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Aphyosemion grelli (Cyprinodontiformes: Nothobranchiidae), a new species from the Massif du Chaillu, southern Gabon

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Abstract

A new species of *Aphyosemion* is described from Gabon, based on ten specimens collected in a small stream belonging to the hydrographic system of the Ikoy River on the northwestern edge of the Massif du Chaillu. *Aphyosemion grelli* is distinguished from all congeners by possessing a unique colour pattern of the unpaired and pelvic fins in the female consisting of the combination of a yellow basal portion and greyish to dark grey broad margin. Males of the new species share the black margins of the unpaired fins with *A. congicum*, *A. labarrei*, *A. ocellatum*, *A. passaroi*, and *A. teugelsi*, but differ from these by the combination of colouration characters and morphology. Phylogenetic relationships of the new species are still unclear; a possible close relationship with the *A. coeleste* group is tentatively excluded because, although geographically close, there are differences on flank colour pattern, head length and number of anal-fin rays.

Key words

Killifish, Africa, Ikoy River, Ikobey, systematics, taxonomy, biogeography.

Introduction

The genus *Aphyosemion* Myers, 1924 is a speciose clade of West African killifishes, with over 80 species inhabiting small streams from Togo to Angola along the coastal plain, the inland plateau and the lowlands of the Congo River basin (Huber, 2000). Among this genus Scheel (1990) recognised nine species groups, combining different information including colour patterns, karyotypes, and distribution: the *Aphyosemion batesii* group, the *A. bivittatum* group, the *A. calliurum* group, the *A. cameronense* group, the *A. coeleste* group, the *A. elegans* group, the *A. exiguum* group, the *A. georgiae* group, and the *A. striatum* group. Most of these species groups have been assigned to specific subgenera: the subgenus *Aphyosemion* corresponds to the *A. elegans* group, *Chromaphyosemion* (Radda, 1971), was established to recognise the very distinctive *A. bivittatum* group. The subgenera *Kathetys*, *Raddaella* (Huber, 1977) and *Diapteron* (Huber & Seegers, 1977) were established to recognize the similarly distinctive *A. exiguum*, *A. batesii* and *A. georgiae* species groups, respectively. The taxon *Mesoaphyosemion* (Radda, 1977) was established as a subgenus of *Aphyosemion* and originally included all the species that show a superficial similarity turning this assemblage into a taxonomic "container", but is currently limited to members of the *A. cameronense* group (Sonnenberg & Blum, 2007). Some species are difficult to place definitively into any one of these groups because currently no comprehensive and detailed comparative morphological study of the African nothobranchiids is available. Recently, Sonnenberg (2007), Van der Zee

Fig. 1. *Aphyosemion grelli*, holotype, male, 29.2 mm SL; Gabon: Province de la Ngounié, Ikoy River system.

Fig. 2. *Aphyosemion grelli*, aquarium material, not preserved, male, about 30.0 mm SL; Gabon: Province de la Ngounié, Ikoy River system.

& Sonnenberg (2011), and Sonnenberg & Van der Zee (2012) propose raising the aforementioned subgenera to the genus level.

The Massif du Chaillu is a mountain range starting in central Gabon just south of the Ogooué River (south of the city of Ndjolé) in a SSE direction across the Gabon-Congo border into the Republic of Congo with an average elevation of 400 to 700 metres. Systematic collections along the few roads in this mountain range have shown a remarkable present day diversity of the nothobranchiid fauna (Huber, 1980, 1994; Huber & Radda, 1977; Radda, 1980). In the Gabonese part of the Massif du Chaillu, nine *Aphyosemion* species are currently known: *Aphyosemion aureum*, *A. citrineipinnis, A. coeleste*, *A. hanneloreae, A. hofmanni, A. joergenscheeli*, *A. ocellatum, A. passaroi,* and *A. wuendschi* (Huber, 2000; Wildekamp, 1993). Apart from *A. hofmanni, A. hanneloreae,* and *A. wuendschi* not belonging to any defined group and *A. joergenscheeli* which seems genetically close to *A. escherichi*, all remaining species belong to the *A. coeleste* species group (Huber & Radda, 1977; Murphy & Collier, 1999; Huber, 2000; Collier, 2007).

In January 2002, the second author was able to cross the River Ngounié east of Sindara, and discover an *Aphyosemion* with dark grey fin margins in females and black margins in males**,** from a stream on the western edge of the Massif du Chaillu**.** It became apparent that these specimens represent a species unknown to science which is herein formally described.

