

Who's behind those red eyes? The *Moenkhausia oligolepis* group in Argentina (Characiformes: Characidae).

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Abstract

The history of red-eyed *Moenkhausia* in Argentina dates back to 1937 when Meinken mentioned *M. sanctaefilomenae* for the first time based on specimens received from Corrientes. Meinken's lot still exists in the ichthyological collection in Berlin and based on this material and preserved specimens from other collection we can confirm that from the species group of the red-eyed *Moenkhausia* so far only *M. australis* and *M. forestii* have been collected in Argentina, while the records of *M. sanctaefilomenae* must be considered erroneous.

Resumen

La historia de las *Moenkhausia* de ojos rojos en Argentina data del año 1937, cuando Meinken mencionó *M. sanctaefilomenae* por primera vez basándose en ejemplares recibidos de Corrientes. El lote de Meinken aún existe en la colección ictiológica de Berlín y, basándonos en este material y ejemplares preservados en otras colecciones, podemos confirmar que, del grupo de especies de *Moenkhausia* de ojos rojos, solamente *M. australis* y *M. forestii* han sido colectadas en Argentina hasta el momento, mientras que los registros de *M. sanctaefilomenae* deben ser considerados erróneos.

Introduction

Moenkhausia sanctaefilomenae is, to date, the only species of the *Moenkhausia oligolepis* group cited for Argentina. It was mentioned by Meinken (1937) from specimens collected in Corrientes and deposited in the ichthyological collection of Berlin.

This group of *Moenkhausia*, as treated in the recent literature (Benine et al. 2009, Reia et al. 2019), includes four species that are mainly distinguishable only by details of their squamation: *Moenkhausia australis* Eigenmann, *M. forestii* Benine, Mariguela & Oliveira, *M. oligolepis* (Guenther), and *M. sanctaefilomenae* (Steindachner). Among those species, *M. australis* and *M. oligolepis* have a complete lateral line, which is interrupted in *M. forestii* and *M. sanctaefilomenae*. These species share a low number of scales in the lateral series (up to 35) and a large dark blotch at the end of the caudal peduncle and base of all caudal-fin rays (Benine et al. 2009).

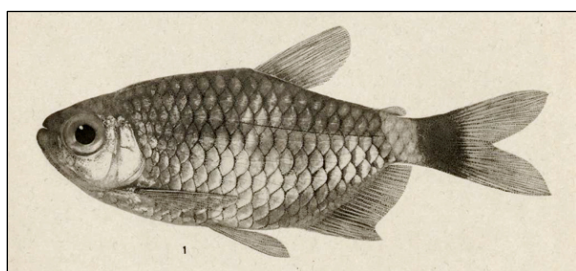


fig. 1. *Moenkhausia forestii*, fig. 1 from plate 16 of Eigenmann (1917)



fig. 2. *Moenkhausia australis*, fig. 2 from plate 16 of Eigenmann (1917)

Eigenmann (1908) described *M. australe* for Paraguay based on two specimens with complete lateral lines. After that, however, Eigenmann (1917) included among the comparative material for *M. sanctaefilomenae* specimens with lateral lines both, complete and interrupted, saying explicitly that the development of the lateral line was related with the size of the specimens. In the same paragraph, Eigenmann said that the number of scales in the lateral series varied among the specimens with complete (usually 30) and incomplete lateral lines (usually 25), which would be an unusual ontogenetic variation for any characid species. In that article, Eigenmann synonymized *M. australis* with *M. sanctaefilomenae*. That synonymy was followed until recently, including Mirande & Koerber (2015). However, in several other articles (Dagosta et al. 2015, Azevedo-Santos & Benine 2016, Mirande 2019), *M. australis* was treated as a valid species. Reia et al. (2019) corroborated with molecular data that the completeness of the lateral line corresponds to a different lineage instead of being intraspecific variation, providing thus important evidence for the validity of *M. australis* (fig. 3).



fig. 3. *Moenkhausia australis* from Staeck's locality A 16/93. Stream some 50 km North of San Roque, Paraná River basin, province of Corrientes. We tentatively assume that this locality could have been the Arroyo Ambrosio at RN 12 (28°12'59"S-58°43'41"W) or somewhere close by in that area.

