BOOK OF ABSTRACTS

First International Symposium in Tropical African Mycology (FISTAM)

Exploring Tropical African Mycodiversity: Progress, Facilities and Challenges

- Fungal diversity
- Molecular systematics
- Bio-informatics
- Pathogenic fungi
- Medicinal mushrooms
- Conservation
- Ethnomycology
- Mushroom cultivation
- Mycorrhizal symbiosis
- Termites-fungi interactions

ASSOCIATE EDITORS
Nourou S. Yorou, Associate Professor
Meike Piepenbring, Professor

9th to 13th September, 2019
Parakou, Benin

University of Parakou, Benin

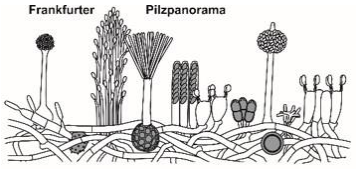
Front cover Photo caption / Légende photo première de couverture :
Cookeina tricholoma, Pobè, Bénin.
© J. Christan (2004)

Back cover Photo caption / Légende photo quatrième de couverture :
Favolaschia calocera, Kpalimé, Togo.
© NS Yorou (2008)

Annales de l'Université de Parakou

Revue publiée par le Vice Rectorat chargé de la Recherche Universitaire (RU/UP)
Université de Parakou, BP 123 Parakou (Bénin) ; Tél/Fax : (229) 23 61 07 12
Email : revue.sna.annales-up@fa-up.bj

Série « Sciences Naturelles et Agronomie »



Book of Abstracts

First International Symposium in

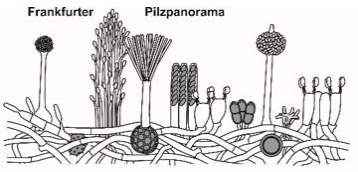
Tropical African Mycology (FISTAM)

www.fistam.leb-up.org

Exploring Tropical African Mycodiversity: Progress, Facilities and Challenges

University of Parakou, Benin
9th to 13th September, 2019
Parakou, Benin

Associate editors:
Nourou S. Yorou, Associate Professor
Meike Piepenbring, Professor



Livre des résumés

Premier Atelier International de Mycologie d'Afrique Tropicale (PAIMAT)

www.fistam.leb-up.org

Exploration de la Mycodiversité d'Afrique Tropicale; Progrès, Facilités et Défis

Université de Parakou, Bénin
9 au 13 Septembre, 2019
Parakou, Bénin

Editeurs associés :
Nourou S. Yorou, Maître de Conférences
Meike Piepenbring, Professeur titulaire

Associate Editors / Editeurs associés : Nourou S. Yorou & Meike Piepenbring
Title / Titre : Book of Abstracts - First International Symposium in Tropical African Mycology (FISTAM). 9th to 13th September, 2019, Parakou, Benin.
ISBN : 978-99982-0-141-5
Legal Deposit / Dépôt légal : n°11577 du 02/09/19, Bibliothèque Nationale du Bénin, 3ème trimestre.

Sponsors and acknowledgment

The organizing committee as well as all the participants of the First International Symposium in Tropical African Mycology (FISTAM) are much indebted to the following organizations for their financial and technical supports:

Volkswagen Foundation.
Under its funding programme: Knowledge for tomorrow-cooperative Research projects in Sub-Saharan Africa.

The University of Parakou

The Faculty of Agronomy

Technical, administrative and logistic facilities have been secured by:

Forewords by the Organising committee

It is a great pleasure to notice that the *First International Symposium in Tropical African Mycology (FISTAM)* received a broad resonance within the international mycological arena. Following the first announcement dated 15th May 2019, we received an increasing number of applications and abstract submissions, attesting a strong interest to promote mycology in tropical Africa. Over 135 abstracts have been submitted within the 11 subtopics of the symposium. To fit with our aim to promote promising mycological research on tropical African fungi, all submitted abstracts went through a strict peer-review process by international experts. We considered the scientific quality of the abstract as well as the scientific background of the applicants and selected a total of 74 abstracts that are included in the present book along with the 11 key note abstracts.

Mycology is experiencing rapid changes in terms of methods and techniques of study. In a similar way, the boom and the remarkable results generated during the last two decades, thanks to current modern techniques, provide numerous ways for practical applications of fungi in our life. Particularly in the context of tropical Africa, the potential of fungi to sustain agriculture, health, food industry, environmental protection, among others, is huge and promising, as long as the properties of fungi are adequately known via most modern techniques

of study. To better disseminate and learn about modern methods, results and trends, physical meetings between experienced mycologists from modern laboratories and junior researchers, are most needed. The goal of the present symposium is to bring together M.Sc., Ph.D. students and early career (postdoctoral) mycologists with senior ones in a single arena for knowledge exchange.

This is possible thanks to a generous financial support provided by the Volkswagen Foundation (Germany). It has been possible to provide travel grants to 32 applicants. Many other selected applicants use own resources to form part of this event. A total of 80 participants, including mostly native African mycologists, is expected to actively take part in this first mycological event in tropical Africa. The scientific activities of the symposium include plenary talks by worldwide experts, parallel sessions that are nourished by presentations by African native junior mycologists and group discussions. The 11 key note talks will path the way for parallel sessions. From a total of 73 oral and poster presentations during the parallel sessions, we expect to depict methodological challenges that will be debated during group discussion. During five days, tropical African mycology will be considered from different perspectives, with the goal to upgrade the skills of junior participants towards optimizing the use and control of fungi in agriculture, forestry, food industry and security.

We are convinced that the present symposium not only improves the scientific competence of African junior mycologists, but also assembles mycologists with similar research interests into a unique international

network. This network will rise to the surface a promising but neglected biological field full of possibilities.

We hope that the present symposium is the first of a series of similar activities that will be organized in future by the newly established "*Association for Tropical African Mycology* (ATAMy)". It is also our wish that the promotion of excellent mycological research becomes a tradition within the ATAMy.

We address special thanks to our donor (Volkswagen Foundation) and to all other institutions who facilitate the realisation of this symposium. Among others, the Faculty of Agronomy of the University of Parakou (Benin), the Goethe University Frankfurt am Main, the Centre for Interdisciplinary Research in Africa (ZIAF-University of Frankfort), the municipality of Parakou, the Ministry of Higher Education and Research (MESRS) and the media service. Special thanks to the editorial committee of the Annales de l'Université de Parakou, Série "Sciences Naturelles et Agronomie" for their invaluable assistance with the edition of this book.

We wish all the best to the newly establish Association!

Cordially yours,

Associate Prof. Dr. Nourou S. Yorou

Prof. Dr. Meike Piepenbring

Symposium sub-topics

Global topic: Exploring Tropical African Mycodiversity: Progress, facilities and challenges

Symposium sub-topics:

Sub-topics and sessions	Key note speaker	Session leaders
Sub-topic 1: History and present knowledge of fungal diversity in West Africa	Prof. Dr. Meike Piepenbring	Prof. Meike Piepenbring & Assoc. Prof. Nourou S. Yorou
Sub-topic 2: Diversity, molecular systematic and phylogeny of tropical African fungi	Prof. Dr. Annemieke Verbeken	Prof. Annemieke Verbeken & Prof. Meike Piepenbring
Sub-topic 3: Environmental samples, soil fungi and bio-informatics	Prof. Dr. Leho Tedersoo	Prof. Leho Tedersoo & Dr. José Macia-Vicente
Sub-topic 4: Endophytic + plant pathogenic fungi and defence mechanism in plant	Dr. José Macia-Vicente	Dr. Jose G. Maciá-Vicente & Assoc. Prof. Léonard Afouda
Sub-topic 5: Medicinal mushrooms and bio-activity in tropical African fungi	Prof. Dr. Kenneth Yonganbi Anchang	Prof. Kenneth Yonganbi Anchang & Dr. Marieka Gryzenhout
Sub-topic 6: Conservation of fungi and their habitat	Dr. David Minter	Dr. David Minter & Dr. André De Kesel
Sub-topic 7: Wild Edible fungi: biomass measurement, ethnomycology and sustainable exploitation	Dr. André De Kesel	Dr. André De Kesel & Assoc. Prof. Dr. Nourou S. Yorou

Sub-topic 8: Food borne fungi and mycotoxins	Dr. Bénoit Gnonlonfin	Gbemenou Joselin Benoit Gnonlonfin & Franck Hongbete
Sub-topic 9: Mushrooms cultivation for food security and development	Dr. Prosper Kiyuku	Dr. Prosper Kiyuku & Dr. Joyce Jefwa
Sub-topic 10: Mycorrhizal symbiosis and regeneration of tropical African forests	Prof. Dr. Amadou Bâ	Prof. Dr. Amadou Bâ & Dr. Ralph Mangelsdorff
Sub-topic 11: Termites-Fungi interactions in tropical Africa	Assoc. Prof. Dr. Michael Thomas-Poulsen	Assoc. Prof. Dr. Michael Thomas-Poulsen & Dr. Ngolo A. Koné

Sous-thèmes de l'atelier

Thème général : Exploration de la mycodiversité d'Afrique tropicale: Progrès, facilités et défis

Sous-thèmes de l'atelier :

Sous-thèmes et sessions	Conférencier	Modérateurs de sessions
Sous-thème 1: Histoire et connaissances actuelle de la diversité fongiques en Afrique de l'Ouest	Prof. Dr. Meike Piepenbring	Prof. Meike Piepenbring & Dr. Nourou S. Yorou
Sous-thème 2: Diversité, systématique moléculaire et phylogénie des champignons d'Afrique Tropicale	Prof. Dr. Annemieke Verbeken	Prof. Dr. Annemieke Verbeken & Prof. Dr. Meike Piepenbring
Sous-thème 3: Echantillons environnementaux, champignons du sol et Bio-informatique	Prof. Dr. Leho Tedersoo	Prof. Dr. Leho Tedersoo & Dr. José Macia-Vicente
Sous-thème 4: Les endophytes, les champignons pathogènes et mécanisme chez les plantes	Dr. José Macia-Vicente	Dr. Jose G. Maciá-Vicente & Dr. Léonard Afouda
Sous-thème 5: Champignons médicinaux et bio-activité chez les champignons d'Afrique tropicale	Prof. Dr. Kenneth Yonganbi Anchang	Prof. Dr. Kenneth Yonganbi Anchang & Dr. Marieka Gryzenhout
Sous-thème 6: Conservation des champignons et de leur habitat	Dr. David Minter	Dr. David Minter & Dr. André De Kesel

Sous-thème 7: Champignons sauvages comestible: mesure de biomasse, ethnomycologie et exploitation durable	Dr. André De Kesel	Dr. André De Kesel & Dr. Nourou S. Yorou
Sous-thème 8: Les champignons des aliments et les mycotoxins	Dr. Bénoit Gnonlonfin	Gbemenou Joselin Benoit Gnonlonfin & Dr. Franck Hongbete
Sous-thème 9: Culture des champignons pour la sécurité alimentaire et le développement en Afrique	Dr. Prosper Kiyuku	Dr. Prosper Kiyuku & Dr. Joyce Jefwa
Sous-thème 10: Champignons mycorrhiziens et régénération des forêts d'Afrique Tropicale	Prof. Dr. Amadou Bâ	Prof. Dr. Amadou Bâ & Dr. Ralph Mangelsdorff
Sous-thème 11: Interaction champignons-Termites en Afrique Tropicale	Prof. Dr. Michael Thomas-Poulsen	Dr. Michael Thomas-Poulsen & Dr. Ngolo A. Koné

Summary of the symposium activities

Sunday, September 8th, 2019

Arrival of participants and installation in Parakou

Registration to the symposium, Hotel terrace, third floor

Monday, September 9th , 2019

Morning

- *08h00-10h20:* Inaugural ceremony
- *10h20-12h00:* Plenary sessions for subtopics 1, 3 and 11

Afternoon

- *13h30-14h30*: Plenary sessions for subtopics 2 and 6
- *14h30-17h40*: Parallel sessions for subtopics 1, 2, 3, 6 and 11

Tuesday, September 10th , 2019

Morning

- *8h00-9h30***:** Plenary sessions for subtopics 4, 5 and 8
- *9h30-12h15*: Parallel sessions for subtopics 4, 5 and 8

Afternoon

- *14h00-17h20*: Groups discussions on methodological aspects for subtopics 1, 2, 3, 4, 5, 6, 8 and 11
- *17h20-18h00*: Short presentation on Okpara forest to prepare the botanical, mycological and ecological excursion

Wednesday, September 11th, 2019

Botanical, mycological and ecological excursion at the Okpara forest

Thursday, September 12th 2019

Morning

- *8h00-9h00***:** Plenary sessions for subtopics 7, 9 and 10
- *9h00-13h05:* Parallel sessions for subtopics 7, 9 and 10

Afternoon

- *14h35-17h30*: Groups discussions on methodological aspects for subtopics 7, 9, 10

Friday, September 13th 2019

Morning

- *8h30-9h15**:*** Plenary discussions
- *9h15-12h00*: Establishing the *Association for Tropical African Mycology* (ATAMy)

Afternoon

- *14h00-17h00*: Closing ceremony
- *17h00*: End of the symposium

Contents

FISTAM 2019, 9 to 13 September

Parakou, Benin

ABSTRACTS

Session 1: History and present knowledge of fungal diversity in West Africa

Session Key Note Speaker: Prof. Dr. Meike Piepenbring, University of Frankfurt am Main, Germany

About Prof. Meike Piepenbring

Mycologist at the University of Frankfurt am Main, Germany, Lecturer in Mycology and Botany since 2002. From 2008 till 2009 she worked as a guest professor at Universidad Autónoma de Chiriquí, Panama (DAAD long-term scholarship). Head of a mycology research group with a focus on taxonomy, morphology, and systematics of plant parasitic microfungi, tropical mycology, and fungal diversity. She guided many research and teaching activities in Latin America (Panama, Costa Rica, Ecuador, Bolivia) and Benin.

ORAL TALKS

What do we know about fungal diversity in West Africa? Results from a checklist compilation

Meike Piepenbring[1*], Jose G. Maciá-Vicente[2], Nourou S. Yorou[3]

1 . *Institute of Ecology, Evolution and Diversity, Faculty of Biosciences, Goethe University Frankfurt am Main, Biologicum, Max-von-Laue-Str. 13, 60439 Frankfurt am Main, Frankfurt, Germany*
2. Goethe University Frankfurt am Main, Biologicum, Max-von-Laue-Str. 13, 60439 Frankfurt am Main, Frankfurt Germany,
3. Research Unit "Tropical Mycology and Plant-Soil Fungi Interactions-MyTIPS", Laboratory of Ecology, Botany and Plant Biology, Faculty of Agronomy, University of Parakou, BP 123, Parakou, Benin
**Corresponding author's contact: piepenbring@bio.uni-frankfurt.de*

Abstract

More than 10,000 records of species of fungi and fungus-like organisms were found in more than 800 publications and are compiled in the first checklist of fungi in West Africa. They represent more than 4,000 fungal species known for West Africa. These species are cited in the checklist together with information on their systematic position, ecology, host species, references to literature, and occurrence in West African countries. Relatively high species numbers are obtained for Ghana, Ivory Coast, Nigeria, and Sierra Leone, while for Gambia, Guinea-Bissau, Mali, and Niger only few species of fungi are known.

Mycological investigation in West Africa started at the end of the 18th century with European naturalists who travelled to West Africa. They were followed by mycologists, lichenologists, and phytopathologists from Europe, who carried out most mycological studies until the second half of the 20th century. Since 1950, African mycologists started to become increasingly numerous and productive.

We estimate that the species diversity presented in the checklist corresponds only to a small part of the fungal diversity present in West Africa. The incompleteness of the data is particularly evident by the fact that species accumulation curves to estimate the rates of species discovery are far from reaching saturation, and by the fact that a high number of the fungal species reported are cited only once in the literature. We are still in a pioneer phase of exploration of African fungal diversity!

Key words: *History of mycology in West Africa; pioneer phase of exploration; species accumulation curves; taxonomy*.

Systematic study of three new putative species for science belonging to the genera *Melanoleuca*, *Lactocollybia*, and *Pleurotus*

Maimouna Kane[1*], Kandioura Noba[1], Regis Courtecuisse[2]

1. *Laboratory of Botany and Biodiversity – University Cheikh Anta Diop of Dakar, Dakar, Senegal*
2. *Laboratory of Plant and Fungal Sciences of Lille 2, Lille, France*

**Corresponding author's contact: hawamaikane@yahoo.fr*

Abstract

Natural and environmental conditions in Senegal show that fungi have many natural environments at their disposal, influenced by climate, habitat diversity and plant diversity. It is therefore reasonable to expect, for this country, a significant fungal diversity. The result of Kane & Courtecuisse's (2013) bibliographic review shows that the fungal diversity of Senegal is largely ignored. A systematic inventory survey conducted in 2014 by Kane made it possible to inventory 82 species belonging to 41 genera, 23 families and 13 orders Homobasidiomycetes. Of these 82 taxa, 53 were actually identified. Of the remaining 29, 4 of them from the genera Lactocollybia, Melanoleuca, Pleurotus and Volvariella are probably new species for science. However, due to the lack of a molecular study, these species have not yet been published. In this work, we will present the ecological, macromorphological and micromorphological characteristics of three of them. In this order, the Melanoleuca, Lactocollybia and Pleurotus taxa will be presented. We hope to find them later again in the field and perform their molecular description to consider their publication as new species for science.

