

The taxonomic status of *Phalloceros uai* (Poeciliidae: Cyprinodontiformes) in the Quadrilátero Ferrífero, Brazil

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INTRODUCTION & AIM

The genus *Phalloceros* Eigenmann, 1907, comprising small-sized species, is one of 27 valid genera within the Poeciliidae family, with a distribution across watersheds in southern and southeastern South America¹.

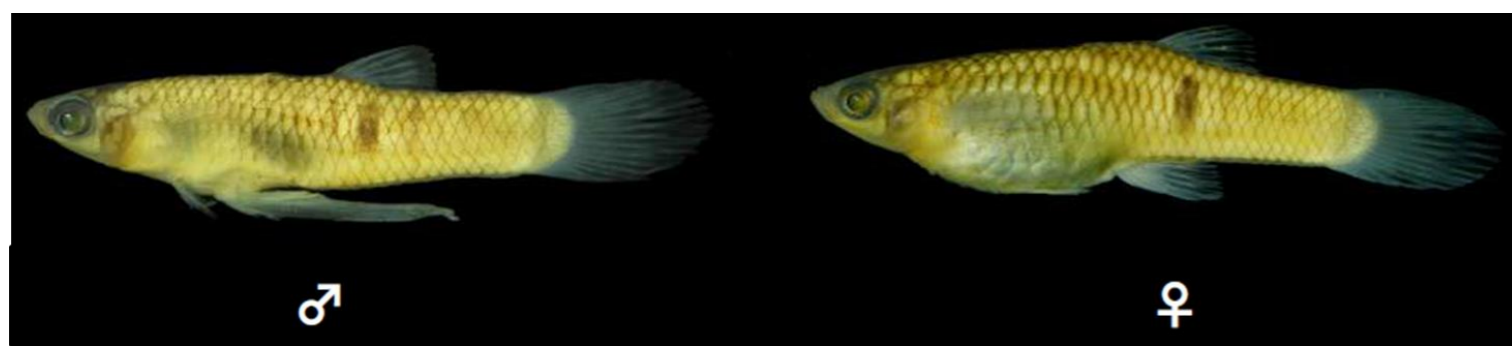


Figure 1: *Phalloceros uai* Lucinda, 2008 specimens, male (left) and female (right). Source: Vieira et al., 2015.

- Phalloceros uai* Lucinda, 2008, is autapomorphically diagnosed by a large, square lateral spot in larger specimens. However, the reliability of the lateral spot pattern as an autapomorphy for *P. uai* has been questioned, as Thomaz et al. (2019) reported specimens lacking this character in the São Francisco River basin.
- Amaral et al. (2015) found a small genetic distance (0.8%) between *Phalloceros anisophallos* Lucinda, 2008, from Ilha Grande and Parati (RJ) and *P. uai*, suggesting potential synonymy.
- Originally described as endemic to the Velhas River, later studies expanded the recorded distribution to the Cipó River and the Velhas River channel^{4,5}, the Piracicaba River⁶ and Santo Antônio River drainages⁷.

Given these divergences in current knowledge regarding geographic distribution, morphological and genetic identification, and the scarcity of natural history studies, this work aimed to employ an integrative taxonomic approach to evaluate the true status of *P. uai* specimens from the upper Doce River (Piracicaba sub-basin) and São Francisco River basin (Paraopeba and Velhas sub-basins).