Material and Methods

Morphometric measurements were taken by means of a micrometer, partly under a dissecting microscope, and rounded to the nearest 0.1 mm. Counts and methods follow Huber (2000) with addition of Valdesalici (2010). Measurements, including subunits of the head, are presented as percentages of standard length (SL). The number of all visible rays of the dorsal, anal, caudal, pelvic, and pectoral fins were counted; the abbreviation D/A means the relative position of the first dorsal-fin ray in regard to the opposite anal-fin ray. Scale count on the mid-longitudinal series is the number of scales between the upper attachment of the opercular membrane and the caudal fin base. Excluded are the scales posterior to the

Fig. 3. *Aphyosemion grelli*, wild female, not preserved, about 25.0 mm SL; Gabon: Province de la Ngounié, Ikoy River system.

Fig. 4. *Aphyosemion grelli*, aquarium material, not preserved, female, about 25.0 mm SL; Gabon: Province de la Ngounié, Ikoy River system.

hypural junction, which were counted separately. Nomenclature for the neuromast system on the head follows Scheel (1968) and Huber (2000) and that for the frontal squamation follows Hoedeman (1958). Morphological data from Huber (1994), Huber & Radda (1977), Radda (1980), Van der Zee & Sonnenberg (2010) were used here for comparisons. Osteological preparations (cleared and stained, C&S) were made according to Taylor & Van Dyke (1985), but not stained for cartilages.

The type material is deposited in the following institutions: Staatliches Museum für Naturkunde (SMNS), Stuttgart, Germany & Museum für Tierkunde, (MTD), Dresden, Germany.

Aphyosemion grelli, new species

Figs. 1–4, Table 1

Holotype. SMNS 25471, male, 29.2 mm SL; Gabon, Province de la Ngounié, Département de Tsamba-Magotsi, 50 km east of the ferry across the River Ngounié along the road "Route Régionale 22" to Ikobey (Ikobé), a small stream belonging to the Ikoy River system (00°59′07″ S, 10°56′00″ E), 19 January 2006, Wolfgang Eberl & François Mengila.

Paratypes. SMNS 25472, 5 males, 26.9-30.7 mm SL, 2 females, 25.8 & 29.6 mm SL, collected with the holotype. MTD F 32782-83, 1 male, 29.4 mm SL & 1 female, 29.0 mm SL C&S; same data as above, 22 January 2002, Wolfgang Eberl & Guido Passaro.

Diagnosis. Distinguished from all congeners by possessing a unique colour pattern of the unpaired and pelvic fins in females consisting the combination of a yellow basal portion and greyish to dark grey broad margin (vs. never a similar colour pattern). Males are similar to *Aphyosemion congicum, A. labarrei*, *A. ocellatum*, *A. passaroi,* and *A. teugelsi* and distinguished from all other species of the genus by having black margins on their unpaired fins (vs. never a similar colour pattern). *Aphyosemion grelli* differs from *A. congicum* males by the blue-green body and head colouration (vs. orange); by the rounded dorsal and anal fins (vs. pointed); by a horizontal series of densely set dots on flank (vs. a few, larger and sparsely set dots); by a thin black distal margin on dorsal fin (vs. dorsal fin almost completely black); by the rounded caudal fin (vs. caudal fin pointed dorsally and ventrally) and by 11–12 dorsal-fin rays (vs. 9–10). *Aphyosemion grelli* differs from males of *A. labarrei* by a horizontal series of dots on flank (vs. a dense pattern of large red blotches forming fused, irregular bands on caudal peduncle); by the

Table 1. Morphometric data of *Aphyosemion grelli*. Measurements are given as percentages of standard length in mm. Eye diameter, interorbital width and snout length are given as percentages of head length. Cleared and stained material is not included.

	holotype	All males (n = 7)	females (n = 2)
Standard length (mm)	29.2	26.9–30.7	25.8–29.6
Depth at pelvic fin	22.9	21.2–24.4	23.2–23.3
Predorsal length	67.8	63.5–67.8	68.2–68.9
Length of dorsal-fin base	14.0	13.3–16.3	12.5–13.9
Preanal length	61.3	58.9–61.3	62.8–63.9
Length of anal-fin base	17.4	17.2–19.8	14.3–15.2
Prepelvic length	48.9	46.9–50.3	50.3–50.6
Length of caudal peduncle	23.6	22.6–24.9	22.6–23.2
Depth of caudal peduncle	13.6	12.2–14.2	12.4–12.5
Head length	29.7	26.7–31.2	27.7–31.0
Snout length	24.1	26.1–31.2	22.5–24.3
Eye diameter	24.1	24.1–32.5	23.7–29.2
Interobital width	35.6	35.0–42.8	36.2–41.4