Key words: *Melanoleuca, Pleurotus, Lactocollybia, Senegal*.

A new species of *Pseudocercospora* on *Encephalartos barteri* from Benin

Yalemwork Meswaet[1*], Ralph Mangelsdorff[1], Nourou S. Yorou[2], Meike Piepenbring[1]

1. *Institute of Ecology, Evolution and Diversity, Faculty of Biosciences, Goethe University Frankfurt am Main, Biologicum, Max-von-Laue-Str. 13, 60439 Frankfurt am Main, Frankfurt, Germany*
2. *Research Unit "Tropical Mycology and Plant-Soil Fungi Interactions-MyTIPS", Laboratory of Ecology, Botany and Plant Biology, Faculty of Agronomy, University of Parakou, BP 123 Parakou, Benin*

**Corresponding author's contact: ymeswaet@gmail.com*

Abstract

Tropical fungi are among the most diverse and poorly known organisms of the world. Within the last two centuries, investigations on tropical fungi in African countries like Benin are even more incomplete. The main objective of this study is to identify and document species of phytoparasitic fungi, namely the cercosporoid hyphomycetes, on useful plants in Benin. The genus *Pseudocercospora* was established by Spegazzini in 1910 based on the type species *Pseudocercospora vitis. Pseudocercospora* species are mainly pathogens on a wide variety of plants all over the world. *Pseudocercospora* species are morphologically characterized by pigmented conidia and conidiophores without thickened scars. An infection of leaves of the West African endemic *Encephalartos barteri* (Zamiaceae) by a cercosporoid fungus was repeatedly observed in central Benin. Morphological characteristics, the host relationship and DNA sequence data for two gene regions, namely ITS and rpb2, were compared to the corresponding characteristics of closely related known cercosporoid species and showed that the specimens from Benin represent a new species of *Pseudocercospora*. *Ps. encephalarti* is the first *Ps.* species on a species of the host genus *Encephalartos*, as well as for the whole class Cycadopsida. It was found to be closely associated with a species of *Corynespora*.

Key words: *Corynespora, Cycadopsida, Mycosphaerellaceae, new species, Zamiaceae.*

POSTERS

How different can be the community of litter decomposers fungi in natural forest area from man-made forest area?

Emilie Kolimedje[1*], Apollon D.M.T. Hegbe[2], Nourou S. Yorou[2]

1. *Laboratory of Applied Ecology, University of Abomey- Calavi, Benin*
2. *Research Unit "Tropical Mycology and Plant-Soil Fungi Interactions-MyTIPS", Laboratory of Ecology, Botany and Plant Biology, Faculty of Agronomy, University of Parakou, BP 123 Parakou, Benin*

**Corresponding author's contact: enkolim@yahoo.fr*

Abstract

Saprotrophic fungi are the most important decomposers in forests. The present study undertaken in dense forest in Pahou (Benin) aims to compare the diversity of litter decomposing fungi in natural forest area to that of a plantation. So five plots were installed in each of the two kinds of forest and prospected twice per week during each mycological season from 2016 to 2018. At each visit, only fruiting bodies of litter saprotrophic fungi were collected and data such as species abundance and habitat were recorded. Morphological and anatomical identification of species were done and specimens are dried, herborized and deposited in the mycological herbarium of University of Parakou, Benin. Species richness and Shannon index of diversity were calculated with the evenness index of Pielou. Rank-abundance curve were done to identify rare and common species and our sample effort has been appreciated using accumulation curves. The degree of similarity between the two kinds of forest was determined using the index of Jaccard. In overall, 28 species were collected. Natural forest is twice as diversified as plantation. There was a high similarity (Jaccard index =0.74) between the two sites. Some species showed affinity (p=0.0001) to forest type, others grew in both sites.

Key words: *saprotrophic fungi, diversity, mycological season.*

Two new African siblings of *Pulveroboletus ravenelii* (Boletaceae)

Akotchayé Sylvestre Badou[1*], André De Kesel[2], Olivier Raspé[2,3], Martin K. Ryberg[4], Atsu K. Guelly[5], Nourou S. Yorou[1]

1. *Research Unit "Tropical Mycology and Plant-Soil Fungi Interactions-MyTIPS", Laboratory of Ecology, Botany and Plant Biology, Faculty of Agronomy, University of Parakou, BP 123 Parakou, Benin*
2. *Meise Botanic Garden, Meise, Belgium*
3. *Fédération Wallonie-Bruxelles, Brussel, Belgium*
4. *Systematic Biology program, Department of Organismal Biology, University of Uppsala, Uppsala, Sweden*
5. *Department of Botany and Plant Ecology, Faculty of Sciences, University of Lomé, Lomé, Togo*

**Corresponding author's contact: sbadou@ymail.com*

Abstract

Several documents on mycology in tropical Africa mention *Pulveroboletus* aff. *ravenelii*, a species of bright yellow color and quite common in the Guineo-Sudanese and Zambezian forests. The study aims to clarify the taxonomy of species associated with *Pulveroboletus ravenelii* on the basis of morphological and genetic characters. We used a combination of anato-morphologic characters, as well as phylogenetic analyzes of DNA sequences from 41 African specimens of *Pulveroboletus* and compared the data to those of North American and Asian species to describe the two new species. Amplification and sequencing of the genes used such as: atp6, tef1 and rpb2 were performed using primer pairs ATP6-1M40F and ATP6-2M, EF1-983F and EF1-2218R, and bRPB2-6F and bRPB2- 7.1R. Macroscopically both African taxa can be distinguished based on the color of the scales on the cap and the stipe, being brown in *P. africanus* and greenish grey or yellow in *P. sokponianus*. Phylogenetic analysis shows that all specimens of *Pulveroboletus* studied, including the new species, form a strongly supported monophyletic clade (BS = 100), separated from the sibling subgroup composed of specimens of American and Asian species.

Key words: *Boletales, Africa, Pulveroboletus, morphology, phylogeny, taxonomy.*

Diversité, distribution et phénologie des champignons du genre *Termitomyces* au Togo

Atsu K. Guelly Kudzo[1*], Dao L.Maba[1], Kamou Hodabalo[1], Pondikpa Nadjombe, Koda Koudzo Donko[1], Amé Rébecca Guelly[1 1], Koffi Akpagana[1]

1. *Université de Lomé, Faculté des Sciences, Département de Botanique, 01 BP 1515 Lomé 01 Togo*

**Corresponding author's contact: kudzoatsuguelly@gmail.com*

Abstract

Les *Termitomyces* de la famille des Lyophyllaceae, de l'ordre des Agaricales, de la division des Basidiomycota, constituent un genre de champignons macroscopiques les plus comestibles très répandus au Togo et ailleurs en milieux tropicaux. Ce sont des champignons qui font symbiose avec les termites. Le présent travail a été réalisé dans les zones écologiques II, IV et V du Togo. Après une phase d'enquêtes dans quelques localités de ces zones, les sites potentiels de *Termitomyces* sont identifiés. Les prospections sont réalisées, d'une part accompagnés des enquêtés, qui dirigent vers les termitières, habitat des *Termitomyces*, d'autre part, suivant des transects lors des prospections générales des champignons.

Au terme des investigations, et à ce stade des travaux, dix-huit (18) taxa avec sûrement quelques variétés (à confirmer) de *Termitomyces* sont reconnus. Neuf sont exclusivement inféodés à la zone forestière (zone IV), certains sont uniquement retrouvés dans la zone II ou III ou V). S'agissant de la phénologie, *Termitomyces schimperi, T. robustus* et *T. clypeatus* apparaissent en été et en automne. Par contre *Termitomyces letestui* apparait au printemps dans certaines localités, mais toute la saison pluvieuse dans d'autres localités. L'objectif de ce travail préliminaire est de disposer des données qualitatives sur la diversité, la distribution et la phénologie des *Termitomyces* au Togo.

Key words: *Termitomyces, Basidiomycota, Diversité, distribution, phénologie, Togo.*

Les Russules de la Réserve de Faune d'Aledjo (RFA) : Quelques nouvelles citations pour la mycologie togolaise

Pondikpa Nadjombe[1*], Kamou Hodabalo[1], Nourou S. Yorou[2], Atsu K. Guelly Kudzo[1]

1. *Université de Lomé, Faculté Des Sciences, Laboratoire de Botanique et Ecologie Végétale, 01 BP : 1515 Lomé 01- Benin.*
2. *Research Unit "Tropical Mycology and Plant-Soil Fungi Interactions (MyTIPS)", Laboratory of Ecology, Botany and Plant Biology, Faculty of Agronomy, University of Parakou, BP 123 Parakou, Benin*

**Corresponding author's contact: nadjomb2012@gmail.com*

Abstract

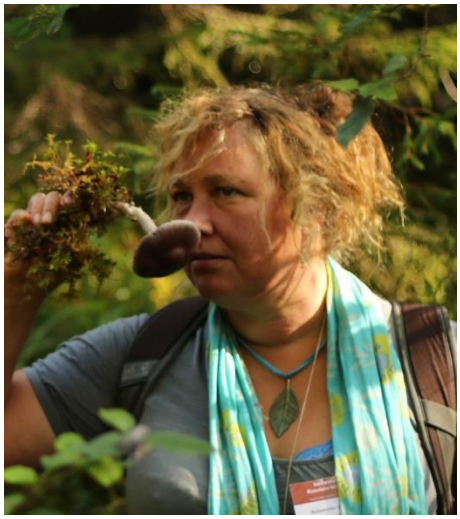
Les champignons ectomycorrhiziens sont d'une importance indéniable dans les écosystèmes forestiers et pour les populations riveraines. Parmi les genres les mieux représentés en Afrique tropicale figurent les russules (*Russula*). Ce genre a fait l'objet d'études approfondies et de documentation dans plusieurs pays en Europe, en Asie et en Afrique centrale. Bien que la diversité des espèces du genre *Russula* soit très élevée en Afrique tropicale, ce genre n'est malheureusement pas encore bien valorisé dans la plupart des pays de l'Afrique de l'Ouest dont le Togo. C'est dans ce cadre que des fouilles mycologiques ont été menées dans huit (08) formations de la Réserve de Faune d'Alédjo entre 2016 et 2018. Au total, 243 carpophores correspondant et 54 taxa ont été récoltés. Trente (30) soit trente pour-cent (56,60%) des taxa récoltés ont été identifiés jusqu'au niveau espèce dont quatre (04) nouvelles citations pour la mycologie togolaise. Les enquêtes ethnomycologiques ont permis de retenir sept (07) Russules comestibles par les populations riveraines.

Key words: *Diversité, Russula, Ethnomycologie, Réserve de Faune d'Alédjo, Togo.*

Session 2: Diversity, molecular systematic and phylogeny of tropical African fungi

Session Key Note Speaker: Prof. Dr. Annemieke Verbeken, University of Ghent, Belgium

About Prof. Dr. Annemieke Verbeken



Mycologist at Ghent University, Belgium, Lecturer in Mycology and Botany. Head of the mycology research group where the main focus is on biodiversity, phylogeny and evolutionary history of Russulales. Old-school taxonomy is combined with modern approaches: fieldwork in tropical Africa, South East Asia and different regions in Europe, thorough species descriptions, views on species concepts, classifications and phylogenies, illustrations and identification tools. Our research group has made the milkcaps, one of the major groups of ectomycorrhizal fungi in all ecosystems world-wide, the best documented group.

ORAL TALKS

Biodiversity and phylogeny of tropical African ectomycorrhizal fungi: what did the molecular era teach us?

Annemieke Verbeken

University of Ghent, Belgium, email: mieke.verbeken@ugent.be

Abstract

In 1996, I wrote a PhD about the biodiversity of *Lactarius* sensu lato (milkcaps) in tropical Africa. Biodiversity was a fashionable and trendy word by then, and I combined fieldwork and detailed microscopical research in order to delimitate and describe species, propose a classification system and brainstorm about possible connections and evolutionary history. The biological methods and our approaches of mycological research underwent a serious revolution since then. First of all it was the beginning of the molecular era, giving us access to the most direct information of organisms and a multitude of characteristics. Secondly, we more and more realized that world-wide sampling covering the underexplored areas such as woodlands and rainforests in tropical Africa was indispensable to understand the world-wide phylogeny and evolutionary history of the major ectomycorrhizal genera. There has been a serious increase in collecting in many African countries, and in sequencing the collected specimens. The generic landscape in Russulales also changed. Here I want to reflect on the impact of this molecular era on the milkcaps in a large sense: *Lactarius* and *Lactifluus*. What species concept do we use? How do we translate this species concept in identification tools that can be used in function of recognizing edible species and in function of forest management? What do the African species tell us about the history and the evolution of the genera? I will also highlight some of the other major groups of ectomycorrhizal fungi in African ecosystems. It is clear that, although much progress has been made the last two decades, tropical Africa is still a treasure box to remain discovered. It is also clear that we have to combine morphological, ecological and molecular approaches in order to gain insights in diversity and phylogeny and translate them into useful tools for recognition and conservation.

Key words: *Taxonomy, molecular systematic, species concept, evolution, Fungi.*

Taxonomy and ecology of Hymenochaetales in the mountain forests of eastern DRC

Alphonse Balezi Zihalirwa

Université Officielle de Bukavu/RDC

**Author contact: bzih2004@yahoo.fr*

Abstract

Hymenochaetales are one of the lignivorous fungi groups. In eastern DRC, 41 species from 7 genera (*Coltricia, Inonotus, Fomitiporia, Fulvifomes, Fuscoporia, Phellinus* and *Phylloporia*) have been recorded from the Kahuzi-Biega National Park, Virunga National Park, in arboreta and other vegetation types in the region. *Inonotus rwenzorianus* and *Phylloporia afrospathala* nom.prov. are recorded as new. *Fulvifomes merrillii, F. grenandensis, F. sublinteus, Phellinus carteri* and *P. macroporus* are recorded for the first time in Africa. Four additional species are recorded as new to the African Great Lakes Region. Based on their ecology, Hymenochaetales in KBNP present many adaptation types; some are parasitic, other saprotrophic or both. It was found that these fungi are more abundant in intact forest (primary forest) than in other types of habitats. Habitat, altitude and substrate seem to have an impact on the distribution of the Hymenochaetales in KBNP. These fungi are more represented at higher than at lower altitudes. Furthermore, it was found that Hymenochaetales play an important role in the ecological balance of the vegetation within the Park. These fungi contribute to the decay of dead wood and also to the replacement of individual trees in trees stratum. Data analysis showed that five plant communities were favorable for the presence of Hymenochaetales. These are: *Staudtia stipitata* and *Julbernardia serti, Michelsonia microphylla* and *Monopetalanthus microphyllus, Strombosia scheffleri* and *Chrysophyllum gorungosanum, Newtonia buchananii* and *Strombosia scheffleri* and finally *Ficalhoa laurifolia* and *Parinari excelsa.*

Key words: *Taxonomy, Ecology,Mountain forest, DRC*

Biogeography collections and herbarium reference of arbuscular mycorrhizal fungal communities in Kenya

Joyce Mnyazi Jefwa[1*], Michael Sakha[2], Mercy Korir[1]

1. *National Museums of Kenya, Botany Department (East African Herbarium), Nairobi, Kenya*
2. *Kenyatta University, Nairobi, Kenya*

**Corresponding author's contact: joycejefwa@gmail.com / jjefwa@yahoo.com*

Abstract

Importance of collections and herbarium references is often overlooked in the study of Fungi. There is still limited reference to collections and herbarium voucher specimens of fungi in Africa. This has affected authenticity and continuity of research, hence affecting utilization, conservation and policy directives. Approaches to application of inoculation practices is not informed by knowledge on inherent mycoflora diversity hence the failure in inoculation programs. In Kenya, plant distribution patterns are distinguished into seven regions. The unique climatic, latitudinal and geological landscapes define distinct biodiversity habitats. Mycorrhizal symbiosis is key to productivity of plant communities. Loss of habitat as a consequence of rapid increase in population, agricultural intensification, urbanization and development is a major threat to mycorrhizal communities. Arbuscular Mycorrhiza Fungi (AMF) spores were isolated directly from the soils from different biogeographical regions in Kenya and traps and spore cultures established. Studies showed clear patterns in variety of mycorrhizal communities with changes in soil types and host plants used in trap cultures. Voucher specimens and cultures are all preserved at the National Museums of Kenya and taxonomic description is in progress. Further evaluation of additional sites is in progress, continuous establishment of cultures and application of molecular tools will explored to further evaluate mycorrhizal communities.