The distinction between *Moenkhausia forestii* and *M. sanctaefilomenae* is more subtle, being almost uniquely distinguished by the number of transverse scales from the lateral series to dorsal-fin origin (four in *M. sanctaefilomenae* vs. five in *M. forestii*). The correlation of this character with different lineages was corroborated by Benine et al. (2009) through a phylogenetic analysis based on the Cytochrome Oxidase 1 (*Coi*).

The aim of this contribution is to report the species of the *Moenkhausia oligolepis* group present in Argentina, according to the available specimens deposited in several scientific collections.

History of red-eyed *Moenkhausia* in Argentina

In their account for *Moenkhausia sanctaefilomenae* (Steindachner, 1907), Ringuélet et al. (1967) provided a list of references including Steindachner's original description, the record of *Poecilurichthys agassizii* by Eigenmann & Kennedy (1903) from Paraguay, *M. sanctaefilomenae* from Eigenmann (1917), and Meinken (1937) as the first record from Argentina. In general, *Tetragonopterus agassizii* Steindachner, 1876 is considered to be a possible, uncertain synonym of *Moenkhausia oligolepis* (Fricke 2020). Yet, specifically the specimens mentioned by Boulenger (1900) as *Tetragonopterus agassizii* (not Steindachner) and by Eigenmann & Kennedy] (1903) under *Poecilurichthys agassizii* (not Steindachner) have been assigned to *M. australis* by Reia (2019).

Surprisingly, in the list of Ringuélet et al. (1967) Boulenger's record of *Tetragonopterus agassizii* was not included. Boulenger (1897) reported on specimens collected by Borelli in San Lorenzo, Jujuy, a place not found in any modern map. A 'hacienda San Lorenzo' in the past was one of the largest in Jujuy (Ferreiro 2016, Peirotti 2007) and today is located in the town of Calilegua (Fernández 2010) in Jujuy, right at the banks of San Lorenzo river, an affluent to San Francisco river which drains to the Bermejo river.

Boulenger made an interesting comment on the specimens of *Tetragonopterus agassizii* he examined: "Chez le plus grand nombre des spécimens (jeunes) la ligne latérale ne s'étend que sur quelques unes des écailles antérieures; chez d'autres, elle est complète." Translated, 'In the largest number of specimens (young) the lateral line only extends over a few anterior scales; in others it is complete'. This comment may have been the basis for Eigenmann's statement on differences in the lateral line between young and adult specimens, which then lead him to synonymize *M. australis* with *M. sanctaefilomenae*. By our actual knowledge Boulenger may have examined a mixture of specimens compound by both, *M. australis* and *M. forestii*. If Boulenger (1897) shall be considered as first records of both species from Argentina, may only be clarified after examining the respective specimens, if still existing.

Background of the specimens from Meinken's first record (1937)

Still today many descendants of German immigrants to Argentina maintain tight connections to the native country, language and culture of their ancestors, sending their children to one of the German schools, being members in German sports clubs, worship in German language churches etc. The second author's in-laws still practice all the above and speak German at home, being the fourth generation from great-grandparents who arrived to Buenos Aires between 1880 and 1905.

Those still existing bonds have surely been yet much stronger in the 1930ies when most German-Argentines were the first generation born in South America. This was most probably the case for Carlos Hahn from Corrientes city, the collector of those specimens of red-eyed *Moenkhausia* Meinken's report (1937) was based on. By his family name and the perfect German writing there is no space for doubts that he was son or grandson of German and/or Austrian immigrants, but the fact that he published under the first name 'Carlos', not as Karl or Carl, indicates that he was part of this Argentina-born generation. Having stated in 1934 that 17 years earlier he was a high school student when breeding *Xiphophorus helleri*, *Macropodus opercularis*, and *Pterophyllum scalare* in aquaria (1934a), it can be assumed that Carlos W. Hahn was born around 1902.

In his hometown Corrientes he started to keep in aquaria the species he could find in the neighborhood and for identification he sent preserved specimens to Meinken, editor of 'Blaetter für Aquarien- und Terrarienkunde', one of the five aquarium journals then existing in Germany. Their cooperation resulted in publications of three different types: notes published by Hahn himself (1934a, 1934b, 1935, 1936), articles published by Meinken based on specimens received from Hahn (1935, 1936a, 1937), and six letters from Hahn to Meinken, subsequently published by Meinken (1936b, 1936c).