rounded caudal fin (vs. pointed dorsally and ventrally); by 10–12 dorsal-fin rays (vs. 12–14); by 13–14 anal-fin rays (vs. 14–17) and by 12 circumpeduncular scales (vs. 13–14). *Aphyosemion grelli* differs from males of *A. ocellatum* by a horizontal series of dots from humeral to caudal-fin base (vs. single blue broad rounded blotch at at humeral region); by the more anterior insertion of dorsal fin relative to anal-fin origin (D/A 6–7 vs. D/A 8–9) and by 13–14 anal-fin rays (vs. 15–16). *Aphyosemion grelli* differs from males of *A. passaroi* by the presence of a horizontal series of dots on flank (vs. absence or a more irregular pattern of a few smaller dots on flank); by caudal-fin with narrow black dorsal and ventral distal margins (vs. broad black band along entire margin of caudal fin); by anal-fin without any spots (vs. with a pattern of red dots) and by 13–14 anal-fin rays (vs. 15–16). *Aphyosemion grelli* differs from males of *A. teugelsi* by the light pectoral-fin margin (vs. dark); rounded dorsal and anal fins (vs. pointed); by 16–18 pectoral-fin rays (vs. 14–15); by 28–32 caudal-fin rays (vs. 23–25) and by 9–10 scales on transverse series (vs. 7–8).

Description. Morphometric data in Table 1. *Aphyosemion grelli* shows sexual dimorphism: males are more colourful; dorsal and anal fin larger and positioned more anteriorly compared to females. Females show pocket-like membrane over urogenital papilla. Body slightly laterally compressed; dorsal profile slightly convex, maximum body depth at pelvic-fin origin. Ventral profile slightly convex, slightly concave to nearly straight on caudal peduncle. Snout slightly rounded, mouth directed upwards, lower jaw longer than upper jaw. Caudal fin subtruncate. Dorsal and anal fins located posterior to mid-body, tips rounded.

Frontal neuromast series 'open' type. Supraorbital series with three neuromast. Preopercular canal with six pores. One neuromast on each scale of median longitudinal series.

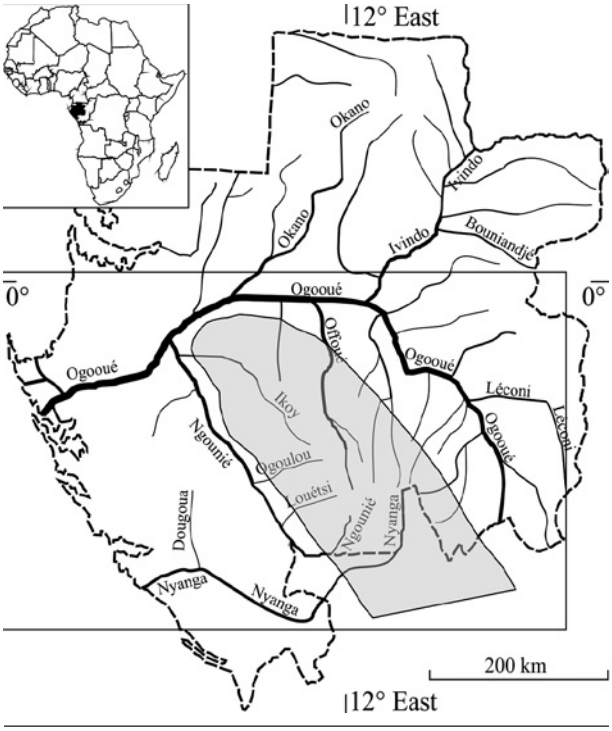

Fig. 5. Map of Gabon and the Massif du Chaillu in grey.

Scales cycloid, body entirely scaled except ventral surface of head; frontal squamation G-type; scales on mid-longitudinal series 28–31; scales on transverse series 9–10, scales around caudal peduncle 12. Dorsal-fin rays 10–12, first dorsal-fin ray on vertical between 6th to 7th anal-fin ray; anal-fin rays 13–14; caudal-fin rays 28–32; pectoral-fin rays 16–18; pelvic-fin rays 5–6.

Premaxilla and dentary with unicuspid, slightly curved teeth. Vomerine teeth absent, anterior border of vomer thickened. Post-temporal lateral process absent. Anterodorsal process of the urohyal bifid.