Key words: *Taxonomic diversity, Biogeographical regions, Mycorrhiza collections.*

Multiple genes phylogenetic placement of *Trametes* (Polyporales, Basidiomycota) species from Benin and description of the new species *Trametes parvispora*

Boris Armel Olou[1,4*], Franz-Sebastian Krah[2], Meike Piepenbring[3], Ewald Langer[1], Nourou S. Yorou[4]

1. Department of Ecology, University of Kassel, Heinrich-Plett-Str. 40, Kassel, Kassel, Germany
2. Plant Biodiversity Research Group, Department of Ecology and Ecosystem Management, Technische Universität München, Emil-Ramann Strasse 2, 85354 Freising, Freising, Germany
3. Department of Mycology Biologicum, Goethe Universität, Max-von-Laue-Str. 13, 60438 Frankfurt am Main, Frankfurt, Germany
4. *Research Unit "Tropical Mycology and Plant-Soil Fungi Interactions-MyTIPS)", Laboratory of Ecology, Botany and Plant Biology, Faculty of Agronomy, University of Parakou, BP 123 Parakou, Benin*

**Corresponding author's contact: borisolou@yahoo.fr / borisolou@student.uni-kassel.de*

Abstract

Trametes is a globally distributed genus of white-rot polypores and well sampled in temperate/boreal areas. However, the diversity, taxonomy, and phylogenetic positions are less well-known in tropical Africa. This study aims at documenting the diversity of *Trametes* species in Benin (tropical Africa) and their phylogenetic positions with a focus on *T. elegans* species complex. We collected specimens from different forest types across Benin. DNA was extracted and sequenced targeting the genes ITS, LSU, RPB1, RPB2, and TEF1. Phylogenetic inference was performed using a dataset composed of 54 sequences we generated and additional sequences obtained from GenBank. Using maximum likelihood and Bayesian phylogeny inference methods, we found eight well-supported clades within the samples from Benin, corresponding to eight different species. Interestingly, among these eight clades, two were found as distinct and well supported, which were analyzed in more detail by combining molecular and anatomical characters. We hereby propose to adopt the name *Trametes palisotii* for species previously known as *T. elegans* in tropical Africa. Further, we propose and describe *Trametes parvispora* as a new species to science. Our molecular phylogeny of *Trametes* with a focus on tropical Benin will hopefully stimulate biodiversity assessments of *Trametes* and related wood-decay fungi in the tropics.

Key words: *Polypores, white rot, new taxa, phylogeny, morphology, taxonomy*.

Diversity of *Amanita* species in *Gilbertiodendron dewevrei* forest (Republic of Congo)

Sydney Thony Ndolo-Ebika[1*], Gallion Berdol Atikani [2], Attis Attibayeba[1], Nourou S. Yorou[3]

1. *Faculty of Sciences and Techniques ; Marien Ngouabi University, Brazzaville, Republic of Congo*
2. *Initiative des Champignons et des Plantes du Congo, Brazzaville, Republic of Congo*
3. *Research Unit "Tropical Mycology and Plant-Soil Fungi Interactions-MyTIPS", Laboratory of Ecology, Botany and Plant Biology, Faculty of Agronomy, University of Parakou, BP 123 Parakou, Benin*

**Corresponding author's contact: ndoloicpc@gmail.com*

Abstract

In central Africa, some macrofungal species establish a symbiotic association with *Gilbertiodendron dewevrei* which is an ectomycorrhizal tree species of the Caesalpinioid subfamily (Fabaceae). The tree forms monodominant forests on terra firma and alongside streams. Since 2008, high quality photographs of macrofungi have been taken and specimens collected in that special habitat in Northern Congo. Careful observations on growth kinetics of some *Amanita* species using growth parameters (stipe height and width, cap diameter) were made on a bi-hourly basis during a short rainy season. Detailed morphological studies were also investigated to discriminate *Amanita* species. In total, 552 collections were made representing eleven families of ectomycorrhizal species. Growth kinetics conducted on three *Amanita* species revealed that the species reach maximum size between 10-28 h. Twenty *Amanita* species have been documented of which one (*A. griseostrobilacea*) is decribed as? a new species and three others (*A. albostrobilis, A. luteolactensis* and *A. squarrosulus*) proposed as new species. Collaborative studies combining morphology with phylogeny are required to increase scientific knowledge on the diversity of *Amanita* across tropical Africa. Making duplicate of samples from Congo available to PhD students and researchers at the LEB herbarium in Parakou will contribute to making such goal to be achieved.

Key words: *Amanita, diversity, Gilbertiodendron dewevrei forest, growth kinetics, taxonomy.*

The first *Hygroaster* (Hygrophoraceae, Agaricales) found in Madagascar

Anna Berthe Ralaiveloarisoa[1,2*], Kare Liimatainen[3], Harisoa Ravaomanalina[1], Hélène Ralimanana[2], Vololoniaina Jeannoda[1], Stuart Cable[3], Tuula Niskanen[3]

1. *University of Antananarivo, Antananarivo, Madagascar*
2. *Royal Botanic Gardens, Kew, Antananarivo, Madagascar*
3. *Royal Botanic Gardens, Kew, London, United Kingdom*

**Corresponding author's contact: annaralaivelo@yahoo.fr / A.Ralaiveloarisoa@kew.org*

Abstract

Madagascar is ranked as one of the hotspots of biodiversity because of its high endemism of fauna and flora (80%). Nevertheless, knowledge on fungi of Madagascar is still very poor. Just a few studies of fungi are available and less than 5% of Malagasy fungi are described and known. Fungi have important roles in the functioning of the ecosystem. The Malagasy people also use fungi as a source of nutrition and export them to China. In this study a new species of *Hygroaster* is described to science based on morphological and molecular data. It is a small, greyish black species with distinctly nodulous spores and small basidia. It is also characterized by the presence of numerous yellow-green crystals in the pileipellis. In addition, the cystidia are lacking from the lamellae. The species is terrestrial and found in habitats dominated by e.g. *Uapaca* (Phyllanthaceae), *Sarcolena* (Sarcolenaceae), *Lauraceae*, *Rhus* (Anacardiaceae), *Prothorhus* and *Eugenia*, in Andasibe, Madagascar.

Key words: *New species, fungi, tropical, morphology, phylogeny.*

POSTERS

Multi-genes phylogenetic placement of tropical African *Inocybe* species (Basidiomycota, Fungi)

Aignon L. Hyppolite[1]*, Anneli Svanholm[2], Nourou S. Yorou[1], Martin K. Ryberg[2]

1. *Research Unit "Tropical Mycology and Plant-Soil Fungi Interactions", Laboratory of Ecology, Botany and Plant Biology, Faculty of Agronomy, University of Parakou, BP 123 Parakou, Benin*
2. *Systematic Biology, University of Uppsala, Norbyvägen 18D, 75236 Uppsala*

**Corresponding author's contact: hyppoliteaignon@yahoo.com*

Abstract

Inocybe has a worldwide distribution and includes more than 700 species with cosmopolitan distribution. This study aims at evaluating the phylogenetic position of *Inocybe* species sampled from West Africa. We sampled a total of 44 different taxa from various forest ecosystems in West Africa. The DNA was extracted from dried samples; PCR and sequencing were performed targeting the ITS, LSU and RPB2 regions. The final data set includes a total of 217 sequences composed of the sampled taxa and completed with similar sequences we searched for in GenBanks using BLAST alogarithm. The sequences were assembled using Geneious v11.1.5 and the dataset was combined with complete alignment, where the species of all major Inocybaceae clades from almost all parts, except Antarctica, are presented. Phylogenetic analysis was performed using RAxML-HPC BlackBox (v 8.2.10) on XSEDE platform as implemented in the CIPRES Science Gateway web server. RAxML was run using GTRCAT model with 1000 rapid ML bootstrap replicates and default settings for other options in the CIPRES Science Gateway. The results show that West African species belong to four different clades (*Inosperma*, *Inocybe*, *Mallocybe* and *Pseudosperma*) on the seven clades of Inocybaceae. The phylogeny tree supports the traditional delimitation of sections within the *Inocybe* genus.

Key words: *Inocybe, diversity, taxonomy, species concept, West Africa.*

Diversity and dispersal potential of ectomycorrhizal spores in some mammal feces in Benin

Rockis Gerovinso Sedodjitche Ganso[1*], Sedjro Gilles Armel Nago[1], Nourou S. Yorou[1]

1. *Laboratory of Ecology, Botany and plant Biology (LEB), Faculty of agronomy, University of Parakou, Benin*

**Corresponding author's contact: gansorockis1206@gmail.com*

Abstract

Fungi are of great importance for human well-being and plant communities with which they are associated. Although spores from most fungi are wind or water dispersed, dispersal may also occur via biotic vectors. This is the case of animals which intervene in the dispersal of ectomycorrhizal fungi spores. In recent decades, much research and discovery have been done on tropical African fungi. However, very few studies have focused on the relation between animals and fungi. Thus, the present study will identify ectomycorrhizal spores found in mammals feces and assess its growth potential. Feces of different mammal species? will be collected through Pendjari Biosphere Reserve in Northern Benin. Spores will be extracted from the feces, identified by microscopic observation and then, grew in laboratory. Morphometric parameters will be measured at each developmental stage of grew spores to assess the variability of these parameters between spores found in the different species' feces and references as well. Appropriate statistical tools will help to analyze data. This future study will strengthen the large-scale conservation of tropical African fungi.

Key words: *Ectomycorrhizal spores, mycophagus mammal, fungi diversity, fungi dispersal, Northern Benin.*

Diversité des champignons mycorhiziens arbusculaires associés au soja (*Glycine max*) dans trois régions climatiques du Bénin

Howell Bidossessi Houngnandan[1*], Abdala Gamby Diedhiou[2], Pascal Houngnandan[1]

1. *Laboratoire de Microbiologie des Sols et d'Ecologie Microbienne / Faculté des Sciences Agronomiques (LMSEM/FSA), Université d'Abomey-calavi, Abomey-calavi, Bénin*
2. *Laboratoire Commun de Microbiologie IRD/UCAD/ISRA, (LCM), Centre de Recherche de Bel Air, Dakar, Sénégal*

**Corresponding author's contact: bhoungnandan@yahoo.fr*

Abstract

L'étude a porté sur la diversité des champignons endomycorhiziens (CMA) associés au Soja (*Glycine max*) dans trois zones agro-écologiques du Bénin (Ina, Savè et Sékou). A cet effet, un échantillon composite des sols provenant respectivement de quatre (4) champs de chaque zone, a été constitué. La diversité des spores de CMA présents dans ces sols a été comparée à celle des spores piégées sous le soja en serre. Le dénombrement des spores a permis d'identifier 10 morphotypes dans les sols issus du piégeage et sept dans les sols provenant directement des champs. Tous ces morphotypes appartiennent aux genres *Gigaspora* et *Glomus* et aux familles Glomaceae et Gigasporaceae. *Glomus* sp2. (Glomeraceae) et Gigaspora sp2. (Gigasporaceae) sont les espèces dominantes avec des densités de 44,25 ; 159 et 233,75 pour Glomus sp2 et de 83,75 ; 71,25 et 40,25 pour *Gigaspora* sp2 respectivement à Ina, Savè et Sékou. Les indices de diversité de Shannon, Simpson et Hill sont plus élevés à Savè et à Ina et plus faibles à Sékou. Ce qui témoigne d'une bonne diversité des champignons mycorhiziens dans les sols échantillonnés. Ces résultats indiquent donc que la densité et la diversité des CMA varient en fonctions des zones agro-écologiques.

Key words: *Soja; Champignons endomycorhiziens ; Gigaspora ; Glomus.*

Composition and distribution of macrofungi across dense forest reserves in southern Benin

Basile Gbètondji Hounwanou[1], Mahugnon Fabrice Daignon[1], Boris Armel Olou[1], Nourou S. Yorou[1]*

1. *Research Unit "Tropical Mycology and Plant-Soil Fungi Interactions-MyTIPS", Laboratory of Ecology, Botany and Plant Biology, Faculty of Agronomy, University of Parakou, BP 123 Parakou, Benin*

**Corresponding author's contact: hounwanou.basile@gmail.com / basile_hounwanou@outlook.com*

Abstract

Fungi constitute the second largest group of organisms on earth and play crucial roles in human livelihoods and in ecosystems. Although numerous research projects were addressing the fungal diversity in Benin, knowledge about composition and distribution of macrofungi in dense forests remains sparse. To fill this gap, macrofungi were sampled within eight permanent plots (30 m x 30 m) in two distinct dense forests of Benin (the forest reserves of Pahou and Lama) from August to October 2017. Specimens' identifications were carried out based on micro-morphological features. The ANOSIM similarity test was performed using R software to compare both macrofungal communities. A total of 393 individual fruit bodies belonging to 64 species and 16 genera were recorded. The species diversity is high in both sites (H = 4.64 bits and H= 5.87 Bits respectively for Pahou and lama forest) with the absolute dominance of saprotrophic taxa (lignicolous (43) and ectomycorrhizal (2%) in all forests). The ANOSIM test results revealed that there is a high similarity in the species composition of both forests (R = -0.17 and p = 0.9). The most common genera were *Trametes* (5 species), *Marasmius* (4 species), *Ganoderma* (4 species) and *Xylaria* (4 species).

Key words: *Macromycetes diversity, Lama forest, Pahou forest reserve, saprotrophic fungi, Benin.*

Phylogenetic relationships, taxonomic revision and new taxa of *Termitomyces* (Lyophyllaceae, Basidiomycota) inferred from combined nLSU- and mtSSU-rDNA sequences

Dominique Claude Mossebo[1*], Marie Claire Machouart[2], Pyrus Flavien Essouman Ebouel[1], Cecile Gueidan[3], Blondo-Pascal Metsebing[1]

1. *University of Yaoundé 1, Mycological Laboratory, B.P. 1456 Yaoundé, Yaoundé, Cameroon*
2. *Laboratoire Stress Immunité Pathogène – EA 7300 – Université de Lorraine, 9 avenue de la forêt de Have, 54511 Vandoeuvre les Nancy, Nancy, France*
3. *Australian National Herbarium, CSIRO-NRCA, GPO Box 1700 Canberra, ACT 2601, Canberra, Australia*

**Corresponding author's contact: dmossebo@yahoo.fr*

Abstract

In order to contribute to the taxonomic revision of several species of *Termitomyces*, sequences of 74 strains representing 28 taxa were used to generate a combined nLSU-mtSSU phylogenetic tree. The phylogenetic analysis showed that re-classification was required for 12 taxa originally misidentified under various names. The changes led to the use of 8 valid names for these 12 taxa, including two new forms: *T. striatus f. subclypeatus* and *T. medius f. ochraceus*; and a new combination: *Termitomyces brunneopileatus* according to their placement on various clades and subclades in the phylogenetic trees. *Termitomyces letestui* and *T. medius* were taxonomically revised. In addition, *T. letestui* collected from China is the first record from the Asian continent. This species was so far collected only in tropical Africa. Similarly, *T. robustus* is reported for the first time from Cameroon. Moreover, the phylogenetic analysis confirms *T. subumkowaan* as a new species that was originally described only on the basis of morphological features. The combined phylogenetic analysis and morphological features reveal that different strains of the same taxon show sometimes large variations in macro- and micromorphological features, some very likely with links to genetic factors other than genes sequenced here, thereby justifying the new forms erected within these taxa in order to facilitate their identification.

Key words: *combined genes, molecular phylogeny, taxonomic novelties, termitophilic fungi.*

Session 3: Environmental samples, soil fungi and bio-informatics

Session Key Note Speaker: Prof. Leho Tedersoo, University of Tartu, Estonia

About Prof. Leho Tedersoo

Mycologist and soil ecologists at the University of Tartu, Estonia. PhD in 2007 on ectomycorrhizal fungal diversity in various ecosystems, followed by PostDoc studies on African ectomycorrhizal fungi; Research Professor since 2018. He is a principal investigator of the global soil fungal diversity initiative.

ORAL TALKS

Trends in African soil fungal communities

Leho Tedersoo

University of Tartu, Estonia, email: bioleho@ut.ee

Abstract

Research on soil-inhabiting saprotrophic and mycorrhizal fungi has been sporadic in Africa. Only a few studies have put African fungi into a global context. Here I provide an overview about specialities of mycobiota across the African continent. Published and ongoing studies indicate that much of the tropical West Africa and East Africa including Madagascar share the species of saprotrophic and ectomycorrhizal fungi, whereas North Africa and South Africa have distinct fungal communities. Much of this can be related to the dominant vegetation and the lack of native ectomycorrhizal host trees in South Africa.