METHOD

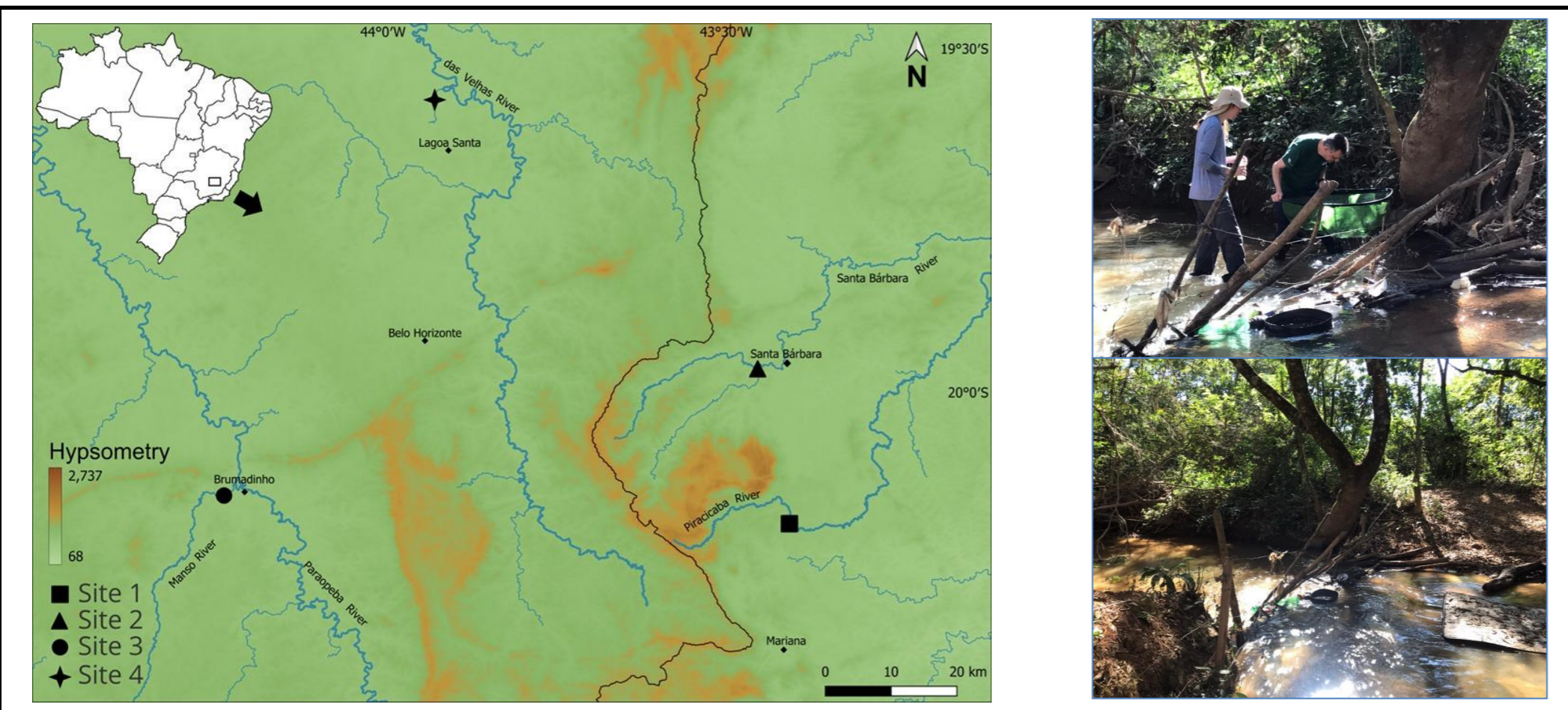


Figure 2: Sampling sites of *Phalloceros* populations in the upper Rio Doce and Upper São Francisco drainages, MG.