Colouration. Male (Figs. 1 & 2). Body and head metallic blue-green, three interrupted horizontal series of red dots on flank. Two narrow oblique red bars on opercle. Dorsal, anal and pelvic fins blue-green with narrow black distal margin. Caudal fin blue-green with dark blue irregular dots, dorsal and ventral distal margin black, dorsal and ventral posterior portion white. Pectoral fin hyaline with ventral white margins.

Female (Figs. 3 & 4). Body and head grey-brown, three interrupted horizontal series of small red dots on flank. Pectoral fin hyaline. Dorsal, anal, caudal and pelvic fins yellow with broad grey distal margin.

Distribution and habitat notes (Figs. 5 & 6). *Aphyosemion grelli* is known only from the type locality, a small stream belonging to the hydrographic system of the Ikoy River, crossing the RR 22 from southwest to northeast on the north-western edge of the Massif du Chaillu. At the time of collecting the stream was no wider than 1 m with a depth less than 40 cm. The only other fish present were small unidentified *Barbus* species.

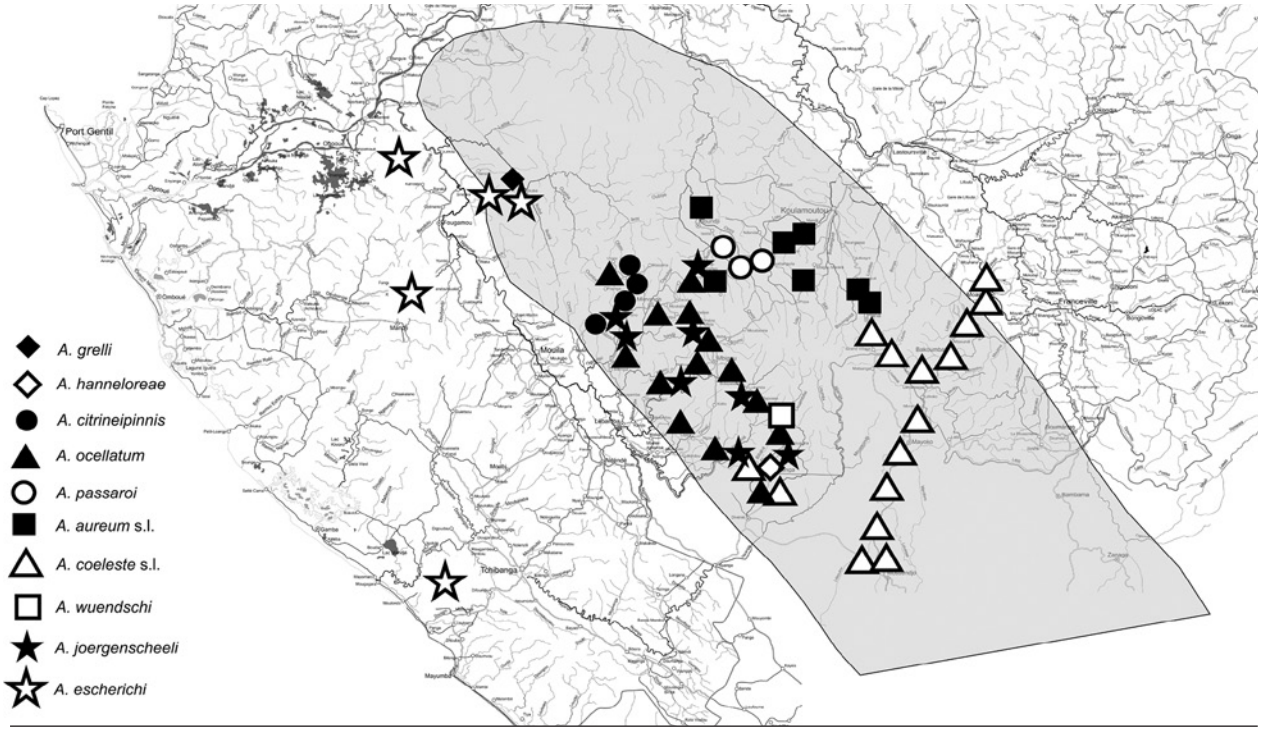

Fig. 6. Distribution of *Aphyosemion grelli* and the other known *Aphyosemion* species in the Massif du Chaillu and southern Gabon.

Etymology. The new species is dedicated to the late Wolfgang Grell, member of the DKG (German Killifish Association); a talented killifish collector, breeder, and photographer who only one year before his death in May 2001, directed the second author's attention to the probable existence of an unknown species in the area east of Sindara.