Key words: *saprotrophic fungi, ectomycorrhiza, arbuscular mycorrhiza.*

Long-read metabarcoding of soil fungi in West African ectomycorrhizal habitats

Brendan Furneaux[1*], Peter Meidl[1], Kerri Kluting[1], Kassim I. Tchan[2], Nourou S. Yorou[2], Martin K. Ryberg[1]

1. Uppsala University, Uppsala, Sweden
2. *Research Unit "Tropical Mycology and Plant-Soil Fungi Interaction-MyTIPSs", Laboratory of Ecology, Botany and Plant Biology, Faculty of Agronomy, University of Parakou, BP 123 Parakou, Benin*

**Corresponding author's contact: brendan.furneaux@ebc.uu.se*

Abstract

DNA metabarcoding allows the detection of a wide variety of fungi, including those which do not produce conspicuous fruitbodies and which cannot be cultured with current techniques. Fungal DNA metabarcoding with "second-generation" sequencing technologies typically relies on the short (100-400 bp), highly variable first or second internally transcribed spacer (ITS) region of the ribosomal DNA. Unfortunately, ITS can not be aligned over large taxonomic scales, and so it is not useful for producing phylogenetic trees. Additionally, it is difficult to identify ITS sequences when no closely related sequences are present in the database, and some groups of fungi are underrepresented due to primer mismatches. "Third generation" technologies can sequence longer amplicons, allowing the capture of the full ITS region as well as part of the flanking ribosomal subunits. These contain highly conserved regions which can be aligned across the fungal kingdom. We present results of several soil metabarcoding studies targeting an approximately 1500 bp amplicon containing the full ITS region and part of the ribosomal large subunit (LSU) with Pacific Biosciences SMRT sequencing. Together, the studies include samples from eighteen ectomycorrhizal-dominated plots distributed among eight localities across West Africa.

Key words: *fungi, ectomycorrhiza, ECM, ITS, LSU, metabarcoding, third-generation sequencing, PacBio.*

Environmental sequencing: Does the data make sense?

Marieka Gryzenhout[1*], Gilmore Pambuka[1], Mark Mqeku[1], Errol Cason[1]

1. *University of the Free State, Bloemfontein, South Africa*

**Corresponding author's contact: Gryzenhoutm@ufs.ac.za*

Abstract

Microbes are viewed as a black box by biologists because of their great diversity and the proportion of undescribed species. Due to sporadic fruiting of macrofungi and lack of sporulation in culture, it is difficult to accurately assess species number and position in a location, that is if fruiting bodies have names. Since microfungi usually have to be isolated first, sporulated and scrutinized by a steadily declining number of experts, the task is even more daunting and time consuming. With the advent of environmental sequencing, the expectation is that this black box can now be studied, including unculturables. Those that can afford this expensive approach, characterizes numerous Molecular Operational Taxonomic Units that are given names in pipelines based on BLAST searches, making it also possible for non-experts to include fungi in environmental studies. However, these name allocations are seldom verified. This is an important flaw that is based on limitations of the used database, gene/-s chosen and the real validity of results, which should be taken into account when analyzing fungal environmental sequencing data. With the speed of which such studies are done by a growing number of biologists, it may result in wrong conclusions being drawn in certain cases.

Key words: *Environmental sequencing, Fungi, Systematics, Taxonomy.*

Distribution and abundance of airborne fungi spores in Lagos, southwest, Nigeria

Adeyinka Odebode[1]*, Adedotun Adekunle[2]

1. *University of Lagos, Lagos, Nigeria*
2. *Department of Environment and Natural science, Kabale University, Uganda*

**Corresponding author's contact: odebode04@yahoo.co.uk*

Abstract

Fungi are ubiquitous microorganisms present everywhere. Airborne fungal spore was sampled from five locations in Lagos State, Nigeria, between May 2015 and April 2017. Fungi spores were collected using the sedimentation plate method with the Petri dishes of Dichloran-glycerol 18 (DG-18) and Potato Dextrose Agar (PDA) media. The most abundant spores were; *A. niger* (14.47) and *A. flavus* (7.93), *Neurospora crassa* (5.32), *P. pinophilum* (2.88), *P. simplicissimum* (1.83), *Curvularia* sp., (0.22) while *Mucor*, *Alternaria* and *Cladosporium* were some of the least observed. Higher number of spores were recorded in market and hospital environments compared to other locations. Atmospheric temperature was between 250C - 280C throughout the period of sampling with highest temperature recorded in February and March while Relative humidity was constant at 88). Fungal spore had a strong correlation with relative humidity (r = 0.62) wind (r = 0.37) and rainfall (r = 0.20) while negative correlation occurred with temperature (r = -0.31). In conclusion, the study revealed the distribution of fungal spores in Lagos, Nigeria which shows their abundance and diversity in different environments.

Key words: *Fungi, abundance, Lagos.*

POSTERS

Diversity and structure of the endophytic seed mycobiome of four legumes using Illumina Sequencing

Gilmore Pambuka[1*], Rosemary Kinge[2], Errol Cason[1], Martin Nyaga[1], Marieka Gryzenhout[1]

1. *University of the Free State, Bloemfontein, South Africa*
2. *University of Bamenda, Bamenda, Cameroon*

**Corresponding author's contact: giles.pambuka@gmail.com / 2016251577@ufs4life.ac.za*

Abstract

A diverse group of microbiota are associated with plants and they are associated with different niches or vegetative and reproductive organs. With respect to the reproductive organs, seed carry microbial communities that can be beneficial or deleterious to the health and productivity of the newly emerging seedlings. Next Generation Sequencing technologies have enabled intensive characterization of the seed microbiome directly from seeds in the field. In this study we characterized the structure and diversity of endophytic fungi from seed in closed pods of Bambara groundnut, Cowpea, Dry beans and Soybeans directly collected from the field. DNA was extracted from seeds and the ITS2 region of the fungal internal transcribed spacer was sequenced using an Illumina MiSeq. Sequence analyses at 97% similarity resulted in the allocation of over 100 unique Molecular Operational Taxonomic Units (MOTUs). Variation in fungal community composition was found at genus level between seed from different legume crops, but each crop also contained their own unique endophytes. Plant pathogenic genera such as *Fusarium* and *Alternaria* were detected in all seed samples, as well as beneficial fungi, such as *Trichoderma*. Environmental sequencing can thus be an important tool for fungal community diversity description. Taxa can be compared and monitored more easily over time, assisting studies on the role of the seed microbiome during stages of growth development, and aiding strategies for disease prevention and increased plant health.

Key words: *Seed mycobiome, fungal endophytes, host plant protection, next generation sequencing, bioinformatics, taxonomy.*

Session 4: Endophytic, plant pathogenic fungi and defence mechanism in plant

Session Key Note Speaker: Dr. Jose G. Maciá-Vicente, Goethe University Frankfurt am Main, Germany

About Dr. Jose G. Maciá-Vicente

He studies fungal ecology, with a main interest in the interactions and evolution of plant-symbiotic fungi. He obtained his PhD at the Plant Pathology laboratory of the University of Alicante in Spain, and then joined the U.S. Geological Survey in Seattle (U.S.A.) as a postdoctoral fellow. Since 2013, he is group leader at Goethe University Frankfurt am Main. His research has mainly focused on different aspects of the diversity and ecology of root endophytic fungi, although he has also carried out fundamental and applied research related to fungal taxonomy, biological control, and natural products discovery.

ORAL TALKS

Fungal endophytes: diversity and effects on plant hosts

Jose G. Maciá-Vicente

Goethe University Frankfurt am Main, Germany, email: MaciaVicente@em.uni-frankfurt.de

Abstract

Fungal endophytes dwell within the tissues of all plants without causing apparent harm to their hosts. They are ubiquitous and abundant in terrestrial ecosystems, encompassing an astounding phylogenetic and functional diversity that remains largely uncharted. In recent years, advances in DNA sequencing technologies and several large-scale samplings have boosted our knowledge about the main groups of endophytic fungi worldwide and the ecological factors influencing the structure of endophytic communities. Nevertheless, such knowledge remains limited and fragmentary, given the number of plant species never screened for endophytes and, more importantly, the large proportion of yet unexplored areas, of which tropical Africa is a good example. Even less known than their taxonomic diversity are the functional roles of endophytic fungi. They are often considered as important determinants of ecosystems' function because of their potential impacts on plant health and productivity. In some instances, endophytes have been shown to be latent pathogens, or to provide benefits to their hosts via assistance in the uptake of nutrients or protection against environmental stress, which makes them prospective tools for agriculture. However, lack of knowledge about the ecology of the sheer majority of fungal endophytes limit the understanding of their place in ecosystems, as well as their exploitation. In my talk, I will give an overview of the topical knowledge on fungal endophytes' diversity, ecology, and known interaction with plant hosts, and I will identify gaps in which further research is needed to understand their role in natural ecosystems. I will use examples from my research group, focused on fungal root endophytes, where we use a combination of field samplings and laboratory experiments, and of cultivation and high-throughput sequencing methods, to gain insight into the evolution and functional diversity of these fungi.

Key words: *community ecology; fungal cultures; high-throughput sequencing; plant symbiosis*

Biological control of *Fusarium oxysporum* in tomato by the use of essential oils in Senegal

Claudia Azontonde[1*], Nalla Mbaye[1]

1. *Université Cheick Anta Diop, Dakar, Senegal*

**Corresponding author's contact: claudia.azontonde@gmail.com*

Abstract

Tomatoes are among the most consumed vegetables in Senegal. They rank fourth in terms of vegetable expenses. This crop faced a serious fungal disease caused by *Fusarium oxysporum*, constituting a main constraint for its production. Hence, in order to mitigate this issue, the antifungal activity in vitro of essential oils extracted from three plant species *Eugenia caryophyllata, Eucalyptus camaldulensis* and *Lavandula officinalis*, was tested on isolates of *Fusarium oxysporum*. The essential oil yields obtained for *Eugenia caryophyllata, Eucalyptus camaldulensis* and *Lavandula officinalis* after extraction were 2.33, 0.033% and 1.05%, respectively. The method of extraction with water vapor was adopted to extract the essential oils with the Clevenger type device. After obtaining the essential oils, we evaluated the antifungal activity on the mycelial growth of the mushroom as well as on the germination of the mushrooms. The use of these three essential oils influenced the mycelial growth of the *F. oxysporum* isolates. Indeed, the essential oil of *E. caryophyllata* totally inhibited the mycelial growth at 10 ppm, followed by the essential oils of *L. officinalis* and *E. camaldulensis* which totally inhibited the mycelial growth at 5000 ppm and 10000 ppm, respectively. Moreover, the essential oil of the clove flower buds (*E. caryophyllata*) caused an inhibition of spore germination at 3 ppm. Then we took the most effective essential oil and we tested it in the greenhouse in three (03) treatments namely: uninoculated controls, untreated inoculated plants and plants inoculated and treated with the essential oil of *E. caryophyllata.*

The inoculation consisted in introducing 20 g of wheat bran inoculum into the sheaths (containing sterilized sand before transplanting). The treatment involves spraying 5 ml of the essential oil (at a concentration of 10 ppm) mixed with tween 80 in the proportions 1/9 HE-tween 80, which is diluted 1/10 beforehand on each plant once a week. After 20 days after transplantation, we assessed the incidence and severity of *Fusarium oxysporum.*

Thus, a better valorization of essential oils could effectively and significantly combat the fungal diseases of tomato in Senegal and in the whole world.

Key words: *Tomato, diseases, Fusarium oxysporum, essential oils, Senegal.*

Antifungal activity and morphological characteristics of endophytic fungi from three herbaceous medicinal plants in Cameroon

Joseph Djeugap Fovo[1*], Biamen Mbatkam[1], Niky Joliesse Nouteka[1], Rémy Bertrand Teponno[2]

1. *Phytopathology and Agricultural Zoology Research Unit, Department of Plant Protection, Faculty of Agronomy and Agricultural Sciences, University of Dschang, Dschang, Cameroon*
2. *Applied organic chemistry Research Unit, Department of Chemistry, Faculty of Science, University of Dschang, Dschang, Cameroon*

**Corresponding author's contact: jdjeugapfovo@yahoo.fr*

Abstract

Endophytic fungi (EF) are considered as alternative to chemical in plant protection. The aim of this study was to evaluate the antifungal activity of EF isolated from three herbaceous medicinal plants (*Lantana camara* Linn., *Emilia coccinae* G. Don and *Bryophyllum pinnatum* Lam) collected in the locality of Dschang on three plant pathogens (*Verticillium albo-atrum, Rhizoctonia carotae* and *Phytophthora megakarya*). To achieve this, EF were isolated on potato agar dextrose agar medium (PDA) and screened for their antifungal activity using the double direct confrontation (DDC) test technique. Growth diameter of pathogenic fungi with or without endophyte was measured weekly. Then, fourteen days after the DDC test, fungistatic or fungicidal activity of the EF was assessed on the pathogens. Finally, EFs that strongly inhibited pathogens growth were submitted to morphological characterization on PDA, Malt Extract Agar (MEA) and Sabouraud Dextrose Agar (SDA) media at three pH levels (5.2, 7 and 9). Results show that eight EF genera are associated with these herbaceous medicinal plants with antifungal activities varying from one species to another. EFs that significantly ($P < 0.05$) inhibited the growths of the three pathogenic fungi were: *Aspergillus* sp (31%), *Cercospora* sp (57%) and *Trichoderma* sp (66%). *Cercospora* sp and *Trichoderma* sp, were fungicidal against *V. albo-atrum*, *R. carotae* and *P. megakarya* while Aspergillus sp was fungistatic against the three pathogens from 5th day after incubation. There was a high morphological variability among EF from one culture medium to another and from one pH level to another. It is envisaged to complete the identification of EF isolated by molecular biology tools as well as the characterization of the active biomolecules present in these endophytes.

Key words: *Antifungal activity, Culture media, Endophytic fungi, Herbaceous medicinal plants, Pathogenic fungi, pH.*

Studying endophytic fungi from tropical Africa: Option and adequacy of methods

Clovis Douanla-Meli[1*]

1. *Julius Kühn-Institut, Institute for National and International Plant Health, Braunschweig, Germany*

**Corresponding author's contact: clovis.douanla-meli@julius-kuehn.de*

Abstract

Endophytic fungi live asymptomatically within tissues of all plants and the plant diversity is an essential factor shaping their community composition. In this respect, the tropical Africa with its rich plant diversity, undoubtedly houses a high endophytic diversity. Available knowledge is still too scarce, but the increasing interest shown by diverse scientists gives a glimmer of hope to uncover great part of this diversity, which is disastrously vanishing due to landscape and ecological disturbances. Renewed attention to tropical endophytic fungi is justified as many species potentially produce various bioactive compounds, and others play important economic role as pathogens of agricultural crops and forest trees. Present research on (endophytic) fungal communities largely benefits from the implementation of cutting-edge technologies like high-throughput-sequencing (HTS) in mycology, and hence different approaches now exist for exploring their community structure. However, these methods lead to extremely varied result patterns, thereby implying that the method chosen should suit the goals and downstream researches. Here, I present first insights into the endophytic fungal communities of some tropical African plants investigated using culture-dependent methods and HTS for different focusses. Results allow emphasizing the advantages and limitations of each method considering the resources availability and priorities for tropical Africa.

Key words: *Fungal culture, taxonomy, mutualism, molecular methods, NGS.*

Epidemiology and control of *Pseudocercospora angolensis* fruit and leaf spot disease of *Citrus sinensi*

John Y.Kupagme[1]*, George N. Ankrah[1]

1. *University of Ghana, Accra, Ghana*

**Corresponding author's contact: jkupagme@gmail.com*

Abstract

A highly devastating fruit and leaf spot disease of sweet orange (*Citrus sinensis* (L) Osbeck) known elsewhere was observed for the first time in Kwaebibirem Municipality of the Eastern region of Ghana during 1995 fruiting season. A study was conducted in April 2018 to study the critical infection period (s) of PFLS disease and to assess the inhibitory effect of five medicinal plants extract on *P. angolensis* and determine the optimum concentration of the five medicinal plant extracts that would best inhibit *P. angolensis* Field survey and harvest indicated that incidence and severity of the disease was highest in fruits subjected to a fortnightly exposure to natural infection from the month of June to August as compared to other months of the year. *Moringa oleifera, Azadirachta indica, Carica papaya, Allium sativum* and *Zingiber officinale* showed some inhibitory effects against the disease in *in vitro* laboratory studies. Results therefore support the use of some medicinal plant extracts such as *A. sativum* as a control regimen within the periods of June and August against *A. angolensis* as a replacement for the most effective fungicide (Carbendazim + Mancozeb) against the disease in Ghana since its report for health and eco-friendly reasons.

Key words: *PFLS, Pseudocerscospora angolensis, Citrus sinensis, Carbendazim, Mancozeb, inhibitory effects, medicinal plant extract.*

Arbuscular Mycorrhizal Symbiosis Decreases Sclerotinia Caused by Sclerotium rolfsii Sacc. in Tomato (*Solanum lycopersicum* L.)

