

The Genera of Indo-Malayan and African Cyprinodont Fishes Related to *Panchax* and *Nothobranchius*

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THE present paper is abstracted from part of a more extensive unpublished manuscript on the classification of the genera of African Cyprinodontidae. The study was begun in 1924, under the kindly supervision of Mr. John Treadwell Nichols, to whom I am greatly indebted not only for the loan of material but for his genial tolerance of my first ichthyological efforts.

The classification of the oviparous Cyprinodontidae is one of the most difficult problems facing the ichthyologist. The species are all small and exceedingly alike and they possess no such ready index of relationship as that provided by the gonopodium of the Poeciliidae. The older attempts at generic segregation were based mainly on a few obvious external differences (for example, fin position) which collapse completely as distinctions when large series of species are compared. In 1911 Regan indicated some fundamental differences between *Aplocheilus* and *Panchax*, which were elaborated by Sundara Raj and others. The first attempt to classify the Old World genera related to *Fundulus* on modern lines was Ahl's paper of 1924. The writer had undertaken study of these fishes at about that time and found himself in disagreement with Ahl on several points. In 1931 the writer published a paper (Myers, 1931) in which he subdivided the Fundulinae into four apparently natural tribes. In this system *Fundulus* and its allies in North America and Spain form a natural division (tribe Fundulini) which excludes those African and Neotropical species formerly referred to that genus. On the other hand the Asiatic and African "*Fundulus*" and *Panchax*-like genera, which have a narrow preorbital, vomerine teeth and pseudobranchiae, form one group (tribe Rivulini) with the Neotropical *Rivulus* and its relatives. Many African species of "*Haplocheilus*" agree with *Procatopus* in having high-set pectoral fins and are placed in a third division (tribe Aplocheilichthyini), while the Asiatic *Aplocheilus*, with non-protractile premaxillaries, is placed in a fourth tribe (Aplocheilini). *Lamprichthys* is relegated to a separate subfamily. The synopsis now presented revises the genera of Old World Rivulini.

The characters found of most value in delimiting the genera have to do chiefly with mouth structure, particularly the position of the maxillary bone and its relation to the surrounding tissues. The examination of these features in such small fishes must be carried out under a binocular dissecting microscope.

Tribe RIVULINI

Premaxillaries protractile. Pectoral fins set low. Preorbital very narrow, less than half eye diameter in width. A small patch of teeth on the head of the vomer and small tuft-like or flattened pseudobranchiae usually present; in a few species one or the other, or both, may be absent.

The genera of this tribe range throughout most of tropical America, Africa and Asia. The Neotropical genera have already been reviewed (Myers, 1927). One described African genus, *Fundulosoma* Ahl (1924: 50), from Togoland, has not been included in the key. I have been unable to obtain a cotype of *F. thierryi* for examination and the tooth structure described as diagnostic is to be seen in many partly dried or shriveled specimens of other genera.

SYNOPSIS OF THE GENERA

- 1a. Distal end of maxillary for half or more its length free from the external skin of the preorbital and movable forward; jaws produced; profile of snout sharp; snout and head greatly flattened; dorsal fin origin over middle of anal fin base, or farther back.
- 2a. Maxillary entirely free from the skin of the preorbital region and very freely movable forward; haemal arches of the caudal vertebrae expanded for the posterior extension of the coelom and air-bladder through them, this extension reaching (in different species) at least through the arches of half the caudal vertebrae and sometimes to the next to last vertebra before hypural.
1. *Panchax*
- 2b. Maxillary distally free from the skin of the preorbital region for only about half its length, much less freely movable forward; coelom and air-bladder not extending into the caudal region and the haemal arches not enlarged.
2. *Epiplatys*
- 1b. Distal part of maxillary to near its tip closely bound by the skin or in the flesh of the preorbital region and very nearly or quite immovable; dorsal position various; profile of snout less sharp.
- 3a. Caudal fin closely and finely scaled more than half way to its tip with regular, diverging series of scales, each row set over an inter-radial space; form *Panchax*-like but more robust; dorsal origin behind that of anal.
3. *Pachypanchax*
- 3b. Caudal with only normal basal squamation, not in straight, diverging series; dorsal position variable; form not *Panchax*-like, the snout usually less flattened and produced.
- 4a. Depth of head at occiput equal to or less than its greatest width; body elongate, not chubby; preorbital bone at its narrowest point usually 0.25 to 0.33 diameter of eye; dorsal position variable.
4. *Aphyosemion*
- 4b. Depth of head at occiput greater than its width; body chubby and somewhat compressed; preorbital bone at its narrowest point usually 0.20 eye diameter or less; dorsal origin opposite that of anal or more anterior, both fins usually rather high.
5. *Nothobranchius*

