

Plan Overview

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Title: An integrated taxonomic investigation into the identity of *Corydoras julii*, with comparisons with allied forms (Siluriformes: Callichthyidae)

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Funder: São Paulo Research Foundation (fapesp.br)

Template: Digital Curation Centre (português)

Project abstract:

With more than 200 valid species recorded, *Corydoras* is the richest genus in the neotropical catfish family Callichthyidae. Despite prolific description of species, there has been limited revisionary work on the taxonomy of *Corydoras*, so that many hidden species, as well as synonyms, are expected to exist in the genus. The research herein proposed aims to conduct a comprehensive taxonomic revision of *Corydoras julii*, based on material deposited in museums worldwide, and to unravel the actual taxonomic boundaries, variation, diagnosis and geographical distribution of the species. Extensive recent collection efforts in the Parnaíba and Lower Tocantins basins have yielded various forms potentially allied to, yet not conspecific with, *Corydoras julii*, which have not been studied in detail and are simply identified provisionally as *Corydoras julii*. A taxonomic revision on *Corydoras julii* and its allied forms is necessary to untangle an apparently complex situation. As a taxonomic revision project that employs a multidimensional approach (i.e., morphological, osteological and molecular analyses) to delimit potential hidden species, this work aims to lay the groundwork for future taxonomic work on species groups that are highly similar morphologically, and where morphological diagnosis alone may not be sufficient to properly delineate species. Additionally, the research will contribute to understanding of the diversity of *Corydoras* in the Parnaíba basin, a region that remains relatively under-sampled in comparison with other major neotropical basins. With only three *Corydoras* species described from the basin, discovery of any new species will be highly significant for the ichthyological diversity of the region. Finally, species of *Corydoras* are highly targeted in the ornamental fish trade and therefore deserving of special conservation attention. Taxonomic research is fundamental in conservation management, providing fine-scale knowledge for realistic estimates of species diversity.

Start date: 07-25-2023

End date: 07-25-2025

Last modified: 03-06-2024

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An integrated taxonomic investigation into the identity of *Corydoras julii*, with comparisons with allied forms (Siluriformes: Callichthyidae)

Conformed to the multidimensionality of taxonomic research, this project will involve the collection of (1) morphometric, (2) osteological, (3) molecular, and (4) geographical data of the species *Corydoras julii* and its allied forms. All data will be collected from specimens deposited in Brazilian and/or overseas museums.

No collection work will be taken place since the materials are all readily deposited in worldwide museums. In this project, the majority of museum specimens are deposited in the Museum of Zoology of the University of São Paulo (MZUSP), the National Museum (MNRJ) and the Federal University of Paraíba (UFPB). Additional museum specimens may be acquired from overseas museums, namely The Smithsonian Institutions.

This project will not involve the use of metadata. Instead, the data obtained from this taxonomic research will be integrated with the already available taxonomic data of species of *Corydoras* to elucidate the phylogenetic relationship among different *Corydoras* species. Considering the fact that the diversity of *Corydoras* is significantly underestimated, with many species yet to be described or wrongly described as corroborated by recent studies, the collection of said data will undoubtedly contribute to the enhancement of current metadata on the phylogeny of *Corydoras*.

Inasmuch as the Museum of Zoology is regulated by the ICOM Code of Ethics for Natural History Museums, protocols of preparation of animal specimens are conformed with the ethical guidelines proposed in the ICOM Code that ensures minimal sufferings of animals, besides which the legality of the source of museum specimens is ensured.

Question not answered.

The data collected can be categorized in four major groups, namely (1) morphometric, (2) osteological, (3) molecular, and (4) geographical variables, all of which are recoverable and will be backed-up in the work computer. For morphometric data, all data collected will be saved in an Excel document, same for osteological data. As for geographical variables, i.e., localities, they will be imported in Google Earth and subsequently exported to QGIS for data processing

In regard to the standardization of taxonomic data, identification of species will involve a standard taxonomy whenever possible. In the case of Siluriformes, there have been reported cases of incongruence in taxonomic data (e.g., morphological vs. genetic; see research proposal). Hence, delimitation of species will likely involve a multidimensional approach, and this will be standardized in this project. Besides, references used for taxonomic identification will be provided. These include technical document, journal article, book, database etc. Standardized identification systems such as Integrated Taxonomic Information System will be consulted.

All data will remain confidential until the end of the project. This will be ensured by the fact that all data processing work will only be conducted in my work computer that nobody else but the project proponent himself can have access to. All data will be automatically backed-up to prevent loss of data in case of accident.

Morphometric & osteological data:

If new species is/are discovered, the materials used in the project will be designated as type specimens. Then, all morphometric and osteological data collected will serve as diagnostics of that new species and hence should be preserved long-term, as these data will be useful in future phylogenetic and taxonomic studies. Any new species

discovered will be scientifically described and published so that a public record will be available. CT scan images of the topotype will be deposited in MorphoSource.

Molecular data:

COI sequences will be obtained and edited, which will be subsequently deposited in GenBank such that all molecular data are easily accessible to other researchers. In the context of *Corydoras julii*, while COI gene of this species has already been sequenced, its species identity remains in doubt. Hence, by sequencing *Corydoras julii* from different river basins, not only can the genetic diversity of different populations be better understood, but these genetic data will be useful in delimiting *Corydoras julii* from its allied forms, ensuring its species identity and hence the validity of their sequence data in Genbank.

All aforementioned data collected will be deposited in the databank of the Museum of Zoology of the University of São Paulo such that the results of the project will be integrated as part of institutional repository. This would not only ensure long-term preservation of such data, but also facilitate exchange of data among national and international institutions.

The data obtained will be published in internationally recognized journals, with preferences for high-impact factor journals such as Zootaxa and Neotropical Ichthyology. Other forms of dissemination, such as articles in magazines like Revista Fapesp are also proposed herein. Apart from conventional ways in sharing scientific knowledge, social media has cemented itself as an important and extremely useful information channel to divulge information to society, for which the proponent of the project will utilize the platform and divulge my research result in Chinese, English and Spanish. To ensure data preservation, sharing will only be made available to the public after the results are published in qualified scientific journals.

No

The proponent of the project, Lam Shu Him, will be responsible for the management of data. His supervisor, Prof. Mario César Cardoso de Pinna, will provide necessary assistance in it.