Brahima Ouattara[1*]

1. *Université Félix Houphouët-Boigny, Abidjan, Côte d'Ivoire*

**Corresponding author's contact: wattarabi@yahoo.fr*

Abstract

Background and Objective: Tomato (*Solanum lycopersicum* L.) domestic production is largely below requirements in Côte d'Ivoire because of numerous abiotic and biotic constraints, especially sclerotinia caused by *Sclerotium rolfsii*. The present study was initiated to test the antifungal activity of a complex consisting of propagules of 6 different species of arbuscular mycorrhizal fungi (AMF) on *S. rolfsii*. Materials and Methods: Inoculations with *S. rolfsii* sclerotia were performed. Green house tomato plants of the 45 day old Lindo F1 variety were transplanted into pots of 297 cm3 volume. The impact of inoculation was assessed at planting and at the end of the experiment on plant height growth, collar diameter, number of functional leaves and number of flowers. Results: The results: revealed that the mycorrhization of nursery plants with the CMAs used has antifungal action on *S. rolfsii*. The incidence of dry rot in non-mycorrhizal plants is 2.5 times higher than the incidence of mycorrhizal plants. Conclusion: Mycorrhization may be advisable for growers in tomato growing areas where sclerotinia is more prevalent as an alternative to the over use of synthetic fungicides.

Key words: *Tomato, arbuscular mycorrhizal fungus, sclerotinia, antifungal, Sclerotium rolfsii, propagules, incidence.*

Characterization and Diversity of Endophytic Fungi in different parts of Cowpea (*Vigna unguiculata* L. Walp) Using Illumina Sequencing Approach

Tonjock Rosemary Kinge[1*], Errol Cason[2], Gilmore Pambuka[3], Marieka Gryzenhout[3]

1. *Department of Biological Sciences, Faculty of Science, The University of Bamenda, P.O. Box 39, Bambili, North West Region, Bamenda, Cameroon*
2. *Department of Microbial Biochemical and Food Biotechnology, University of the Free State, Bloemfontein, South Africa*
3. *Department of Genetics, University of the Free State, Bloemfontein, P. O. Box 339, Bloemfontein 9300, Republic of South Africa*

**Corresponding author's contact:* rosemary32us@yahoo.com

Abstract

Cowpea is an economically important indigenous African legume crop. Different parts of the vegetative organs can carry endophytic fungal communities that can be beneficial or deleterious to the health and productivity of the plant. Next Generation Sequencing technologies have enabled intensive characterization of the mycobiome from plants. Endophytic fungi were characterized, and their diversity was determined in symptomless tissues of the leaf, main stem, crown stem and roots of cowpea. DNA was extracted and the ITS2 region was sequenced using the Illumina MiSeq. Data were analyzed using Qiime, Principal Coordinates Analysis, heatmap and phylogenetic analyses. The highest fungal diversity was recorded for the Ascomycetes followed by Basidiomycetes and Zygomycetes. The highest fungal species richness was recorded from the roots and the least from the main stem. Some endophytes showed tissue specificity. Thirty fungal genera were identified in one or more of the four cowpea plant parts with *Fusarium*, *Cladosporium* and *Phoma* being the dominant genera. The result is a concern since some endophytic species might become pathogenic with time. Environmental sequencing is thus a useful tool for fungal community diversity comparisons. Taxa can be compared and monitored over time, aiding strategies for disease prevention and increased plant health.

Key words: *Cowpea, Diversity, Endophyte fungi, Identification, Illumina MiSeq, Plant parts.*

POSTERS

Preliminary study of the diversity of host plants of rust and smut fungi in the Western Highlands of Cameroon

André-Ledoux Njouonkou[1*], Einstein Maxwell Nana Tchouta[2], Gaston Noumbo Tsopmbeng[2]

1. *University of Bamenda, Bamenda, Cameroon*
2. *University of Dschang, Dschang, Cameroon*

**Corresponding author's contact:* alnjouonkou@yahoo.fr

Abstract

Rust and smut fungi are among the most common plant pathogens that cause huge loss to farmers. The western highlands of Cameroon are an important agricultural zone with a great diversity of plants, of which some are often infested by these fungi. The diversity of plants infested as well as the infesting fungi are poorly known here. This study aims to contribute to the documentation of plants infested by these fungi in Cameroon with their pathogens. Plant specimens presenting symptoms of rust and smut diseases were collected and identified morphologically. A preliminary identification of pathogenic fungi was also done. At least 47 plant species are infested by rust and smut fungi in the area, with respectively 37, 8 and 1 species infested by rust, smut and both groups respectively. Rust was found on 18 families while smut was found only on Cyperaceae and Poaceae. Fabaceae and Poaceae families were the most infested by respectively rust and smut. In contrast to plant species infested by smut fungi, the large majority of plants infested by rust fungi were discovered for the first time in Cameroon. This preliminary works show that, the western highlands of Cameroon is potentially rich in both groups of pathogenic fungi. Extended studies are needed for accurate documentation of rust and smut fungi as well as their host in this county.

Key words: *Phytopathology, Angiosperms, Basidiomycota, Tropical savanna, Africa.*

Effect of arbuscular mycorrhizal and oyster's shells powder on cocoa seedlings growth and resistance against *Phytophthora megakarya* (causal agent of black pod disease) in the nursery

Paul Martial Tene Tayo[1,] Aristide Dzelamonyuy[1]

1. *Biotechnology Center of the University of Yaounde I, Yaounde, Cameroon*

**Corresponding author's contact:* tenetayo@yahoo.com

Abstract

Application of organic amendments such as arbuscular mycorrhizal fungi (AMF) as well as chitinous sources have been proposed as a strategy for the management of disease caused by soil borne pathogens. The aim of this study was to evaluate the combined effect of AMF and oyster shell powder soil amendment to enhance cocoa seedling growth and induce resistance against *Phytophthora megakarya* under nursery conditions. The results showed that AMF combined with oyster shells powder soil amendment significantly increased plant height, leaf number, leaf area, dry shoot and root weight more than chemical fungicide treatment after five months of growth. This treatment raised soil pH significantly and reduced *Phytophthora megakarya* load of the soil suspension by 78%. Leaf inoculation showed the weakest disease severity index (highest level of resistance) recorded in plants treated either with AMF and oyster shell powder combined. Moreover, this resistance was correlated with the increased synthesis of phenolic compounds, total proteins and polyphenoloxidase, chitinase and peroxidase activities. These findings demonstrate that AMF and oyster shells powder combined could be used as biofertilizer and biofungicide to improve the quality of cocoa seedling production and their resistance against *Phytophthora megakarya.*

Key words: *Cocoa, seedling, oyster shell, biofungicide, arbuscular mycorrhizas, Phytophtora megakarya.*

Session 5: Medicinal mushrooms and bio-activity in tropical African fungi

Session Key Note Speaker: Prof. Kenneth Yongabi Anchang, Imo State University, Owerri, Nigeria

About Prof. Kenneth Yongabi Anchang

A professor of public health infectiology and Phytobiotechnology at the department of Public Health, Faculty of Health Sciences, Imo State University, Owerri, Nigeria and adjunct Professor of medical biotechnology at the Ebonyi State University, Abakaliliki, Nigeria. He founded the Phytobiotechnology Research Foundation Institute Cameroon in 2007, an institute that validates and scale up local knowledge for sustainable development in Africa. He served as the director of research and development at the Catholic University of Cameroon 2013 -2018.His research covers the African public health systems and the African traditional medical system, biopharmaceuticals, mushroom biotechnology. He has more than 100 scientific publications, six scholarly chapters, two books and numerous conference and technical papers.

ORAL TALKS

Can we conquer infectious diseases in Africa with myco-pharmaceuticals from African medicinal mushrooms? A 19 years research testament

Kenneth Yongabi Anchang[1]

1. *Faculty of Health Sciences, Imo State University, Owerri, Nigeria, email: yongabika@yahoo.com*

Abstract

African mushrooms are widely known for their ethno medicinal and nutritional value but detail studies to authenticate the effect of these medicinal mushrooms on specific infectious diseases and its complications are still questionable and unexploited. The need for a critical exposé of African mushrooms as biopharmaceuticals and myco-ceuticals in the treatment and prevention of infectious diseases and its attending complication is presented. We demonstrate in this paper a 19 years unbroken studies on how bioactive extracts from mushrooms have been studied via both bioassay guided fractionation and product formulation field trials to address HIV/AIDS, Malaria, opportunistic fungi infections and some selected bacterial infections such as Mycobacterium spp the etiologic agent of buruli ulcers, and water borne bacterial infections. A documentation of 23 mushroom species belonging to 23 families used in various therapeutic preparations for the management of HIV/AIDS in rural North West Region of Cameroon and South East Nigeria was made. Dietary supplements made from organic and aqueous extracts of *Flammiluna spp, Termitomyces titanicus and Pleurotus ostreatus* have demonstrated more than 95% increase in CD4 counts of patients with HIV/AIDs with significant reduction of viral loads. Mycoderm™ [a] topical product developed from extracts from *Ganoderma lucidum species* have demonstrated both in vitro antimycotic activity as well total clearances of skin fungal infections in an "exit pool clinical trial". In this paper, we further shed light on how extracts of *Ganoderma lucidum* have demonstrated antimalarial effects via modulation of Lipoprotein cholesterol levels in *Plasmodium berghei malarial infection.* For the first time, a report on the use of *Pleurotus tuberregium* sclerotium extracts to disinfect water, serving as a myco-electrolytes and mycocoagulants comparable to alum and chlorine with significant in vitro activity on water borne *E coli* strains. From the phytochemical profiles of these mushrooms, beta glucans, chitins, chitosan, and other bioactive peptides can potentially serve as sources for biopharmaceuticals for the treatment of tropical infectious diseases.

Key words: *Mushrooms, Myco-pharmaceuticals, Infections, Diseases, Bioactivity.*

Phytochemical screening and nutritional analysis of *Agricus subsaharianus* and *Macrocybe lobayensis* two edible mushrooms species in Niger

Chaibou Ousmane Zakari[1*], Ibrahim Dahiratou[2], Ikhiri khalid[1]

1. *Laboratoire des Substances Naturelles et de Synthèse Organique, Université Abdou Moumouni de Niamey : BP 10662 Niamey (Niger)*
2. *Laboratoire de mycologie de d'Ecole Normale Supérieure, Université Abdou Moumouni de Niamey, BP10963, Niamey, (Níger)*

**Corresponding author's contact:* zakarichaibou@yahoo.com

Abstract

For centuries, edible mushrooms have been known and consumed by people around the world. They contribute substantially to diets in some civilizations. However, despite the important role of mushrooms, this field is rarely explored in Niger. This study aims to integrate the use of *Agaricus subsaharianus* and *Macrocybe lobayensis* into the eating habits of Niger populations. The study focuses on phytochemical screening and nutritional analysis. Phytochemical screening was carried out using colouring and/or precipitation reactions and the protein content was determined by the KJEDHAL method. The results of phytochemical screening revealed the presence of many secondary metabolites (alkaloids, tannins, polyphenols, quinones, anthocyanins, steroids and terpenoids). The nutritional analysis carried out on the two species shows that *Agaricus subsaharianus* has higher protein contents than *Macrocybe lobayensis* with 27.50 respectively. It would be interesting to deepen the study to evaluate other nutritional and/or therapeutic potentialities.

Key words: *Phytochemical, nutritional, Agarius subsaharianus, Macrocybe lobayensis, Edible mushrooms, Niger.*

Effects of polysaccharides of medicinal mushroom, *Climacodon pulcherimus* (phanerochaetaceae), on macrophages and neutrophils phagocytic functions via ingestion process and the intracellular killing mechanisms

Oumar Mahamat[1*], Christopher Tume[2]

1. *University of Bamenda, Bamenda, Cameroon*
2. *University of Dschang, Dschang, Cameroon*

**Corresponding author's contact:* oumahamat@yahoo.com

Abstract

Mushrooms have historically been considered as important sources of medicinal material amongst whom polysaccharides that display several immunomodulatory activities. This study was designed to investigate the effect of polysaccharides extracted from *Climacodon pulcherimus* on macrophages and neutrophils activities. Macrophages and neutrophils were collected by peritoneal lavage from wistar rat. Neutral red and MTT were used as cytotoxicity tests examining the membrane integrity and mitochondrial dehydrogenase activity. Successively, the ingestion process (phagocytosis) and the intracellular mechanisms were studied separately. Exo and endo polysaccharides are found to induce impairment of the mitochondrial dehydrogenase activity processes at concentration high than 0.55 mg/ml. Both types of polysaccharides was found to stimulate significantly the ingestion processes, production of nitric oxide, superoxide anion and acid phosphatase by neutrophils and macrophages. The myeloperoxidase activity of neutrophils was increased by the exo polysaccharides while the endo polysaccharides showed inhibitory effect. In addition, *C. pulcherimus* polysaccharides increased the neutrophil adhesiveness. Our results suggest that *Climacodon pulcherimus* has polysaccharides with potent stimulatory activities of phagocytic capacity of the cells especially after infections as it is in response to lipopolysaccharide.

Key words: *Climacodon pulcherimus, polysaccharide, phagocytes, phagocytosis, oxidative metabolism, acid phosphatase, myeloperoxidase.*

Bioactive secondary metabolites from some ascomycetes

Rémy Bertrand Teponno[1*], Abolfazl Narmani[2], Sara Noumeur[3], Soleiman Helaly[4], Marc Stadler[5]

1. *University of Dschang, Dschang, Cameroon*
2. *University of Tabriz, Tabriz, Iran*
3. *University Sétif 1 Ferhat Abbas, Sétif, Algeria*
4. *Aswan University, Aswan, Egypt*
5. *Helmholtz Centre for Infection Research, Braunschweig, Germany*

**Corresponding author's contact:* remyteponno@gmail.com / rteponno@yahoo.fr

Abstract

The emergence of drug-resistant pathogens, cancer cells and occurrence of various side effects for the currently available drugs is an overwhelming problem of medical concern. There is an urgent need in exploration of novel compounds with natural origin as well as further studies on exact mechanism of action of already identified compounds as they may have different modes of action targeting several sites. Microorganisms represent an important source of bioactive natural products with enormous potential for the detection of new molecules for drug discovery, industrial use and agricultural applications. Ascomycetes constitute a large branch of fungi grouping many species useful to humans such as yeasts. Many of them are known to produce bioactive secondary metabolites. This prompted us to embark search for new bioactive agents from fungi, leading to the isolation and structure elucidation of 26 secondary metabolites including 13 new ones, mainly furanones and anthranilic acid derivatives from the endophytic fungus *Dendrothyrium variisporum*, *pseurotin* derivatives from the phytopathogenic fungus *Wilsonomyces carpophilus*, *terphenylquinones* and *heptanedioic acid* derivatives from the plant pathogenic fungus *Cytospora* sp.. The results of their bioactivity will also be presented.

Key words: *Ascomycetes, Dendrothyrium variisporum, Wilsonomyces carpophilus, Cytospora sp., Bioactive secondary metabolites.*

Ethnomycology, myco-chemical analyzes and larval toxicity of wild mushrooms of genus *Amanita* (Benin)

Olyvia Gwladys Fadeyi[1 *], Fidèle Mahoudo Assogba[2], Boni Christophe Dieu-Donné Chabi, Nourou S. Yorou[1], Joachim D. Gbenou[2]

1. *Research Unit "Tropical Mycology and Plant-Soil Fungi Interactions -MyTIPS", Laboratory of Ecology, botany and Plant Biology, Faculty of Agronomy, University of Parakou, 03 BP: 125, Parakou (Benin)*
2. *Laboratory of Pharmacognosy and Essentials Oils, Institute of Applied Biomedical Sciences, Champ de Foire, Cotonou 01 BP: 918 (Benin)*

**Corresponding author's contact:* olyviafadeyi@gmail.com

Abstract

Endogenous knowledge, toxicity and therapeutic values of wild mushrooms of the genus *Amanita* are poorly documented in West Africa. The present study aims at identifying wild mushrooms of the genus *Amanita* harvested from the forest reserve of Ouémé Supérieur (Benin). These inventories were combined with ethnomycological surveys conducted on a sample of sixty-eight (68) individuals randomly selected from three (03) ethnic groups (Yom, Peuhl and Lokpa). We realized the myco-chemical screening according to the standard methods. The content of certain chemical compounds has been determined and we also carried out a toxicity test on *Artemia salina* larvae. An ANOVA test was performed to assess the differences in total phenol and flavonoid content among species. Antioxidant activity was determined using the 1,1- diphenyl-2-picrylhydrazyl radical. We have identified a total of eleven (11) *Amanita* species. We have recorded some proportions, including alkaloids, flavonoids present vary according to the species. We have some proportions of which the total phenols (1.48 to 2.69 mg gallic acid equivalent per g by dry weight). All species have anti-oxidant activity (EC50 less than 10 mg / ml). All species are toxic (CL50 <0,1 mg/ mL).