1. *Panchax* Cuvier and Valenciennes

Panchax Cuvier and Valenciennes, Hist. Nat. Poiss., 18, 1846: 380 (genotype *Esox panchax* Hamilton Buchanan, by tautonymy).

This genus is wholly Indo-Malayan in distribution. I have examined many specimens of *P. panchax* (Hamilton Buchanan), *P. lineatus* Cuvier and Valenciennes and *P. blockii* (Arnold). This last species (*Haplochilus panchax* var. *blockii* Arnold, Wochenschr. Aquarien und Terrarienkunde, 8, 1911: 672, fig. 3, type locality Cochin) seems to be identical with the more recently described *Panchax parvus* Sundara Raj. I have not seen the Ceylonese *P. dayi* (Steindachner). Steindachner's *Haplochilus rubropunctatus*, said to be from China, may be a mislabelled African *Epiplatys*.

2. *Epiplatys* Gill

Epiplatys Gill, Proc. Acad. Nat. Sci. Phila., 1862: 136, footnote (genotype *E. sexfasciatus* Gill).

Lycocyprinus Peters, Monatsb. k. Akad. Berlin, 1868: 146 (genotype *Poecilia sexfasciata* Peters, nec Gill, = *Haplochilus chaperi* Sauvage).

This well-marked genus is entirely African in distribution. It is apparently absent in East Africa. I have been able to dissect only four species of *Epiplatys*, *E. sexfasciatus* Gill, *E. chaperi* (Sauvage), *E. fasciolatus* (Günther), and *E. annulatus* (Boulenger), but as these four are probably as diverse anatomically as it is possible to find within the genus, I feel sure that the others will prove to differ very little in the air bladder and haemal arches. Other species of which I have examined specimens are: *E. multifasciatus* (Boulenger)¹, *E. macrostigma* (Boulenger), *E. nigricans* (Boulenger)¹, and *E. singa* (Boulenger)¹. Others not seen which certainly belong to this genus are: *E. ansorgii* (Boulenger), *E. baudoni* (Pellegrin), *E. bifasciatus* (Steindachner), *E. boulengeri* (Pellegrin), *E. chevalieri* (Pellegrin), *E. grahami* (Boulenger), *E. longiventralis* (Boulenger), *E. marnoi* (Steindachner), *E. normani* (Ahl), *E. nyongensis* (Ahl), *E. ornatus* (Ahl), *E. petersii* (Sauvage), *E. sangmelinensis* (Ahl), *E. senegalensis* (Steindachner), *E. steindachneri* (Svensson), *E. taeniatus* (Pfaff) and *E. zenkeri* (Ahl). Others of the many species described by Ahl under "*Panchax*" may belong here.

3. *Pachypanchax* Myers

Pachypanchax Myers, Amer. Mus. Novit., 592, 1933: 1 (genotype *Haplochilus playfairii* Günther).

The only species which can be placed in this genus with certainty is *P. playfairii* (Günther), from the Seychelles Islands. Aquarists have obtained specimens at Zanzibar. Very probably *Panchax sakaramyi* Holly and *Poecilia omalonota* Duméril, both from Madagascar, belong in *Pachypanchax*.

4. *Aphyosemion* Myers

Aphyosemion Myers, Amer. Mus. Novit., 116, 1924: 2 (genotype *A. castaneum* Myers).

Fundulopanchax Myers, Amer. Mus. Novit., 116, 1924: 4 (as a subgenus; genotype *Fundulus gularis* var. *caerulea* Boulenger).

This genus is a very large one and contains several diverse elements. It was originally described to include especially those species of Boulenger's "*Haplochilus*" with low-set pectoral fins, rounded snout and posterior dorsal, related to *elegans*. With these I included the more elongate species of Boulenger's "*Fundulus*," related to *gularis*, under the subgenus *Fundulopanchax*, since it seems impossible to draw a line, based on dorsal position, to distinguish the two groups. Ahl (1928: 116), while holding "*Fundulus*" as distinct, has synonymized this genus with "*Panchax*" (= *Panchax* + *Epiplatys*). Holly (1930) still further confuses the issue by including species of *Aplocheilichthys* in *Panchax*.