Discussion

The *Aphyosemion coeleste* species group is distributed on the Massif du Chaillu and was defined by Huber & Radda (1977). Despite its distribution and although males *A. ocellatum* and *A. passaroi* possess similar patterns on the unpaired fins, we hesitate here to assign *A. grelli* into this species group. *A. grelli* differs from all others members of this assemblage by the presence of a dotted pattern on the flank from humeral to caudal-fin base (vs. absence or if present limited to humeral area or few, smaller and irregularly distributed dots), a relatively longer head (26.7–31.2 % SL vs. 22.0–29.0 % SL) and fewer anal-fin rays (13–14 vs. 14–17).

Aphyosemion grelli does not belong to the subgenus *Aphyosemion*, so is clearly not related to *A. congicum*, because, apart from the preopercular neuromast system with 6 pores, the slender body, and the posterior origin of the dorsal fin, it does not show less than 10 dorsal fin-rays, the females do not show a strong reticulation due to dark scale borders, and the edges of the caudal fin in males are not pointed or extended as in the species of this subgenus (Huber, 2005; Van der Zee & Sonnenberg, 2011).

Inferring a possible relationship of *Aphyosemion grelli*, belonging to ichthyofaunistic „Gabonian group" (sensu Scheel, 1974) and in Ogooué River system, with the other species showing black margins on unpaired fins is so far impractical because both *A. labarrei* and *A. teugelsi* belong to ichthyofaunistic „Zaire group" (sensu Scheel, 1974) and are known from the left bank of the Congo River in the Democratic Republic of Congo.

Scheel (1990) placed *A. labarrei* in the *A. elegans* group, however the molecular data clearly exclude this taxon from this group (Murphy & Collier, 1999; Collier, 2007).

Male *A. grelli* are distinguished from male *A. labarrei* by the colour pattern on the flank (horizontal series of dots vs. a dense pattern of large red blotches, forming fused irregular bands on caudal peduncle), by the shape of the caudal fin (rounded vs. pointed dorsally and ventrally), by the length of the dorsal fin (tip reaching middle of caudal peduncle vs. reaching caudal fin); by more dorsal- and anal-fin rays (10–12 vs. 12–14 and 13–14 vs. 14–17, respectively), and by fewer circumpeduncular scales (12 vs. 13–14).

Due to the differences with the members of the geographically close subgenus *Aphyosemion* (Van der Zee & Sonnenberg, 2010; Van der Zee, 2011), *Aphyosemion teugelsi* probably belongs to a currently unknown supraspecific taxon. Male *A. grelli* can be distinguished from male *A. teugelsi* by a different colour of the pectoral-fin margin (white vs. dark brown), by the different

shape of the dorsal and anal fins margin (rounded vs. pointed), by more pectoral- and caudal-fin rays (16–18 vs. 14–15 and 28–32 vs. 23–25, respectively) and by more scales on transverse series (9–10 vs. 7–8).

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References

Collier, G.E. (2007): The genus *Aphyosemion*: Taxonomic History and Molecular Phylogeny. – Journal of the American Killifish Association, **39**:147–168.

Costa, W.J.E.M. (2008): Catalog of aplocheiloid killifishes of the world. – Universidade Federal do Rio de Janeiro. Departmento de Zoologia, Rio de Janeiro. 120 pp.

Hoedeman, J. (1958): The frontal scalation pattern in some groups of toothcarps (Pisces: Cyprinodontiformes). – Bulletin of Aquatic Biology, **1**: 23–28.

Huber, J.H. (1980): Rapport sur la deuxième expédition au Gabon (août 1979). Etude des Cyprinodontidés récoltés. – Revue française d'Aquariologie Herpétologie, **7**: 37–42.

Huber, J.H. (1994): *Aphyosemion passaroi*, espèce inédite du Gabon sud-oriental, au patron de coloration unique et description complémentaire de *Aphyosemion decorsei* (Pellegrin). Cyprinodontiformes, Aplocheilidae. – Revue française d'Aquariologie Herpétologie, **20**: 77–79.

Huber, J.H. (2000): Killi-Data 2000. Updated checklist of taxonomic names, collecting localities and bibliographic references of oviparous Cyprinodont fishes (Cyprinodontiformes). – Société Française d'Ichtyologie, Paris. 538 pp

Huber, J.H. (2005): Identifikation einer kleinen Sammlung von *Aphyosemion* aus Zaire im Münchener Museum (Z.S.M.), mit weiteren Kommentaren über die Validität der bekannten Komponenten der *elegans*-Superspezies. 1. Teil. – Deutsche Killifisch Gemeinschaft Journal, **37**: 8–21.