Key words: *Myco-chemical screening, Antioxidant activity, Larval toxicity, Benin.*

POSTERS

Assessment of basidiocarp versus sclerotium antifungal and antibacterial activities of hexane and chloroform crude extracts of *Pleurotus tuber-regium* (Basidiomycota, Pleurotaceae)

Blondo-Pascal Metsebing[1], Fabrice Tsigaing Tsigain[1], Romuald Oba[1] , Thierry Youmbi Fonkui[2], Derek Ndinteh Ntantoh[3] , Marthe Carine Djuidje Fotsing[3], Dominique Claude Mossebo[1*]

1. *University of Yaoundé 1, Mycological Laboratory, B.P. 1456 Yaoundé, Cameroon*
2. *Mycotoxins Laboratory, Biotechnology and Food Technology Department, University of Johannesburg*
3. *University of Johannesburg, Faculty of Science, Department of Applied Chemistry, Natural Product and Smart, Doornfontein campus, South Africa*

**Corresponding author's contact:* dmossebo@yahoo.fr

Abstract

Antifungal and antibacterial activities of crude extracts of basidiocarp compared to that of sclerotium of *Pleurotus tuber-regium* were investigated on 11 species of bacterial and 3 of fungal human pathogens. The Minimum Inhibitory Concentration (MIC) of basidiocarp extract was recorded to be 12.5 mg/mL on *Bacillus subtilis*, *Enterococcus faecalis*, *Staphylococcus epidermidis, Escherichia cloacae, Proteus mirabilis, P. vulgaris, Klebsiella oxytoca, K. aerogenes* and 6.25 mg/mL as well on *Staphylococcus aureus*, *Escherichia coli*, *Mycobacterium smegmatis* as on all 3 species of fungal pathogens including *Candida albicans, Aspergillus fumigatus and Aspergillus ochraceus*. In comparison, the MIC of sclerotium was recorded to be 12,5 mg/mL on *Bacillus subtilis* and *Klebsiella aerogenes*; 6,25 mg/mL on *Enterococcus faecalis*, *Staphylococcus aureus, S. epidermidis, Escherichia cloacae, E. coli, Mycobacterium smegmatis, Proteus mirabilis, P. vulgaris, Klebsiella oxytoca,* and 3,13 mg/mL on the 3 fungal pathogens. Based on the above mentioned figures, it appears that bacteria are much more resistant to crude extracts than pathogenic fungi. In fact, antimicrobial activities of crude extracts of *Pleurotus tuber-regium*, no matter the part of the carpophore considered, are in general higher on human pathogenic fungi than bacteria. These figures also demonstrate that crude extracts of sclerotium show a higher antimicrobial activity than that of basidiocarp. Carpophores of *Pleurotus tuber-regium* could therefore constitute a new source of natural products potentially more efficient than synthetic products against bacterial and fungal infections.

Key words: *Pleurotus tuber-regium, basidiocarp, sclerotia, antimicrobial activity, bacteria, pathogenic fungi.*

Assessment of antifungal and antibacterial activities of hexane and chloroform crude extracts of 3 species of *Rigidoporus* (Basidiomycota, Polyporaceae)

Romuald Oba[1*], Fabrice Tsigaing Tsigain[1], Blondo-Pascal Metsebing[1], Derek Ndinteh Ntantoh[2], Dominique Claude Mossebo[1]

1. *University of Yaoundé 1, Mycological Laboratory, B.P. 1456 Yaoundé, Yaoundé, Cameroon*
2. *University of Johannesburg, Faculty of Science, Department of Applied Chemistry, Natural Product and Smart, Doornfontein campus, South Africa, Johannesburg, South Africa*

**Corresponding author's contact:* romual_oba@yahoo.fr

Abstract

This work aimed at assessing the antifungal and antibacterial activities of hexane and chloroform crude extracts of 3 species of *Rigidoporus* including *R. microporus*, *R. ulmarius* and *R. vinctus*. The assessment was based on the Minimum Inhibitory Concentration (MIC) determined by the microdilution method. 11 species of bacteria of which 5 gram-positive and 6 gram-negative as well as 3 human pathogenic fungi were investigated. Results recorded show an overall weak activity of crude extracts of the 3 species of *Rigidoporus* on various bacteria species with a MIC of 6.25 mg/ml. More precisely, *Mycobacterium smegmatis, Proteus vulgaris, Klebsiella oxytoca* and *Proteus mirabilis* were sensitive to crude extracts of *R. vinctus*; *Staphylococcus aureus* and *Escherichia coli* to *R. ulmarius* and *R. microporus* was active only against *Proteus vulgaris*. The 5 remaining species of bacteria including *Bacillus subtilis, Enterococcus faecalis, Staphlococcus epidermis, Escherichia cloacae* and *Klebsiella aerogenes* were resistant to crude extracts of all 3 species of *Rigidoporus*. In contrary, the inhibition activity was generally higher in fungi with an average activity (MIC = 0.39 mg/ml) of *R. microporus* and *R. vinctus* on *Aspergillus fumageceous*, a very weak activity (MIC = 6.25 mg/ml) of *R. ulmarius* on the same fungus and also an average activity of *R. microporus* and *R. ulmarius* on *Aspergillus ochraceus.* The above mentioned figures show that pathogenic fungi are in general much more sensitive to crude extracts of *Rigidoporus* than bacteria.

Key words: *Polyporaceae, Rigidoporus, crude extracts, antifungal activity, antibacterial activity.*

Session 6: Conservation of fungi and their habitat

Session Key Note Speaker: Dr. David Minter, CABI International

About Dr. David Minter

President of the International Society for Fungal Conservation. President of the European Mycological Association. Chair of the IUCN Species Survival Commission's Cup Fungi, Truffles and Allies Specialist Group. Curator of the Cybertruffle website [www.cybertruffle.org.uk]. Corresponding Member of the Cuban Academy of Sciences. Interests: fungal conservation; taxonomy of ascomycetes.

ORAL TALKS

Fungal conservation in Africa and beyond

David Minter

CABI International; email: d.minter@cabi.org

Abstract

Without fungi, life as we know could not be sustained on this planet. We need them, and they need conservation. They are just as endangered as animals and plants. They face the same threats. They have no magical protection against climate change, exploitation, habitat loss, persecution and pollution. Nature cannot be saved if fungi are forgotten: you can't protect the producers (plants) and consumers (animals) unless you also protect the recyclers. Amazingly, the conservation movement still focuses overwhelmingly on animals and plants. Fungi get little or no attention. The 1992 Rio Convention is a good example. It aims to protect all nature globally, but in practice almost totally overlooks fungi. Fungi are the "Orphans of Rio"! It is the duty of mycologists to challenge this terrible deficiency. We must press conservationists worldwide to include fungi in their plans. If we don't do this, who will?

Getting protection for fungi is difficult. Several problems must be addressed at the same time. Conservation is a combination of science and politics. Science says, "this species is endangered". Politics says, "something must be done to protect it". So we need scientific evidence, we need to educate the public, and we need to press politicians. To do that, there must be infrastructure for fungal conservation, and policies for promoting it. Many different NGOs protect animals and plants, but where are the fungal conservation societies? They need to be set up. That is our job. Work has already begun. There is an International Society for Fungal Conservation and some regional fungal conservation societies. The IUCN has formally recognized that fungal conservation is just as important as animal and plant conservation, and the number of fungal specialist groups in its Species Survival Commission has increased. That is a start, but only a start. There are no fungal conservation societies in Africa south of the Sahara. Almost everywhere, national fungal conservation societies are needed. Very few places have an agreed strategy for conserving fungi.

With so few mycologists, it will be difficult to address these problems. Efforts must be targeted. We need to change attitudes. People who describe biodiversity as "animals and plants" or "flora and fauna" should be challenged. These words are lazy and inaccurate. They send the wrong message, they damage our cause. Descriptions of biodiversity must explicitly include fungi, and it's not good enough simply to add fungi as an afterthought. Botanists and zoologists can help get mycologists included in teams planning biodiversity conservation: they are often invited when we are not. We must press national representatives for the Rio Convention to ensure fungi are properly covered in their reports and plans [their e-mail addresses can be downloaded from www.cbd.int/doc/lists/nfp-sbstta.pdf]. We must demand that fungi are included in biology lessons at school and in universities. We must improve the presence of fungi on the Internet: editing the biodiversity part of Wikipedia entries for each country is easy and can be done by anyone with Internet access. We must produce red lists at all levels from global to local and, to do that, we must provide information resources, training and guidance in making those evaluations.

Key words: *education, politics, protection of fungi, Rio Convention, fungal conservation societies.*

Conservation of wood inhabiting fungi in Cameroon rainforest: current situation and obstacles

Clovis Douanla-Meli[1*]

1. *Julius Kühn-Institut, Institute for National and International Plant Health, Braunschweig, Germany*

**Corresponding author's contact:* clovis.douanla-meli@julius-kuehn.de

Abstract

Recent decades have seen increasing efforts to develop indigenous mycological research in tropical Africa. The number of described species is still, however, very small and estimates of existing diversity, for instance, in the Cameroon rainforest, are lacking. Unrestrained land conversion is causing disappearance of countless undescribed species. To counter this, biodiversity conservation and management need urgently to include fungi. A pilot project has been started in Mbalmayo Forest Reserve, which is under continuous land cover change. A survey of macrofungi clearly indicated diversity decline along a disturbance gradient. The most plausible explanation was human removal or destruction of dead woody material. The project's second phase therefore focused on conservation of wood-inhabiting fungi through preservation of coarse woody debris. A multi-actor approach was imperative to ensure positive outcomes. Getting support of local people was particularly challenging as they are mostly dependent on forest resources. Using a consensus-building process, various activities have been initiated to raise awareness of fungi as non-timber forest products and as agents for natural turnover of wood biomass to maintain and stabilize tropical forest ecosystem productivity.

Key words: *Tropical biodiversity, deforestation, endangered fungal species, saprophyte.*

Host plants and edaphic factors influence distribution and diversity of rainforest ectomycorrhizal fungal fruiting bodies from Tshopo, Democratic Republic of the Congo

Héritier Milenge Kamalebo[1*], André De Kesel[2], Jérôme Degreef[2], Hippolyte Nshimba Seya Wa Malale[3], Céphas Masumbuko Ndabaga[4]

2. *Centre de Recherches Universitaires du Kivu (CERUKI-ISP), Bukavu, Democratic Republic of the Congo*
3. *Meise Botanic Garden, Meise, Belgium*
4. *University of Kisangani, Kisangani, Democratic Republic of the Congo*
5. *Official University of Bukavu, Bukavu, Democratic Republic of the Congo*

**Corresponding author's contact:* kamaleboheritier@gmail.com / mkheritier@yahoo.fr

Abstract

Ectomycorrhizal fungi constitute an important component of forest ecosystems that enhances plant nutrition and resistance against stresses. Diversity of ectomycorrhizal fungi is, however, linked with host plant diversity and soil heterogeneity. This study provides information about the influence of host plants and soil resources on diversity of rainforest ectomycorrhizal fungal fruiting bodies in the Democratic Republic of the Congo. Based on presence of fungal fruiting bodies, significant differences in the number of ectomycorrhizal fungi species existed between forest stand types.

Key words: *Congo basin, Ectomycorrhizal fungi, indicator species, rainforests, Soil texture.*

Diversity and ecology of wild mushrooms in the riparian zone of Lake Kivu, Rwanda

Emmanuel Munyaneza[1*], Elias Bizuru[2], Jérôme Degreef[3]

1. *Institute of National Museums of Rwanda, Kigali, Rwanda*
2. *University of Rwanda, Kigali, Rwanda*
3. *Fédération Wallonie-Bruxelles & Botanic Garden Meise, Meise, Belgium*

**Corresponding author's contact:* emunyaneza@museum.gov.rwa / munyaneza4@gmail.com,

Abstract

Fungi are among the most diverse group of living organisms on earth, though inadequately studied worldwide and especially in Rwanda. The main objective of this study was to assess the diversity and describe the ecology of mushrooms in the riparian zone of Lake Kivu to develop a baseline for further studies on fungi in the country. Diversity and distribution were studied by plot-based mushroom surveys at 3 sites (Mariri, Mpangara and Nyakarwa) and by random searches in the Museum of Environment garden, in different seasons. Species similarity between sites was determined using the Sorenson's coefficients; the Chao 2 estimator was used to estimate species richness. Sixty four species were collected, belonging to 8 orders, 26 families and 40 genera. The zone is dominated by Agaricales (81%). The total order/family ratio of 0.31, family/genus ratio of 0.65 and genus/species ratio of 0.63 indicate high familial and generic diversity in the collections. More mushrooms species were recorded in Nyakarwa Forest, and the Sorenson similarity matrix showed dissimilarity richness and distribution of mushrooms species in the 4 study sites.

Key words: *Mushrooms, diversity, ecology, Lake Kivu, riparian zone.*

Diversity of macrofungi in *Eucalyptus* and *Pinus* plantations of Melap Forest Reserve (West Cameroon)

André-Ledoux Njouonkou[1*], Gislaine Virginie Njapdounké[2], Ruth Yumdinguetmun[3], Gaston Noumbo Tsopmbeng[2], Jérôme Degreef[4]

1. *University of Bamenda, Bamenda, Cameroon*
2. *Université de Dschang, Dschang, Cameroon*
3. *Bilingual High School Bayelle, Bamenda, Cameroon*
4. *Jardin Botanique de Meise, Bruxelles, Belgique*

**Corresponding author's contact:* alnjouonkou@yahoo.fr

Abstract

Eucalyptus and *Pinus* are two exotic tree genera found in Africa's tropical savanna zone, particularly in upland west Cameroon. Plantations of these species are numerous in this area but their fungal components are poorly known. To contribute to documentation of macrofungi of these ecosystems in the savanna zone of tropical Africa, macromycete diversity was studied in mature eucalyptus and pine stands of the Melap Forest Reserve in west Cameroon. Four permanent plots of 1000 m2 were set up in each community and, for three months, sporophores were collected and identified, and some diversity parameters calculated. One hundred and twenty five species were found. Taxonomic diversity was significantly higher in eucalyptus plots than in pine, with 107 and 33 species respectively. The number of ectomycorrhizal species was higher in eucalyptus plots, where some locally consumed species were found. The predominance of the mycota in Eucalyptus communities can be explained by the diversity of indigenous shrubs and trees.

Key words: *Diversity, macrofungi, plantation forests, conservation, tropical Africa.*

Effects of macroclimate and resource on diversity of tropical wood-inhabiting fungi

Boris Armel Olou[1,2*], Nourou S. Yorou[2], Manuel Striegeld[1], Claus Bässler[3], Franz-Sebastian Krah[4]

1. *Department Ecology, University of Kassel, Kassel, Germany*
2. *Research Unit "Tropical Mycology and Soil-Plant Fungi Interactions", Laboratory of Ecology, Botany and Plant Biology, Faculty of Agronomy, University of Parakou, Benin*
3. *Bavarian Forest National Park, Grafenau, Germany*
4. *Plant Biodiversity Research Group, Department of Ecology & Ecosystem Management, Center for Food and Life Sciences Weihenstephan, Technical University of Munich, Freising, Germany*

**Corresponding author's contact:* borisolou@yahoo.fr

Abstract

Wood-inhabiting fungi are one of the most important groups of organisms as they contribute substantially to carbon and nutrient cycles by decomposing dead wood. Current knowledge on the drivers of their diversity derives almost exclusively from temperate and boreal ecosystems. We sampled wood-inhabiting fungi across Benin, a tropical country with a strong north–south seasonality gradient consisting of three macroclimatic zones. We aimed at determining whether macroclimate or resource (size or amount of dead wood, number of host tree species, and stage of wood decomposition) is more important for their diversity. Variation partitioning revealed a stronger partial effect of resource on fungal species richness and a strong effect of macroclimate on community composition. A more detailed linear mixed-effects model revealed a significantly positive effect of host richness, amount of dead wood, and macroclimate on fungal species richness and a significantly positive effect of macroclimate and stage of wood decomposition on the community composition. These findings are consistent with patterns found in temperate and boreal ecosystems, which indicates the existence of general drivers of the diversity of wood-inhabiting fungi. Based on these results, we recommend that existing knowledge should be applied to conservation of wood-inhabiting fungi in tropical Africa.