It is noteworthy that among the notes from the second group, Meinken (1936a) published a report on *Melanorivulus punctatus*, (sub *Rivulus* sp., similar but not identical to *R. strigatus*) based on a report and drawing received from Hahn. This was in fact the first record for this species from Argentina, and not the paper of Alonso de Arámburu et al. (1962, sub *R. strigatus*) as stated by later authors (Ringuelet et al. 1967, López et al. 2003, Mirande & Koerber 2015).

From the specimens received from Hahn, Meinken described several new species: *Farlowella hahni*, *Leporinus nigripinnis* (a synonym of *Abramites hypselonotus*), *Leporinus platycephalus* (a synonym of *Schizodon borellii*), and *Rhamphichthys hahni*. It is doubtful that Hahn collected the type specimen of *Farlowella paranaense* (a synonym of *F. amazonum*) in Corrientes and more probable that Meinken mixed up labels (Azpelicueta & Koerber 2015).

Other specimens sent by Hahn were not considered as new to science by Meinken, but have been the basis for first records from Argentina published by him: *Leporinus striatus*, *Hyphessobrycon eques* (sub *H. serpae*), *Sternopygus macrurus*, *Rineloricaria parva*, *Hypostomus latifrons* (sub *Ancistrus vittatus*), *Otocinclus vittatus*, *Bujurquina vittata* (sub *Aequidens paraguayensis*), and *Moenkhausia sanctaefilomenae*, the subject of the present note.

Meinken's description of the material examined by him (figs. 4, 5)

Moenkhausia sanctae filomenae (Steindachner)

One male of 41, one female of 46 mm total length. Height 2.6-2.5; head 3.5-3.7; eye 2.8-2.7. Interorbital distance only slightly bigger than eye diameter. D 10; A 25-26; in one longitudinal row 26 scales, between dorsal and pelvic fins 10 scales. The lateral line perforates 9 or 10 scales. Coloration yellowish-grey-olive, the belly more yellowish, in the male silver, in this [the male] also the body shiny silver. Edges of scales darker, the scales with fine radii. On the caudal peduncle from the end of the

adipose fin a pale yellow, in the living animal a metallic bright zone, followed by a dark brown swathe of equal width, which extends to the caudal fin. First rays of anal fin with a fine dark line. All other fins colorless.



fig. 4. *Moenkhausia forestii*: ZMB 23687a, city of Corrientes, río Paraná, used by Meinken (1937)



fig. 5. *Moenkhausia forestii*: ZMB 23687b, city of Corrientes, río Paraná, used by Meinken (1937)

Examined material

All from Argentina. Specimens from CFA, MHNG, and ZMB examined from photos.

Moenkhausia australis: (figs. 8-11)

- CFA-IC 4428 (2), Misiones, dept. 25 de Mayo, lower arroyo Canal Torto, río Uruguay basin, coll. S. Bogan & J.M. Meluso, 04.05.2015
- CFA-IC 10549 (4) [ex ILPLA 549], Misiones, Nemesio Parma, río Parana basin, coll. A. Miquelarena & L. Protogino, Aug. 1993 [tentatively determined as *M. australis*]
- CI-FML 7800 (2), Corrientes, arroyo Pehuajó, río Parana basin, coll. G. Aguilera, B. Bugeau, F. Ruiz-Díaz & G.E. Terán, Dec. 2018

Moenkhausia forestii: (figs. 12, 13)

- CFA-IC 25 (6), Corrientes, dept. Ituzaingó, Isla del Agipé, laguna Camba Cué, coll. 06.11.2007
- CFA-IC 407 (1), Corrientes, laguna del Iberá, coll. S. Bogan, Oct. 2009
- CFA-IC 7115 (3), Formosa, city of Formosa, puente en el circuito Sur, Costanera, riacho Formosa, coll. P. Minotti & F. Brancolini, 16.09.2015
- CFA-IC 10050 (2) [ex ILPLA 50], Chaco, Isla del Cerrito, Madrejón Chaqueño, mouth of río Paraguay into río Paraná, coll. 25.11.1982
- CFA-IC 10672 (2) [ex ILPLA 672], Formosa, dpto. Formosa, riacho Timbo-Porá, coll. H. López, R. Menni & J. Casciotta, Aug. 1986
- MHNG 2676.092 (1), Corrientes, depto. Itatí, village of Corza-Cué, Paraná river at arrocera Puerto Rzepecki, RN 12, km 1.126, 27°18'47"S-57°53'36"W (taken from Google Earth), coll.: S. Koerber and J.O. Fernández Santos, 21.09.1995 (fig. 6)
- MHNG 2678.042 (2), Corrientes, depto. San Cosme, RN 12, km 1.072, permanent lake in the premises of Olho-Porá, 27°22'34"S-58°23'47"W (taken from Google Earth), coll.: S. Koerber and J.O. Fernández Santos, 23.09.1995 (fig. 7) [Azpelicueta & Koerber 2017: locality and co-fauna]
- ZMB 23687 (2), Corrientes, city of Corrientes, río Paraná, coll. C. Hahn, ~1935 (figs. 4, 5)



