

Project Update: September 2022

Introduction

Tropical forests have high diversity but the decrease in their area is due to fragmentation and human actions which are partly responsible for the disappearance of more than 7% of the species present under tropical habitats (Perfecto and Vandermeer 2008). Benin has more than 16842 species of fungi (Piepenbring et al. 2020) but only 2% have been determined, this small percentage of determined diversity includes species that are threatened. However, the knowledge available on fungi, their role and their importance in ecosystems remains fragmentary. Many fungi remain associated with forest trees, so threats to forest ectomycorrhizal trees affect indirectly fungi. The most common threats are related to habitat degradation and logging (Yorou and De Kesel 2011). With this habitat degradation, many species may disappear without being known. It is therefore essential to take concrete measures to limit the threats of extinction which today weigh on fungal biodiversity. Thus, this report aims to: (1) contribute to fungal diversity assessment in north Benin, (2) contribute to the delimitation of fungal habitats with high diversity through installation of wild fungal warning signs to safeguard the fungi in Benin and (3) convince the authorities to take into account the various threats to fungi and will be more open to their integration into development plans to promote mycodiversity conservation.

Methodology

Assessment of the level of knowledge of local populations on conservation laws in Benin

The overall sample size was determined using the method of Rea et al. (1997). The semi-structured interview technique was used using a pre-established survey questionnaire. This questionnaire was designed on the Kobotoolbox platform and deployed in the KoBoCollect application for field data collection. Respondents' socio-demographic data were collected and analysed. In addition, their level of knowledge in relation to various offences as well as the penal sanctions described by the Beninese legislator in the code governing the forest regime in the Republic of Benin was collected and interpreted.

Data collection and Molecular identification

The vegetation dominated by *Berlinia grandiflora* (Vahl), *Isobertia doka* Craib. & Stapf, *Isobertia tomentosa* (Harms) Craib & Stapf, *Uapaca somon* Aubrév. & Léandri Syn. and *Uapaca togoensis* Pax were identified for fungal data collection and opportunistic collection method based on transects lines of 1000 × 10 m (Yorou et al. 2001) was used from June to August 2022. A total of 40 transects lines were traced in each forest, starting from the east, the centre and the west.

All fungi sample were geo-referenced, photographed, collected, described morphologically, cleaned and preserved by drying with an electric dryer (type Stöckli Dörrex) for 24 hours at 45°C and deposited at the Mycological herbarium of Parakou University (UNIPAR). The genomic DNA was extracted using dried samples, following the NuClean Plant Genomic DNA kit (ComWin Biotech, Beijing). The primers ITS1F/ITS4 were used for polymerase chain reaction (PCR) and the sequencing (Gardes and Bruns 1993).

Results

Knowledge of local populations on habitats conservation laws in Benin

A total of 128 people were randomly surveyed: 20 in Kouaba, 27 in Tchapeta, 28 in Kougnangon and 53 in Koussoucoingou. Then, the size of the sample of each of the four localities to be investigated was determined in proportion to the number of inhabitants who live there. The age of the people surveyed varied between 17-86 years. 79.68% of respondents are farmers, therefore those who degrade forest habitats in search of fertile land. About 82% of the local population have knowledge of the conservation laws in force in Benin and are either informed by conservation NGOs, the forestry administration, or local authorities through awareness campaigns. But around 18% of the local population has no information on the existence of a conservation law and does not know of any sanctions on the destruction of forests in Benin. In order to inform them, raise their awareness and improve their knowledge of conservation laws, we have initiated awareness campaigns as well as explanations of wild fungal warning signs in order to draw their attention to the conservation of mushrooms.

Wild fungal warning signs

In each target forest, the wild fungal warning signs are installed. These permanent signs are positioned in key places such as the welcome, tourist passage lines, farmers passage lines and loggers passage lines to draw the attention of many people on fungi. The wild fungal warning signs are used to signal the presence of habitats with high diversity of fungi and the various critically endangered species. These graphics designs illustrate the link between trees and fungi to facilitate understanding as well as environmental destruction activities to avoid the destruction of fungal habitat.





Fig 1. Realization and explanation of wild fungal warning signs

These wild mushroom warning signs will facilitate ongoing communication between local people and mushrooms and their habitats for sustainable mushroom conservation.

Fungal diversity in Koussoucoingou and Kota galleries forests

The sampled are distributed into the following families: Russulaceae Lotsy, Boletaceae Chevall., Agaricaceae Chevall., Amanitaceae E.-J. Gilbert, Sclerodermataceae Corda, Clavulinaceae Donk and Tricholomataceae R. Heim ex Pouzar. The high diversity was obtained in the family Russulaceae with 104 collections dominated by the species *Lactifluus gymnocarpoides* (Verbeken) Verbeken and *Russula congoana* Pat. Moreover, the lowest diversity is obtained in the Tricholomataceae family with a single collection.