Key words: *fungi, dead wood, tropics, resource, macroclimate, Africa.*

Education and mitigation for macrofungi conservation in communities around Mount Cameroon (Cameroon)

Tonjock Rosemary Kinge[1*], Theobald Mue Nji[2], Afui Mathias Mih[3]

1. *Department of Biological Sciences, Faculty of Science, The University of Bamenda, P.O. Box 39, Bambili, North West Region, Bamenda, Cameroon*
2. *Department of Sociology and Anthropology, Faculty of Social Sciences, The University of Buea, P.O.Box 63, South West Region, Buea, Cameroon*
3. *Department of Botany and Plant Physiology, Faculty of Science, University of Buea, P.O. Box 63, South West Region, Buea, Cameroon*

**Corresponding author's contact:* rosemary32us@yahoo.com / tonjock.rosemary@fulbrightmail.org

Abstract

Conservation education in the Mount Cameroon region of Cameroon is limited to plants and animals with little attention paid to fungi despite their socio-economic importance for food and medicine, and their essential roles in ecosystem function. Their diversity and conservation is threatened by human activity since inhabitants depend on the forest for their livelihood. This study was carried out for 2 years in ten communities around Mount Cameroon to promote and implement conservation measures for macrofungi. Interviews, questionnaires, focus group discussions and oral presentations were done to educate communities about the importance of macrofungi and their conservation. Major threats to macrofungi were habitat degradation due to landslides and volcanic eruptions, climate change, unsustainable harvesting of some edible and medicinal mushrooms, deforestation for farmland by local people, oil palm cultivation by multinationals, settlement expansion due to urbanization, and fire outbreaks. Laws and policies on biodiversity conservation in Cameroon do not cover macrofungi and this exposes fungi to extinction risks. Mitigation solutions proposed and carried out were in situ conservation, cultivation of unsustainably harvested species by local communities, and planting of fast growing leguminous trees for multipurpose usage.

Key words: *Conservation, Education, Macrofungi, Mitigation, Threats, Cameroon.*

Session 7: Wild Edible fungi: biomass measurement, ethnomycology and sustainable exploitation

Session Key Note Speaker: Dr. André De Kesel, Botanic Garden Meise (Belgium)

About Dr. André De Kesel

André is mycologist and researcher at Botanic Garden Meise (Belgium) since 1997. He studies mainly tropical African fungi and focuses on systematics, phylogeny, ecology and taxonomy of ectomycorrhizal taxa (Cantharellales, Boletales, …). He is interested in ethnomycology, ecosystem services and methods delivering data for valorization and conservation. He has collaborated with most African mycologists and co-authored books and papers, as well as a website about wild edible fungi from tropical Africa (https://www.efta-online.org/). Being committed to capacity building, he has initiated or guided research activities in Benin (1997), Togo (2006) and DR Congo (2012). He supervised masters and PhD research of many African mycologists.

ORAL TALKS

African edible fungi and ecosystem services

André De Kesel[1], Nourou S. Yorou[2], Bill Kasongo[3], Nyiongabo Elias[4], Héritier Milenge Kamalebo[5], Jérôme Degreef[1]

1. *Botanic Garden Meise, Meise, Belgium, email: andre.dekesel@botanicgardenmeise.be*
2. *Research Unit "Tropical Mycology and Soil-Plant Fungi Interactions", Laboratory of Ecology, Botany and Plant Biology, Faculty of Agronomy, University of Parakou, Benin*
3. *Faculty of Agronomic Sciences, University of Lubumbashi, route Kasapa, 1825, Lubumbashi, RD. Congo*
4. *Office Burundais pour la Protection de l'Environnement, Bujumbura, Burundi*
5. *Centre de Recherches Universitaires du Kivu (CERUKI-ISP), Bukavu, Democratic Republic of the Congo*

Abstract

Across tropical Africa hundreds of wild edible fungi are collected for local trade and consumption. In spite of this, fungal habitats (mostly woodland), suffer from increasing anthropogenic pressure. Due to a lack of information, wild edible fungi are still considered far less valuable than timber or charcoal. In this contribution we'll outline the potential of African edible fungi, highlighting aspects of sustainable use, local economy, forest conservation, traditional knowledge and its preservation. We show the need for an interdisciplinary approach to value wild edible fungi. The subject is complex because in its qualitative part, all fungal taxa, their habitats and hosts, need to be understood. In its quantitative part, sporocarp productions and factors affecting them need to be recorded in permanent forest plots; which requires time and local stability. To finally also determine whether wild edible fungi should be used for exploitation, the local interest needs to be established with ethnomycological surveys. Based on such an integrated approach conducted in Benin, Burundi and DR Congo, we obtain science evidence that wild edible fungi are a far more valuable resource than generally accepted. Because many wild edible fungi are ectomycorrhizal, sustainable exploitation and forest conservation are often linked. In this talk we'll discuss some factors that make or break this link.

Key words: *ethnomycology, sustainable use, macrofungi, conservation, NTFP, Africa.*

Influence of tree plant cover on ectomycorrhizal fungal community in Guineo-Soudanian forests

Souleymane Boni[1]*, Roël D. Houdanon[1], Brendan Furneaux[2], Martin K. Ryberg[2], Nourou S. Yorou[1]

1. *Research Unit « Tropical Mycology and Plant-soil Fungi Interactions », Laboratory of Ecology, Botany and Plant Biology, Faculty of Agronomy, University of Parakou, 03 BP 125, Parakou, Benin,*
2. *Systematic Biology, University of Uppsala, Norbyvägen 18D, 75236, Uppsala Sweden*

**Corresponding author's contact:* boni.souley@yahoo.fr

Abstract

Several studies showed that natural productions of ectomycorrhizal (EcM) fungi is linked to annual climate conditions and habitat characteristics. This study aims to determine the effect of tree density, basal area and canopy density of host trees on species richness and biomass of ectomycorrhizal (EcM) fungi. We selected three different plant communities (V1 dominated by *Isoberlinia doka*, V2 dominated by *Isoberlinia tomentosa* and V3 dominated by *Uapaca togoensis*) located in guineo-sudanian ecozones of Benin. In each plant community, three permanents plot of 2.500 m^2 split into 25 sub-plots of 100 m^2 were installed and surveyed twice a week per plot from June to October of 2015 and 2016 to pick mushrooms. Multiple linear regression showed that tree canopy density and tree density of host trees were positively correlated to species richness of EcM fungi whilst basal area of host trees was positively correlated to biomass of EcM fungi. Mantel tests revealed that EcM tree density has no significant (P=0.6457) effect on the EcM fungi community, but the presence-absence of EcM trees does significantly (P=0.0357). The canopy of EcM tree has significant (P=0.0218) effect on EcM fungi community and EcM tree basal area has no significant (P=0.62) effect on EcM fungi community.

Key words: *basal area, biomass, canopy, diversity, species richness, West Africa.*

Dynamics of ectomycorrhizal macromycetes in the Soudano-Guinean woodlands: the case of *Amanita masasiensis, Russula congoana* and *Lactifluus luteopus* in Ouémé Supérieur Forest reserve

Abdoul-Azize Boukary [1*], Roël D. Houdanon [1], Nourou S. Yorou[1]

*Research Unit « Tropical Mycology and Plant-soil Fungi Interactions », Laboratory of Ecology, Botany and Plant Biology, Faculty of Agronomy, University of Parakou, 03 BP 125, Parakou, Benin *Corresponding author's contact: abdoulbazize@gmail.com*

Abstract

Studying ectomycorrhizal with high ecological, economic and nutritional value, is essential in a perspective of conservation of resources. This study aims to determine the spatial and temporal distribution of: *Amanita masasiensis, Russula congoana* and *Lactifluus luteopus* in the Ouémé Supérieur forest in northern Benin. It was performed in 6 permanent plots of 2500m² split into 25 subplots of 100m², each dominated by an ectomycorrhizal tree species. The absence/presence variables, number of carpophore and fresh biomass for each fungal species were recorded during 3 mycological seasons. The evolution of these variables was evaluated through mean comparison tests, analysis of variance and generalized linear models. A total of 642 mycosociological surveys were conducted during this study with a dominance of *Russula congoana* fruiting bodies. The presence of a fungal species in a plot is conditioned by the presence of EcM trees (p=0.0009). *Russula congoana* and *Amanita masasiensis* grow in all plant formations, particularly in the *Isoberlinia* spp. and *Lactifluus luteopus* in groups dominated by *Uapaca togoensis*. Plant groups with the highest trees densities give the highest fresh fungal biomasses (p = 0.0001). The study revealed that the variation in rainfall and soil moisture content greatly affects species phenology.

Key words: *fungi, EcM, climatic variables, plant groups, phenology, natural production.*

Trace metals and safe consumption of edible fungi from Upper-Katanga (DR Congo)

Bill Kasongo[1*], André De Kesel[2], Nausicaa Noret[3], Pierre Meerts[3], Jérôme Degreef[2]

1. *Faculty of Agronomic Sciences, Université de Lubumbashi, route Kasapa, 1825 Lubumbashi, DR Congo*
2. *Botanic Garden Meise, Meise, Belgium*
3. *Université Libre de Bruxelles, Bruxelles, Belgium*

**Corresponding author's contact: billkasongo@gmail.com*

Abstract

In Upper Katanga region (DR Congo) wild edible fungi are an important source of food and income. This study is the first to present the trace metal content of six edible mushrooms collected from the mining region around Lubumbashi. Samples were taken in places where local people collect fruit bodies for consumption. Inductively coupled plasma spectrometry (ICP-OES,) was used to determine concentrations of ten trace metals (Al, Cr, Cu, Co, Pb, Cd, Fe, Ni, Mn and Zn) in *Amanita loosii, Amanita pudica, Cantharellus congolensis, Cantharellus densifolius, Cantharellus platyphyllus* and *Cantharellus ruber*. Concentrations of Cr, Ni and Pb are under the EU norm in all six species, but values for Al, Co, Cu, Fe, Mn, and in some cases also for Zn or Cd are above. Significant differences between species were observed for Al, Cd, Co, Cr, Cu, Mn and Zn. Cd concentrations are highest in *Amanita* while Al and Co reach highest concentrations in *Cantharellus* species. Recommended tolerable, monthly, weekly or daily intake of metals and average metal concentrations in edible fungi were used to calculate the safe weekly consumption (SWC, in kg fresh weight/week) for a 60 kg person. Cd limits the consumption of *A. loosii* and *A. pudica* to 0.6-1.2 kg FW/week, Fe limits *C. congolensis* and *C. platyphyllus* to 2.2-2.5kg FW/week and Al limits *C. ruber* and *C. densifolius* to 3.5-3.8 kg FW/week. Recommendations are listed to further reduce the intake of metals through the consumption wild edible fungi.

Key words: *Toxicity, mushrooms, food safety, Miombo woodland, Copperbelt, Upper-Katanga.*

The mushrooms consumed in the around urban area of Lubumbashi/Upper-Katanga (DR Congo)

Rosine Mbuyu[1,2*], Bill Kasongo, André De Kesel[2], Jérôme Degreef[2]

1. *University of Lubumbashi, Faculty of Agronomic Sciences, route Kasapa, 1825 Lubumbashi, DR Congo*
2. *Botanic Garden Meise, Belgium, Nieuwelaan 38, B-1860 Meise, Belgium*

**Corresponding author's contact: rosinembuyu2@gmail.com*

Abstract

The study on the ethnomycological knowledge of local populations in Upper-Katanga in the Democratic Republic of Congo was carried out in order to develop a list of the mushroom species consumed: their local names and their meaning. This study contributes to the valorization of edible mushrooms produced in the open Miombo woodland of Upper-Katanga. A survey was conducted among the peoples (Bemba, Lamba and Tabwa) in three villages (Baya, Mususwa and Tumbwe) in the Lubumbashi around-urban area. Structured and semi-structured surveys were conducted with 101 people distributed as follows: 41 people from the Lamba ethnic group, 30 people from the Bemba ethnic group and 30 people from the Tabwa ethnic group. A simple and brief questionnaire developed by De Kesel et al. (2002) was used for this purpose. The edibility of mushrooms and individual factors, such as: age, sex and ethnic group of the respondents, were taken into account. The results obtained reveal 112 local names relating to 36 species of mushrooms consumed, all ethnic groups combined. Two ethnic groups (Bemba and Lamba) each consume 35 species of mushrooms related to 24 local names. In addition, the Tabwa ethnic group consumes 34 species with 15 local names. The local names assigned to mushrooms have a meaning. Species considered toxic have no local names and are referred to by a collective name that refers to toxicity or simply means "lethal".

Key words: *Ethnomycology, Wild Edible Fungi, Non-timber forest products (NTFPs), Miombo Woodland, Zambesian Region, Upper-Katanga.*

Host plants and edaphic factors influence distribution and diversity of rainforest ectomycorrhizal fungal fruiting bodies from Tshopo, Democratic Republic of the Congo

Héritier Milenge Kamalebo[1*], André De Kesel[2], Jérôme Degreef[2], Hippolyte Nshimba Seya Wa Malale[3], Céphas Masumbuko Ndabaga[4]

1. *Centre de Recherches Universitaires du Kivu (CERUKI-ISP), Bukavu, Democratic Republic of the Congo*
2. *Meise Botanic Garden, Meise, Belgium*
3. *University of Kisangani, Kisangani, Democratic Republic of the Congo*
4. *Official University of Bukavu, Bukavu, Democratic Republic of the Congo*

**Corresponding author's contact: kamaleboheritier@gmail.com / mkheritier@yahoo.fr*

Abstract

Ectomycorrhizal fungi constitute an important component of forest ecosystems that enhances plant nutrition and resistance against stresses. Diversity of ectomycorrhizal fungi is, however, linked with host plant diversity and soil heterogeneity. This study provides information about the influence of host plants and soil resources on diversity of rainforest ectomycorrhizal fungal fruiting bodies in the Democratic Republic of the Congo. Based on presence of fungal fruiting bodies, significant differences in the number of ectomycorrhizal fungi species existed between forest stand types.

Key words: *Congo basin, Ectomycorrhizal fungi, indicator species, rainforests, Soil texture.*

Wild edible mushrooms from Burundi miombo woodlands: A source of income and a lever for the sustainable management of this threatened ecosystem in Burundi

Elias Niyongabo[1*]

1. *Office Burundais pour la Protection de l'Environnement, Bujumbura, Burundi*

**Corresponding author's contact: eliasnniyongabo@gmail.com*

Abstract

In Burundi, many species of wild edible mushroom (WEM) are collected, consumed or sold by indigenous people around protected areas that produce this natural resource. Mean yield was estimated 263 kg.ha-1year-1, and is produced by at least 46 species of WEM (east of Burundi). This natural resource is one of the main pillars of food security for harvesters, who are generally poor people. As one of the many ecosystem services provided by miombo woodlands, these WEM, if they were all picked and put on the market, they would have a value of about 20 billion BIF or $ 10 million (annually). The traditional fungal knowledge of these people is sharp and original: rarely consumed species such as boletus are eaten, the culinary art reveals curious realities and storage techniques adapted to the rural environment have been developed.

The local and even international value chain for WEM is unfortunately absent and the WEM from Burundian miombo woodlands, a symbiotic ecosystem to these WEF is threatened. The valorization of WEM is one of the sure paths to follow in order to achieve the sustainable management of miombo woodlands in Burundi, even in other countries.

Key words: *wild edible mushrooms, miombo woodlands, Burundi, natural production.*

Edible Mushrooms of Madagascar: Diversity and Distribution

Emile Randrianjohany[1*], Nirina Rakotoarimanga[1], Rondro Harinisainana Baohanta[1], Jaona Ranaivo[1], Luciano Ramaroson[1]

1. *Centre National de Recherches sur l'Environnement, Antananarivo, Madagascar*

**Corresponding author's contact: randrianjohanye@yahoo.com*

Abstract

This paper gives an updated and detailed data on the wild edible mushrooms of Madagascar and aims to show the diversity and natural distribution of these fungal resources. During a long period of sixteen years since 2003, ethnomycological investigations were conducted in the central highlands and the east coast, two main regions where rural people are traditional collectors and macrofungi eating. As results, first, we present a general checklist of the seventy inventoried taxa of edible mushrooms which are well known and eaten by the population. The vernacular names and the corresponding references to our photo-data are mentioned, all these organized in the following six habitat types : 1) mushrooms of « Tapia » (*Uapaca bojeri* - Phyllanthaceae) dominated woodlands, 2) mushrooms of eastern littoral forest, 3) mushrooms of native dense forests at eastern slopes, 3) mushrooms of Eucalypt plantations, 4) mushrooms of pine plantation, 5) mushrooms of grassland and savannah, 6) mushrooms of agricultural and cultivated lands. In each category, few important taxa that are sold or most gathered are commented. Second, the presentation of more diverse morphospecies of native dense forests but entirely unknown to rural people about their edibility shows yet the potential of edible mushrooms in Malagasy forest ecosystems. These latest comprise seventeen newly described species of *Cantharellus*, and some other ectomycorhizal as like as saprobic edible taxa belonging to different morphological groups such as: Pleurotoids (*Pleurotus* spp, *Hohenbuehelia* spp *Lentinula edodes*, *Lentinus* spp) ; Hydnoids (*Hydnum* spp, *Beenakia* spp, *Pseudohydnum gelatinosum*) ; Agaricoids (Russulaceae, Marasmiaceae) ; Clavarioids and and Boletaceae family. Discussion is oriented on their importance in scientific, ecological and economical issues.