¹ Types examined.

With the more complete diagnosis now given there is no excuse for the confusion of *Aphyosemion* with either *Panchax* or *Epiplatys*. The structure of the maxillary of *Aphyosemion* is very different. Even on the rather incomplete and vague original description of the genus (particularly the rounded snout) it is possible to recognize well preserved specimens of *Aphyosemion* without microscopic examination. This is well illustrated by the fact that aquarists, who in general know these fishes better than most ichthyologists, immediately accepted the genus and found no difficulty in recognizing its members in their aquaria (see Rachow, 1931). It was, in fact, the differences observed in aquaria that led me to describe the genus. Aquarists have, however, of late used the name *Fundulopanchax* in a generic sense. The only justification for such use is the differing dorsal position of the two groups. I admit that the larger species of *Fundulopanchax*, with heavily undershot lower jaw and long anterior dorsal fin are very different from the delicate little fishes related to *elegans*, but I confess my inability to draw any hard and fast line between the two. When one takes into consideration such a series as *gardneri*, *multicolor*, *loennbergii*, *splendopleuris*, *liberiense* and *cameronense*, I fail to see how the species may be divided into two genera, one with the dorsal origin above or before that of the anal and the other with the dorsal origin behind that of the anal. It was just this point that made Boulenger's separation of "*Fundulus*" and "*Haplochilus*" seem unnatural. In the case of *gardneri* Boulenger originally described the male as a "*Fundulus*" and the female as a "*Haplochilus*"! In aquaria, specimens of *splendopleuris* and even of *caeruleum* show in their habitus and actions their resemblance to *Aphyosemion* (*sensu stricto*) and their difference from *Epiplatys* and *Panchax*.

The chief difficulty in defining *Aphyosemion* in its present sense is the similarity of certain species of the subgenus *Fundulopanchax* to *Nothobranchius*. It may be found impossible to draw a distinct line, but the material examined falls readily enough into one genus or the other.

Subgenus *Aphyosemion*.—Dorsal fin inserted slightly to considerably behind origin of anal. Dorsal short, rays 8 to 12. Smaller species with a more rounded snout and less projecting lower jaw. Angled notch before eye for reception of rictus well developed. Teeth in each jaw in a relatively narrow band, at all points much narrower than half eye diameter.

The known species of this subgenus range from Liberia, Cameroon and Gaboon over the entire Congo Basin. They do not appear to be found in Tanganyika. I have examined the following species: *A. australe* (Rachow), *A. calliurum calliurum* (Boulenger), *A. cameronense* (Boulenger), *A. castaneum* (Myers)¹, *A. christyi* (Boulenger)¹, *A. elegans* (Boulenger)¹, *A. ferranti* (Boulenger)¹, *A. lujae* (Boulenger)¹ and *A. schoutedeni* (Boulenger)¹. Species not seen, but which doubtless belong to this group, are: *Aphyosemion calliurum ahli* Myers, *A. exiguum* (Boulenger), *A. liberiense* (Boulenger), *A. meinkeni* Myers, *A. oeseri* (Ahl), *A. pascheni* (Ahl) and *A. vexillifer* (Meinken).

Aphyosemion calliurum ahli is a new name to replace *Panchax calliurus* var. *caeruleus* Meinken (Das Aquarium, Jan., 1932: 3, pl. 48, fig. 1; no

¹ Types examined.

locality given) preoccupied by *A. caeruleum* (Boulenger) 1915. *Aphyosemion meinkenii* is a new name to replace *Panchax pictus* Meinken (Blätt. Aquarien und Terrarienkunde, 43, 1932: 56, fig. 3; Tropical West Africa) preoccupied by *Panchax pictum* Cuvier and Valenciennes (= *Betta picta*).

A number of other names proposed by Ahl doubtless refer to fishes of this group, but it is impossible to determine their generic status from his descriptions.