Fig 3. Installation of wild fungal warning signs in the forests

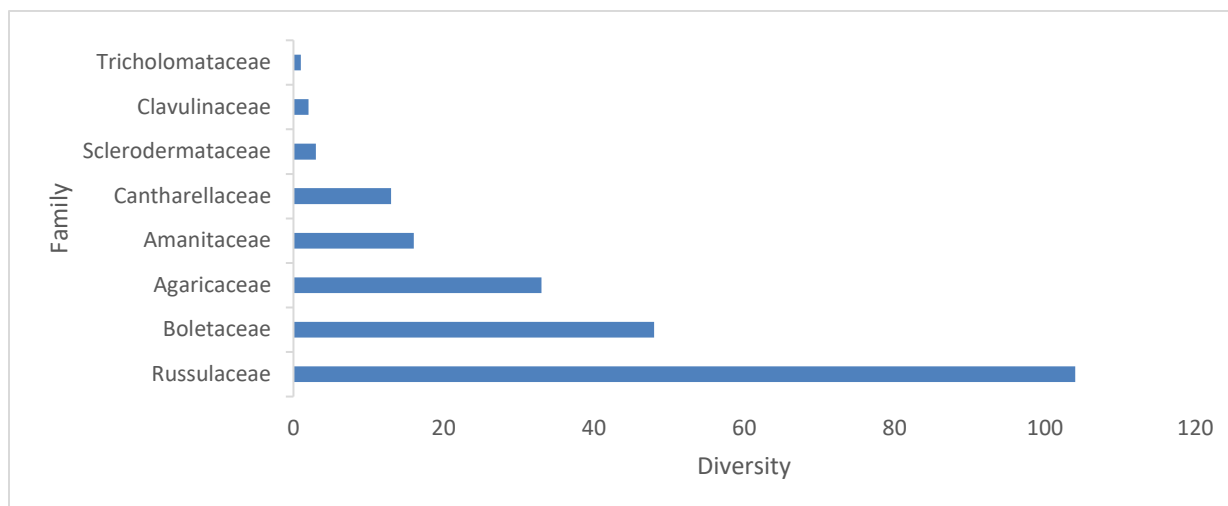


Fig 4. Fungal diversity in in Koussoucoingou and Kota galleries forests.

The figures below (Fig 5-8) present some species collected and stored in the Mycological Herbarium of the University of Parakou (UNIPAR).

Boletaceae



Fig 5. A. *Boletus* sp. (NY0004), B. *Boletus* sp. (NY0035), C. *Boletus* sp. (NY0043) and D. *Boletus* sp. (NY0075).

Russulaceae



Fig. 6. A. *Russula* sp (HLA0919), B. *Russula* sp. (HLA0904), C. *Russula* sp. (NY00137) and D. *Lactifluus* cf. *flammans* (NY0053).

Cantharellaceae

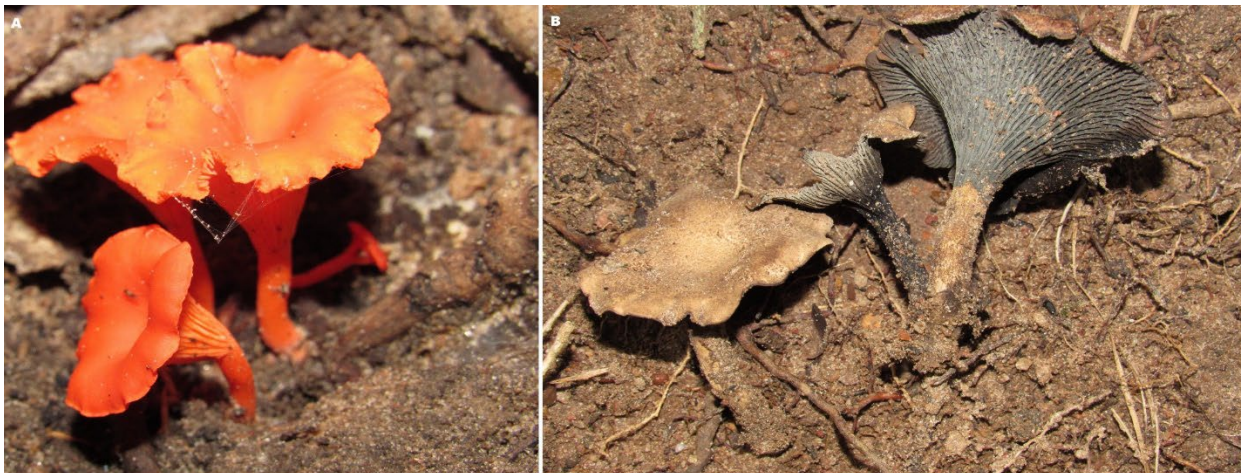


Fig 7. A. *Cantharellus addaiensis* Henn. (HLA0812) and B. *Cantharellus congolensis* Beeli (HLA0813)

Amanitaceae



Fig.8. A. *Amanita subviscosa* Beeli (NY0049), B. *Amanita* sp. (HLA0428), C. *Amanita* sp. (NY0031) and D. *Amanita masasiensis* Härk. & Saarim.

New sequences generated

Unidentified species have been sequenced and the sequences have been published in Genbank. Table 1 presents the list of species and their accession number.

Species	Voucher	Accession number
<i>Chlorophyllum globosum</i> (Mossebo) Vellinga	HLA0783	OP218484
<i>C. globosum</i>	HLA0783a	OP218485
<i>C. globosum</i>	HLA0784	OP218486
<i>C. globosum</i>	HLA0784a	OP218487
<i>C. globosum</i>	HLA0785	OP218488
<i>Chlorophyllum</i> sp.	HLA0737	OP218492
<i>Chlorophyllum</i> sp.	HLA0738	OP218493
<i>Chlorophyllum</i> sp.	HLA0740	OP218494
<i>Russula</i> sp.	HLA0786	OP218497

Conclusion and recommendation

This project presents a major contribution to the conservation of fungal diversity in Benin. It will help to improve law enforcement to curb the destruction of fungal habitats. In addition, it will contribute to the delimitation of fungal habitats with high diversity through installation of wild fungal warning signs to safeguard the fungi in Benin. The project will strengthen the knowledge of local populations about conservation of fungal species through awareness campaigns and popularisation of forest conservation law. These actions will convince the authorities to consider the various threats to fungi and will be more open to their integration into development plans to promote mycodiversity conservation. In addition, this project will increase the fungal sampling efforts at the national level. The collected samples will be helpful to enrich the Mycological Herbarium of Parakou University and will be used as educational and conservation materials.

Acknowledgment

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