Huber, J.H. & Radda, A.C. (1977): Cyprinodontiden-Studien in Gabun. IV. Das Du Chaillu-Massiv. – Aquaria: Vivaristische Fachzeitschrift für die Schweiz und Österreich, **24**: 99–110.

Murphy, W.J. & Collier, G.E. (1999): Phylogenetic relationships of African killifishes in the genera *Aphyosemion* and *Fundulopanchax* inferred from mitochondrial DNA sequences. – Molecular Phylogenetics and Evolution, **11**: 351–360.

Radda, A.C. (1980): Beschreibung zweier neuer Aphyosemion-Arten aus Süd-Gabun. – Aquaria: Vivaristische Fachzeitschrift für die Schweiz und Österreich, **27**: 201–205.

Scheel, J.J. (1974): Rivuline Studies: Taxonomic Studies of Rivuline Cyprinodonts From Tropical Atlantic Africa (Rivulinae, Cyprinodontidae, Alteriniformes, Pisces). – Annales du Musée royal de l'Afrique centrale, **211**: 1–150.

Scheel, J.J. (1990): Atlas of KilliWshes of the Old World. – T.F.H. Publication, Neptune City, NJ. 448pp.

Seegers, L. (1980): *Diapteron* – Eine neue Killifischgattung aus dem Ivindobecken. – Aquarien Magazin, **14**: 200–207.

Sonnenberg, R. (2000): The distribution of *Chromaphyosemion* Radda, 1971 (Teleostei: Cyprinodontiformes) on the coastal plains of West and Central Africa. – In: Rheinwald, G. (ed.): Isolated Vertebrated Communities in the Tropics. Proceedings of the 4th International Symposium of Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, May 13–17, **46**: 79–94.

Sonnenberg, R. (2007): Description of three new species of *Chromaphyosemion* Radda, 1971 (Cyprinodontiformes: Nothobranchiidae) from the coastal plains of Cameroon with a preliminary review of the Chromaphyosemion splendopleure complex. – Zootaxa, **1591**: 1–38.

Sonnenberg, R. & Blum, T. (2005): *Aphyosemion (Mesoaphyosemion) etsamense* (Cyprinodontiformes: Aplocheiloidei: Nothobranchiidae), a new species from the Monts de Cristal, Northwestern Gabon. – Bonner zoologische Beitrage **53**: 211–220.

Sonnenberg, R. & Van der Zee, J.R. (2012): *Aphyosemion pseudoelegans* (Cyprinodontiformes: Nothobranchiidae), a new killifish species from the Cuvette centrale in the Congo Basin (Democratic Republic of Congo). – Bonn zoological Bulletin, **61**: 3–12.

Taylor, W.R. & Van Dyke G.C. (1985): Revised procedures for staining and clearing small fishes and other vertebrates for bone and cartilage study. – Cybium, **9**: 107 – 109.

Valdesalici, S. (2010): *Nothobranchius boklundi* (Cyprinodontiformes: Nothobranchiidae): a new annual killifish with two male colour morphs from the Luangwa River basin, Zambia. – Aqua, International Journal of Ichthyology, **16**: 51–60.

Van der Zee, J.R. (2011): An introduction to the killifish of the Congo Basin. – Journal of the American Killifish Association, **44**: 142–160.

Van der Zee, J.R. & Sonnenberg, R. (2010): *Aphyosemion teugelsi* (Cyprinodontiformes: Nothobranchiidae), a new species from a remote locality in the southern Democratic Republic of the Congo. – Zootaxa, **2724**: 58–68

Van der Zee, J.R. & Sonnenberg, R. (2011): *Aphyosemion musafirii* (Cyprinodontiformes: Nothobranchiidae), a new species from the Tshopo Province in the Democratic Republic of Congo, with some notes on the *Aphyosemion* of the Congo Basin. – Bonn zoological Bulletin **60**: 73–87.

Wildekamp, R.H. (1993): A world of killies. Atlas of the oviparous cyprinodontiform Fishes of the world. In: Watters, B.R. (Ed.): The Genera *Adamas, Adinia, Aphanius, Aphyoplatys* and *Aphyosemion*, vol. 1. – American Killifish Association, Mishawaka, IN. 311 pp.