fig. 6. Paraná river at Puerto Rzepecki in Corrientes, collection locality of MHNG 2676.092



fig. 7. Laguna in the premises of Olho-Porá, Corrientes, collection locality of MHNG 2678.042



fig. 8. *Moenkhausia australis*: CFA-IC 4428, Misiones, lower arroyo Canal Torto, río Uruguay basin



fig. 9. *Moenkhausia australis*: right after capture, specimen from CI-FML 7800, Corrientes, arroyo Pehuajó, río Parana basin



fig. 10. *Moenkhausia australis*: CI-FML 7800, male, Corrientes, arroyo Pehuajó, río Parana basin



fig. 11. *Moenkhausia australis*: CI-FML 7800, female, Corrientes, arroyo Pehuajó, río Parana basin



fig. 12. *Moenkhausia forestii*: CFA-IC 25, Corrientes, Isla del Agipé, laguna Camba Cué



fig. 13. *Moenkhausia forestii*: CFA-IC 10050], Chaco, Isla del Cerrito, mouth of río Paraguay into río Paraná

Discussion

Moenkhausia australis is readily distinguished from *M. forestii* and *M. sanctaefilomenae* by the complete lateral line (vs. interrupted). Both *M. australis* and *M. forestii* are further distinguished from *M. sanctaefilomenae* by the presence of 5 transverse scales between dorsal-fin origin and the lateral series (vs. 4) and 4 between the lateral line and anal-fin origin (vs. 3). These three species are distinguished from *Moenkhausia oligolepis* by the lower number of scales in the lateral series (23-27 in *M. australis*, 23-26 in *M. forestii*, and 22-24 in the types of *M. sanctaefilomenae* vs. 28-31 in *M. oligolepis*) (Eigenmann 1917, Benine et al. 2009, Reia et al. 2019).

The type localities of *M. australis* and *M. forestii* are located in the Paraguay River basin of Paraguay and Brazil, respectively, with an evidences for sympatry provided by illustrated specimens of *M. forestii* (fig. 1) and *M. australis* (fig. 2) collected by Haseman in Cáceres, Mato Grosso, Brazil, readily identifiable by the interrupted vs. complete lateral line. We present evidence for both species to occur in the lower Paraná and Uruguay basins in Argentina. The distribution of each species in Argentina, however is still not known in detail and there is, instead, scattered information about them, with all the reported lots containing only one of these species. Studies of both, the degree of sympatry and syntopy of *M. australis* and *M. forestii*, and of reproductive aspects preventing the hybridization of these closely related species are still needed. The type locality of *M. sanctaefilomenae*, instead, is in the Parnaíba River basin in Brazil and its occurrence in other basins is uncertain since the description of *M. forestii* (Benine et al. 2009) and resurrection of *M. australis* (Reia et al. 2019). According to our

conclusions, all the specimens of *Moenkhausia sanctaefilomenae* reported previously from Argentina are in fact either *M. australis* or *M. forestii*.

Finally, the generic allocation of these species in *Moenkhausia* was challenged repeatedly in published phylogenetic analyses (Mariguela et al. 2003, Mirande 2010, Oliveira et al. 2011, Mirande 2019). In these articles the species of red-eye *Moenkhausia* were obtained instead as related with the currently monotypic genus *Bario*, embedded in a '*Bario* clade' by Mirande (2019). However, more studies are still needed to get support and morphological diagnoses for any generic reorganization of the species included now in *Moenkhausia*.

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