Scanning electron microscopy of the dentition in four cichlids (tribes Perissodini and Tropheini) of Lake Tanganyika showing different trophic types

Rasterelektronenmikroskopische Untersuchungen an der Bezahnung von Cichliden mit unterschiedlichen Nahrungsansprüchen (Tribus Perissodini und Tropheini) aus dem Tanganjika-See

Hartmut Greven<sup>1</sup>, Dirk Hagemann<sup>2</sup> and Günter Clemen<sup>2</sup>

<sup>1</sup>Institut für Zoomorphologie und Zellbiologie der Universität Düsseldorf, Universitätsstr. 1, D-40225 Düsseldorf, Germany; grevenh@uni-duesseldorf.de

<sup>2</sup>Institut für Evolution und Ökologie der Tiere, AG Experimentelle Morphologie, Universität Münster, Hüfferstrasse 1, D-48149 Münster, Germany

**Summary:** The dentition of the premaxillae, dentaries and the upper and lower pharyngeal tooth plates of two Perissodini (*Haplotaxodon microlepis*, a species that feeds on a wide spectrum of food items, and the lepidophagous *Plecodus straeleni*) and of two aufwuchs-eaters of the tribe Tropheini (*Tropheus moorii* that feeds mainly on filamentous algae and *Petrochromis trewavasae* that prefers unicellular algae) from the Lake Tanganyika is described using scanning electron microscopy. Premaxillaries and dentaries bear a single row of unicuspid (*H. microlepis*) or highly specialised (*P. straeleni*) teeth or many rows of bicuspid and tricuspid teeth (*T. moorii*, *P. trewavasae*); dentition of these bones is more modified than those of the pharyngeal jaws. This is less conspicuous in the omnivorous *H. microlepis*. Dentition of the pharyngeal jaws is much less specialised, but more variable in size and shape; the latter ranges from hooked (with aboral and oral humps) to bevelled orally. There is evidence that in the lower and upper jaw of *P. straeleni* and *T. moorii* replacement teeth are formed labial to older teeth. Despite of their enormous variability, teeth show always a major cusp. In addition, most, if not all, teeth have either two lateral cusps being then clearly tricuspid or exhibit lateral tips, ridges or wings that may represent modifications or traces of lateral cusps.

**Key words:** dentition, cuspidity, accessory cusps, tricuspidity, trophic types, *Haplotaxodon microlepis*, *Plecodus straeleni*, *Tropheus moorii*, *Petrochromis trewavasae*

**Zusammenfassung:** Die Bezahnung der Prämaxillaria, Dentalia sowie der oberen und unteren pharyngealen Zahnplatten zweier Perissodini (des nahezu omnivoren *Haplotaxodon microlepis* und des lepidophagen *Plecodus straeleni*) und zweier Aufwuchs fressender Tropheini (*Tropheus moorii*, der filamentöse Algen bevorzugt, sowie *Petrochromis trewavasae*, der einzellige Algen aus dem Substrat kämmt) aus dem Tanganjika See werden anhand von rasterelektronenmikroskopischen Aufnahme beschrieben. Prämaxillaria und Dentalia tragen eine Zeile unicuspiden (*H. microlepis*) oder extrem spezialisierte Zähne (*P. straeleni*) oder mehrere Zeilen bicuspiden und tricuspiden Zähne (*T. moorii*, *P. trewavasae*). Die Bezahnung dieser Knochen ist viel stärker spezialisiert als die der pharyngealen Kiefer; dies wird bei *H. microlepis* am wenigsten deutlich. Die Zähne der pharyngealen Kiefer sind zwar weniger spezialisiert, aber variabler in Größe und Gestalt; letztere reicht von hakenförmig (mit aboralen und oralen Höckern) bis oral abgesschrägt. Es gibt Hinweise, dass im Ober und Unterkiefer von *P. straeleni* und *T. moorii* der Zahnersatz von labial erfolgt. Trotz ihrer enormen Diversität haben die Zähne stets eine Hauptspitze; darüber hinaus besitzen die meisten, wenn nicht alle, zwei laterale Spitzen – die Zähne sind

dann deutlich tricuspid – oder Schneiden, Grate etc., die als Modifikationen oder Spuren lateraler Spitzen gedeutet werden.

**Schlüsselwörter:** Bezahnung, Zahnsitzen, Nebensitzen, Tricuspidität, trophische Anpassungen, *Haplotaxodon microlepis*, *Plecodus straeleni*, *Tropheus moorii*, *Petrochromis trewanasae*

## 1. Introduction

The oral dentition and the dentition of the pharyngeal jaws in cichlids are well documented. Their enormous diversity is used for taxonomic purposes and obvious specializations are largely interpreted as adaptation to certain food items, although in some cases no such correlation exists. Apart from that, independent evolution in trophically related groups has led to similar body shape and feeding structures in distinct phylogenetic lineages (e.g. Poll 1956, 1986, Fryer and Iles 1972, Greenwood 1973, 1974, 1979, Liem 1974, 1978, 1980, Liem and Osse 1975, Barel 1983, Barel et al. 1977, Rüber and Adams 2001 and others).

Shape, size and distribution of teeth may differ between the various dentigerous bones and even between different parts of the bones in one individual.

In some cichlid species a remarkable trophic polymorphism has been demonstrated (e.g. Meyer 1990a, b) and phenotypic plasticity was shown in the neotropical species *Cichlasoma managuense*, which was strongly influenced by the diet (see Meyer 1987 and references therein; see also Meyer 1990b). Further, a diet-dependent ecological plasticity was shown for the lower pharyngeal bone and its teeth (e.g. Greenwood 1965, Hoogerhoud 1986; Meyer 1990a, b, Huisseune 1995, Huisseune et al. 1994), and the premaxillary bone (Witte 1984). To our knowledge this plasticity is unknown in the oral dentition.

The great diversity of adult dentition documented in a vast literature sharply contrasts with the uniformity of the first tooth generation. First teeth are conical and unicuspid and change their shape during successive replacements (e.g. Yamaoka 1987, Huisseune and Sire 1997, Strelman et al. 2003; see also Sire et al. 2002 and references therein).

Recently we described the dentition of three carnivorous Lamprologini by scanning electron microscopy (SEM) and showed in almost all teeth lateral extensions or ridges of variable size, which we interpreted as incipient cusps (Greven et al. 2005). In the present article we broaden these observations examining the dentition of four further cichlid species from the litoral of Lake Tanganyika, East Africa, belonging to the tribes Perissodini and Tropheini. Both taxa include species highly adapted to special food items (Poll 1956, 1986).

## 2. Material and methods

We examined adults of *Haplotaxodon microlepis* (Boulenger, 1906) (3 females, standard length 12.2 to 16.5 cm) and *Plecodus straeleni* (Poll, 1948) (4 females, standard length 8.6 to 11.8 cm), both belonging to the tribe Perissodini, and the Tropheini *Tropheus moorii* (Boulenger, 1898) (3 females, standard length 8.7 to 9.5 cm) and *Petrochromis trewanasae* (Poll, 1948) (2 males, 1 female, standard length 14.8 to 15.1). Animals were caught in 1994 and 1995 by D. Hagemann

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**Figs. 1-9:** Total aspect of **1** *Haplotaxodon microlepis*; **2** *Plecodus straeleni*; **3** *Tropheus moorii*; **4** *Petrochromis trewanasae*; and transparencies of the mouth (frontal) and dentition of **5** *P. straeleni*; **6** *T. moorii*; **7** *T. moorii*; teeth of the dentary with dark apices; **8** *P. trewanasae*; **9** *P. trewanasae*; teeth of the premaxilla with brownish apices.