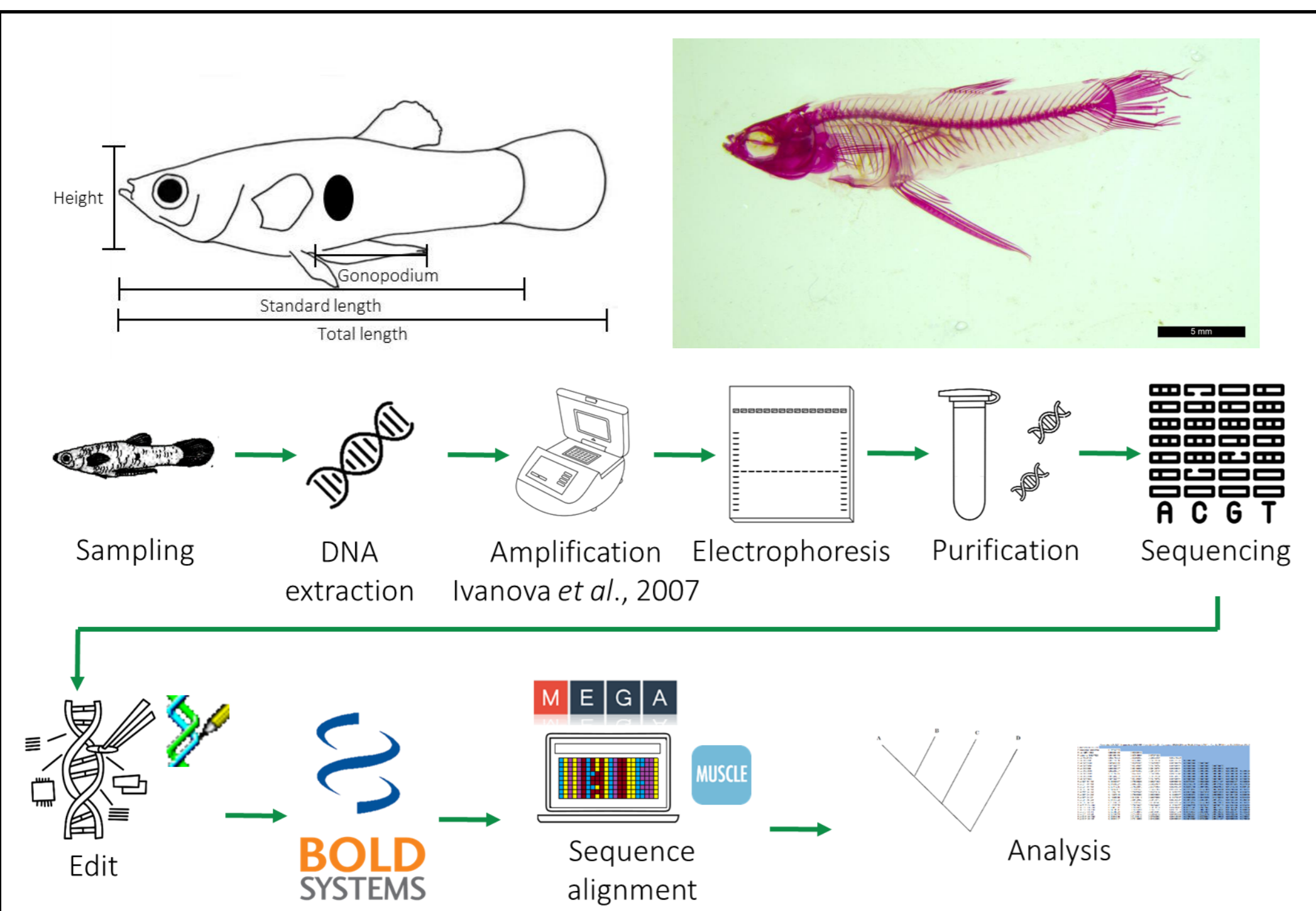


Figure 3: Methodology scheme. All specimens collected were measured. 19 males and 3 females were cleared and stained for osteological analysis. 16 specimens were selected for DNA extraction, amplification and sequencing.

RESULTS & DISCUSSION

- A total of 1622 specimens were sampled, exhibiting six different phenotypes (1x1, 1x2, 1x3, 2x2, 2x3 and 3x3 lateral spots).
- Phenotypes differing from the original description of *P. uai* were observed in all populations except those from the Rio das Velhas.
- Total length ranged from 8.21 – 48.60 mm, standard length from 6.67 – 42.17 mm, and height from 0.87 – 11.47 mm.
- Females generally attained larger sizes and heights, with greater variation, attributable to sexual dimorphism and abdomen dilation when pregnant.
- The mean values of inferred genetic distance based on the K2P model resulted in approximation of less than 2% between *P. uai* sequences and more than 2% between its congeners