Subgenus *Fundulopanchax*.—Dorsal fin before, over, or slightly behind that of anal. Dorsal fin comparatively longer, rays 10 to 16. Larger species, generally with a slightly more projecting lower jaw and heavier gular region. Angled notch before eye for reception of rictus well developed. Teeth in each jaw in a relatively narrow band, at all places much narrower than half eye diameter.

The distribution of this subgenus is rather restricted, the species ranging from the Gold Coast through Southern Nigeria to South Cameroon. In the Congo drainage they have been taken only in the Sanga Basin (Ja and Sanga Rivers). This area is almost entirely within the West African rain-forest. I have examined the following species: *A. bivittatum bivittatum* (Lönnerberg), *A. caeruleum* (Boulenger), *A. gardneri* (Boulenger), *A. gulare* (Boulenger), *A. loennerbergi* (Boulenger), *A. multicolor* (Meinken), *A. splendidum* (Pellegrin)¹, and *A. splendopleuris* (Meinken). The following species have not been seen: *A. arnoldi* (Boulenger), *A. batesii* (Boulenger), *A. beauforti* (Ahl), *A. bitaeniatum* (Ahl), *A. bivittatum hollyi* Myers, *A. gustavi* (Ahl), *A. filamentosum* (Meinken), *A. pappenheimi* (Ahl), *A. riggenbachi* (Ahl), *A. rubrostictum* (Ahl), *A. spurrellii* (Boulenger), and *A. zimmeri* (Ahl). Whether *Fundulus palmquistii* Lönnerberg and *F. walkeri* Boulenger belong to this genus or to *Nothobranchius* I do not know. Several of the described species seem to be poorly defined.

Aphyosemion bivittatum hollyi is a new name to replace *Fundulopanchax bivittatus* var. *coerulea* Meinken (Blätt. Aquarien und Terrarienkunde, 41, 1930: 178, fig.; Equatorial West Africa) preoccupied by *A. caeruleum* (Boulenger) 1915.

Subgenus *Callopanchax*, new.—Dorsal and anal fin origins rather far forward and opposite. Dorsal very long, with 17 to 19 rays. Larger species, with a projecting lower jaw. Angled notch before eye for reception of rictus rather poorly developed. Teeth in each jaw in a very wide band, wider at the sides of the lower jaw where the band is wider than half the eye diameter.

There is only one species in this subgenus, the type species, *Aphyosemion sjoestedti* (Lönnerberg). It ranges from Sierra Leone to South Cameroon, in the coastal region.

5. *Nothobranchius* Peters

Nothobranchius Peters, Monatsb. Akad. Wiss. Berlin, 1868: 145 (genotype *Cyprinodon orthonotus* Peters).

Adiniops Myers, Amer. Mus. Novit., 116, 1924: 6 (genotype *Fundulus guentheri* Pfeffer).

¹ Types examined.

This genus ranges from Somaliland and Mozambique to the Central African Lakes and Northern Nigeria. It is not found in the Congo Basin or the West African rain-forest.

Recent study has convinced me that Ahl was perfectly correct in referring *Fundulus neumanni*, *F. guentheri*, and related forms (=my *Adiniops*) to *Nothobranchius*. *Fundulus kuhntae* Ahl and *Adiniops troemneri* Myers, both from Beira, appear to be identical with *N. orthonotus*. Peters' types of *orthonotus*, one of which I have examined, were in poor condition, and the lips are flabby and stretched. This makes the specimen I have examined (just as in Peters' figure) seem to have a great lateral gape. I find that the lips, when placed in their original position, are like those of *guentheri*. *N. orthonotus* has, however, longer jaws than any other *Nothobranchius*, but I cannot separate it generically on this character alone.

I have examined specimens of the following species: *N. orthonotus* (Peters)¹, *N. kiyawensis* Ahl, *N. guentheri* (Pfeffer), *N. neumanni* (Hilgendorf)¹ and *N. rachovii* Ahl. Other species which appear to belong to this genus are: *N. microlepis* (Vinciguerra), *N. patrizii* (Vinciguerra), *N. taenopygus* (Hilgendorf), and *N. vosseleri* Ahl. *Fundulus palmquistii* and *walkeri* may, as mentioned above, belong here. Further, it seems probable that *Fundulus melanospilus* Pfeffer, from the Seychelles Islands, and *F. gambiensis* Svensson, from the Gambia, belong to *Nothobranchius*.

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¹ Types examined.