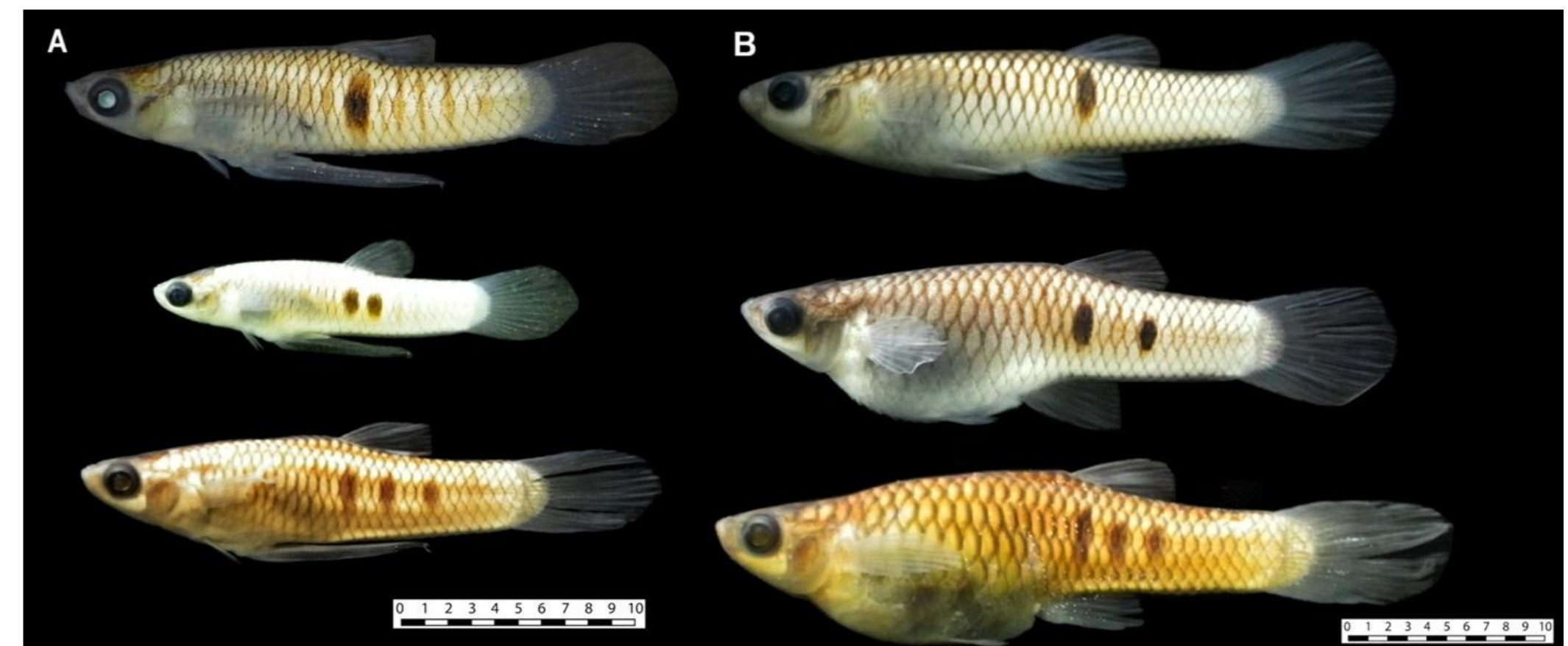


Figure 4: Phenotypes of *Phalloceros uai* male (left) and female (right) collected in this study.

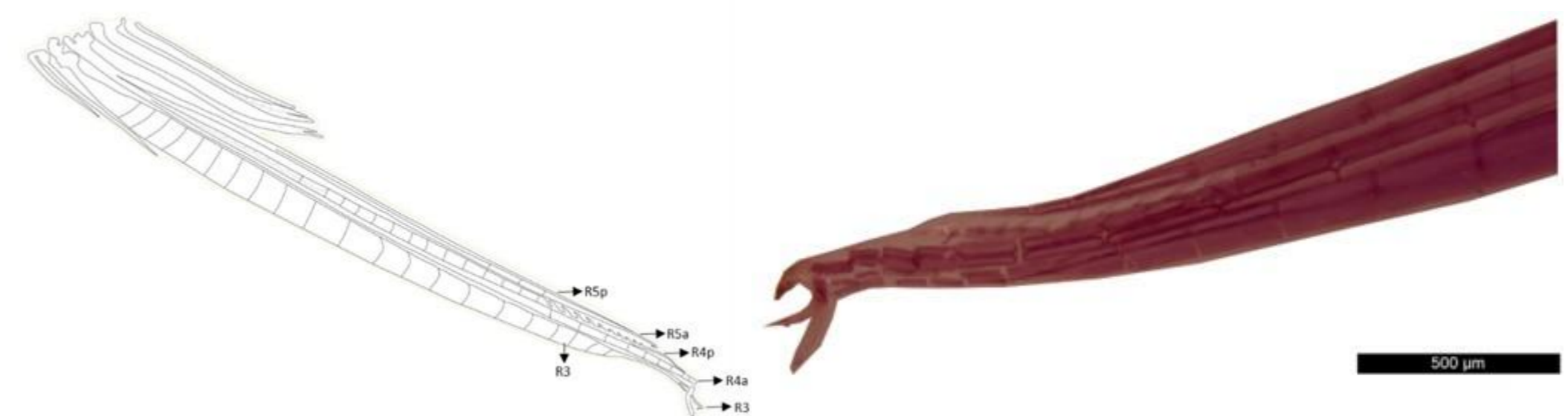


Figure 5: Gonopodium of *Phalloceros uai* having a left hook on the gonopodium, an asymmetrical gonopodial appendage (right wider than the left), a canoe-shaped ray 5, a serrated structure on ray 4p, and radius 3 with spines and extensions, consistent with original description. (A) Drawing of the left view, (B) Picture of the right view.

In poeciliids, coloration patterns are influenced by predation⁸, female mate choice^{9,10,11}, environmental factors such as background color¹¹ and luminosity¹⁰, and intrinsic factors including stress, age, genetics¹², and thyroid hormones¹³.

- Due to the lack of contemporary knowledge regarding color patterns in *Phalloceros* under varying environmental conditions, the polymorphism reported here cannot be definitively evaluated. Nevertheless, despite the phenotypic differences, other morphological characters were consistent with original diagnosis.
- We did not evaluate the genetic distance between *P. anisophallos* and *P. uai* since no data was available for *P. anisophallos* and we did not obtain samples for comparison. Further investigation is required to support Amaral et al. (2015) statement.

CONCLUSION

- Our data did not reveal sufficient morphological and molecular differences to classify these populations as distinct species, aligning with the original diagnosis, despite diverging from the lateral spot pattern autapomorphy used by Lucinda (2008).
- The diagnosis of *P. uai* requires expansion to incorporate the phenotypic variation observed in this study.
- Its geographic distribution is expanded and confirmed for the sub-basins of the Paraopeba River (São Francisco basin), and for the sub-basins of the upper Piracicaba River and Santo Antônio, both within the Doce river basin.
- Further studies are necessary to ascertain the origin and role of the observed color pattern differentiation in *P. uai* in allopatric differentiation among different populations.

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