Key words: *Ethnomycology, Edible fungi, Madagascar, Diversity, Distribution.*

POSTERS

Nutritional value of three wild edible mushrooms (Republic of Congo)

Vidrige Hulriche Kandza[1*]

1. *Initiative des Champignons et des Plantes du Congo, Leipzig, Germany*

**Corresponding author's contact: vidrich.kandza@outlook.com*

Abstract

Impact of mushrooms as valuable food resources for human beings has been highlighted by many researchers. Mushroom species are cultivated throughout the World where the food and pharmaceutical industries play a major role in valuing fungi. It has been reported that Wild fugi can be used as additive in children's diet to fight against infantile diseases. In the Republic of Congo, local people use wild fungi as a source of food and income but nothing is known about the nutritional value the species. To fill this gap, a study aiming at quantifying the nutritional value of three wild edible mushrooms (*Lepiota lignicola, Lentinus* sp. and *Marasmius buzungolo*) has been conducted based on specimens collected on a daily basis following Mbenzele children foraging fungi in a tropical forest in Northern Congo. Samples were weighted, dried then grounded. Thereafter, the macro and micro nutrients were quantified using standard methods. The results showed higher level of protein (93), ratio C/N (4.6-8.63) and low level of fat (0.2) and sugar (0.4). This study reveals the beneficial input of the species in children's diet and, therefore, opens a possibility for envisaging domestication the mushrooms to solve issues on food security in remote zones of Congo.

Key words: *Children, fat, mbenzele, protein, sugar, tropical forest, wild edible mushrooms.*

Study of wild edible fungi sold at the markets of Brazzaville (Republic of Congo)

Isis Gloria Mienandi[1*], Darlina Nanale Ibara Hissongo[1], Sydney Thony Ndolo-Ebika[3]

1. *Initiative des Champignons et des Plantes du Congo (ICPC), Brazzaville, Republic of Congo*
2. *Faculté des Sciences et Techniques ; Université Marien Ngouabi, Brazzaville, Republic of Congo*

**Corresponding author's contact: isismiena@gmail.com*

Abstract

The diversity of fungi sold at the markets of Brazzaville is still not known yet. To document these fungi, semi-structured interviews were conducted with saleswomen from 2016 to 2019; photographs of fungi on display were taken; specimens were bought, weighed and identified. In total, 25 interview sheets were used in 8 markets. The mushrooms are sold either fresh for 500 and 1000 FCFA, rarely 1500 FCFA or dry for 250 and 500 FCFA. A kilogramme of mushrooms is estimated to 1400 and 2200 FCFA from fresh ones while it varies from 9400 to 29400 FCFA for dried ones. The fresh fungi are mainly represented by the genus *Termitomyces* while the dried ones belong to two genera, namely *Auricularia* and *Termitomyces*. The former principally come from Brazzaville's surrounding localities whilst the latter come from Cameroon and DRC. Carpophores are the parts sold except for one species, *Termitomyces fuliginosus* where it is rhizomorphs. Establishment of a trade network of edible fungi would be promising in Brazzaville if natural production of fungi in local zones of origin is mastered.

Key words: *Brazzaville, market, price, sale, trade network, trading, weight.*

Assessment of the ethnomycological value of the edible fungi in Dogbo commune, Benin

Gloria Peace Souand Tahi[1*], Gbenato Laurent Houessou[2], Toussaint Olou Lougbegnon[3]

1. *Laboratory of Biomathematics and Forest Estimation, University of Abomey-Calavi, Abomey-Calavi, Benin*
2. *Faculty of Agronomy of the University of Parakou, Parakou, Benin*
3. *School of Tropical Forests, National University of Agriculture (UNA), Ketou, Benin*

**Corresponding author's contact: souandtahi@gmail.com*

Abstract

Edible mushrooms are particularly appreciated for their nutritional value. Most mushrooms also have medicinal properties. The objective of the study is to evaluate the ethnomycological use value of the fungi in Dogbo municipality. Ethnomycological survey was carried out with 100 households in the area. The ethnomycological use value was calculated to assess people's knowledge about fungi in the environment. Parametric test (Anova and t-student) were performed to test how far age, gender and ethnicity affect the ethnomycological use value of the survey people. In total, nine species of edible mushrooms are listed. These inventoried species are used for food, medicinal and food additive purposes. However, *Volvariella volvacea* is the most consumed species in this survey. Because of their higher use value (2.06 and 2.11), the different mushrooms are used more in food and in food additives. Ethnomycological use value was significantly different among ethnic while there was no difference for age and gender. Our findings highlight the most valued mushrooms which can be promoted in the area.

Key words: *Use value, ethnic groups, wild mushrooms, Dogbo, Benin.*

Temporal dynamic of the ectomycorrhizal fungal diversity in relation to microclimate in Ouémé Supérieur Forest Reserve (Benin)

Kassim I. Tchan[1*], Sylvestre A. Badou[1], Roël D. Houdanon[1], Nourou S. Yorou[1]

1. *Unit Tropical mycology and Plant-Soil Fungi Interaction (MyTIPS), Laboratory of Ecology, Botany and Plant Biology, Faculty of Agronomy, University of Parakou 03 BP 125 Parakou*

**Corresponding author's contact: kassimtchan@gmail.com*

Abstract

During the decade, few studies have investigated qualitative and quantitative variations of fungi and factors that govern their temporal availability. For this, a study was performed in the classified forest of Ouémé Supérieur in North-Benin from June to October of 2016-2017. It aims to evaluate variation of richness, abundance and natural productions of ectomycorrhizal fungi linking to microclimate. Nine permanent plots of 2500 m^2 split into 25 plots of 100 m^2 were installed in three plant groups dominated by *Isoberlinia doka*, *Isoberlinia tomentosa* and *Uapaca togoensis*. A frequency of 2 visits/plot/week was made. Soil and air temperature, relative humidity of soil and air were recorded continuously every 30 minutes. Six homogeneous fructification phases were detected with the greatest diversity recorded in mid-July and mid-August each year. The intense fruiting stage of the fungi is preceded by a drop in air and soil temperature (30 to 26.88 °C and 32 to 25.58 °C respectively for 2016 and 26 to 24 °C and 35 to 25.5 °C respectively for 2017) and a rapid increase in air humidity (from 40 to 90% for both years) and soil moisture content (from 0.07 to 0.16). m^3/m^3 for 2016 and 0.05 to 0.15 m^3/m^3 for 2017).

Key words: *ectomycorrhizal fungi community, vegetation type, climate variables.*

Session 8: Food borne fungi and mycotoxins

Session Key Note Speaker: Dr. Gbemenou Joselin Benoit Gnonlonfin, ECOWAS-USAID Senior SPS standards advisor

About Dr. Gbemenou Joselin Benoit Gnonlonfin

Dr Gbemenou Joselin Benoit Gnonlonfin is currently ECOWAS-USAID Senior SPS standards advisor. Prior to this, Dr Gnonlonfin worked for 10 years as research scientist at Benin National Agricultural Research Institute. He has also worked as consultant/expert in the African Union Inter-Bureau on Animal Resources (AU-IBAR)/African Union's various projects especially on food safety and Codex Alimentarius related matters. I am also Food Safety preventive controls for human food Lead Instructor. He has a vast experience in capacity building, risk assessment and management, and project design and implementation in the field of food safety and Sanitary and Phytosanitary (SPS) at large. He is also member of the Joint FAO/WHO Experts on Food Additives and Contaminants (JECFA). He is committee member of the African Society of Mycotoxicology (ASM). He is one of the Standards and Trade Development Facility (STDF) developing country experts. Further, he worked as a post-doctoral scientist at the International Livestock Research Institute, Nairobi, Kenya. He holds a master degree in applied microbiology from University of Botswana, and a PhD in food safety from University of Copenhagen, Denmark.

ORAL TALKS

Fungi Diversity and Mycotoxin problem in Africa-perspectives from East-Central-Southern and West Africa

Gbemenou Joselin Benoit Gnonlonfin,

1. *African Union, Nairobi, Kenya, email: bgnonlonfin74@gmail.com*

Abstract

Global warming is creating conditions perfect for fungal proliferation and mycotoxin accumulation in food and feed in Africa. The climate changes scenario including El Nino are factors to be considered. Most of the affected foods are cereal grains and some dried spices which are staple foods in Africa. Thus, the need to focus on fungi and the impact of climate change. Mycotoxins are toxic secondary metabolites produced by fungi that contaminate agricultural commodities pre- or post-harvest. Africa is one of the continents where environmental, agricultural, processing and storage conditions of food commodities are conducive of *Aspergillus, Fusarium* and *Penicillium* fungal infection and mycotoxins biosynthesis. Among mycotoxins, aflatoxins have been studied more due to aflatoxicosis outbreaks that have resulted into loss of life of both humans and livestock in Africa. At high doses, aflatoxins can cause acute poisoning and death, and at chronic lower-level doses they can cause liver cancer and chronic immunosuppression. Further, aflatoxins have affected peanut trade in the producing countries in Africa. Significant efforts to reduce aflatoxin in contaminated produce through various strategies have been explored research, academia, and donor community. Some of these control practices are not well known by smallholder farmers. Important pre-and postharvest practices, in addition to the stringent food safety regulations and monitoring, are not undertaken as a result of various factors such as a lack of awareness and training, and the high cost of awareness and sensitization drives. The challenge of controlling aflatoxin contamination persists, and the situation may worsen as a result of climate change. Further, useful and guided prioritization of development activities, continuous awareness creation and training and future research.

Key words: *Climate change, fungi, mycobiota, aflatoxins, aflatoxicosis, capacity building.*

Mycotoxins contamination on african edible non-timber forest products from Cameroon

Joseph Djeugap Fovo[1*], Sita Ghimire[2], Anne Muiruri[3], Jagger Harvey[4]

2. *Phytopathology and Agricultural Zoology Research Unit, Plant Protection Department, Faculty of Agronomy and Agricultural Sciences, University of Dschang, Dschang, Cameroon*
3. *Biosciences eastern and central Africa-International Livestock Research Institute (BecA-ILRI) Hub, Nairobi, Kenya*
4. *Texas Feed and Fertilizer Control Service, Office of the Texas State Chemist, Texas A&M, AgriLife Research, Texas A & M University, Texas, USA*
5. *Feed the Future Innovation Lab for the Reduction of Post-Harvest Loss, and Department of Plant Pathology, Kansas State University, Manhattan, New York, USA*

**Corresponding author's contact: jdjeugapfovo@yahoo.fr*

Abstract

A survey was carried out to assess the presence and concentration of Total Aflatoxin (AFs), Fumonisin (F) and Zearalenone (ZEN) on seven edible non-timber forest products (ENTFP) in Cameroon. A total of 210 samples were collected from farmers and local markets in three agroecological zones and analyzed for moisture content and mycotoxins. Mycotoxins were analyzed using a commercially available enzyme-linked immunosorbent assay (ELISA) kits and results were validated using VICAM fluorometric method. The European Union regulation (No1881/2006) of mycotoxins for human consumption was adopted as reference. The moisture content of samples varied from 5.01 to 22.55 of the samples of which 5.71 of samples of which 5 of samples of which 21% were above the legal limit (100 ng/g). This is the first report of these mycotoxins contamination of ENTFP in the Congo Basin forest. Results of this study will be important to create farmers/consumers awareness on good harvesting and postgarvest practices and establish a mycotoxin monitoring program to alleviate mycotoxins contaminations of ENTFP.

Key words: *Aflatoxin, Edible non-timber forest products, Enzyme-linked immunosorbent assay (ELISA), Fumonisin, VICAM AflaTest, Zearalenone.*

Identification of Aflatoxigenic Fungi from Grains in a Nigerian Region Region Using MALDI-TOF Mass Spectrometry

Onyekachukwu F. I. Okeke[1], Stepthen O. Fapohunda[2], Celia Soares[3], Nelson Lima[4], Grace M. Ayanbimpe[5]

1. *University of Jos, Plateau State, Nigeria*

**Corresponding author's contact: liciasly@yahoo.com*

Abstract

Background: Aflatoxigenic fungi produce aflatoxins, highly toxic and carcinogenic compounds of concern in food safety. It has been estimated that more than 5 billion people in developing countries worldwide are at risk of chronic exposure to aflatoxins through contaminated foods. This study was carried out to identify aflatoxigenic fungi from maize (*Zea mays*) and guinea corn (*Sorghum bicolor*) which are major food items in Plateau state, north-central of Nigeria.

Materials and Methods: In a multistage sampling technique, markets for the study were selected. Simple random sampling method was used for sample collection from various sampling points within selected markets where these grains are sold. Isolation and identification of aflatoxigenic fungi employed the modern polyphasic methodology for filamentous fungi identification.

Results: Employing MALDI-TOF MS, a dendogram of spectral proximity between isolates was created based on various phenotypic traits. This was then used to finally identify the aflatoxigenic fungi isolated as *Aspergillus niger, A. aculeatus, A. tamari*, and *A. flavus*.

Conclusion: Our findings indicate contamination of maize and guinea corn in the study area with aflatoxigenic fungi which may pose serious health risks for the human and animal population and also have implications for food safety and public health in Nigeria.

Key words: *Aflatoxigenic fungi, grains, MALDI TOF MS, Nigeria.*

POSTERS

Fungal Profile and Mycotoxin Contamination in Animal Feed in Urban and Peri-urban Zones of Bamako

Ousmane Diarra[1*], Amadou Hamadoun Babana[2], Fassé SAMAKE Samake[1], Kadia Maiga[2]

1. *USTTB/FST-ISA, Bamako, Mali*
2. *USTTB/FST, Bamako, Mali*

**Corresponding author's contact: diarraousmane758@gmail.com*

Abstract

In animal production in Mali, food appears to be the major constraint. In fact, mycotoxin contamination of animal feed is common and widely spread in West Africa. Due to their ubiquity, mycotoxin producing moulds are capable of reducing the nutritional value of animal feed by elaborating several mycotoxins. Animal feed contaminated with mycotoxins has adverse effects on animal health and productivity. Also, mycotoxins may be carried over into meat and milk when animals are fed with contaminated feed. Samples of feed used for animal nutrition in Urban and Peri-urban Zones of Bamako were randomly collected and analyzed for fungal flora and natural incidence of mycotoxins. Ten mould genera were recovered, six of them known to be mycotoxigenic. More than 11 species were determined. Fumonisins, deoxynivalenol and zearalenone were detected in all the samples, while Aflatoxins were not detected in samples from Massala. Thirty-six out of 36 samples were contaminated with zearalenone, 34 out of 36 were contaminated with Fumonisins and 26 out of 36 were contaminated with deoxynivalenol. Also, 7 out of 36 samples were contaminated with aflatoxins. This study indicates the need for continuous assessment of the mycological status of animal feed production, in order to ensure food safety.

Key words: *Animal feed ,Contamination, Fungi, Moulds, Mycotoxin.*

Session 9: Mushrooms cultivation for food security and development

Session Key Note Speaker: Dr. Prosper Kiyuku, University of Burundi

About Dr. Prosper Kiyuku

Holding a Master Degree in Applied Biology, option Microbial Ecology. Lecturer and researcher in microbiology as well as in mushrooms cultivation technology at the University of Burundi, Faculty of Agriculture and Bioengineering (FABI). Since 1996, head of Food Microbiology Laboratory and Edible Mushroom research project at FABI. Also consultant in mushromms cultivation technology, fisheries and aquaculture at FAO Burundi.

ORAL TALKS

The contribution of mushroom cultivation technology to food security and development in Africa

Prosper KIYUKU

University of Burundi, pros1960@yahoo.fr

Abstract

In many African countries, the majority of the population is living upon agriculture and livestock. However, in most cases the production is insufficient due to overpopulation, bad agricultural techniques and climate change which lead to food insecurity and a high malnutrition rate.

Facing such a situation, mushroom cultivation was identified in many countries as an alternative solution to increase and diversify food production, contribute to food and nutritional security because of the high nutritional value (proteins, vitamins, minerals, …), short cycle and high yield of edible mushrooms. It is also a source of income for many producers.

Research activities carried out by the university of Burundi allowed to produce good quality spawn using local ingredients (sorghum) as well as several mushroom species *(Pleurotus ostreatus, P. cornucopiae, P. citrinopileatus, P. eryngii, Lentinula edodes, Ganoderma lucidum, Agaricus blazei)* on local crop residues (cottonseed shells, bean straw, soya beans straw, corn cobs, rice and wheat straw, palm oil fibers, elephant grass, etc.) using simple techniques available in rural areas.

These results led to the creation of small-sized mushroom cultivation enterprises in Burundi and in other countries. This has contributed to food security and poverty alleviation in many households. Most of the used technologies are simple and could be easily extended to many other African countries.

Isolation and mycelial growth of Malagasy wild edible mushrooms on different culture media

Martial Doret Andrianandrasana[1*], Harinisainana Rondro Baohanta[1], Herizo Randriambanona[1], Robin Duponnois[2], Heriniaina *Ramanankierana*[1]

1. *Centre National de Recherches sur l'Environnement, Antananarivo, Madagascar*
2. *Laboratoire des Symbioses Tropicales & Méditerranéennes- Montpellier, Montpellier, France*

**Corresponding author's contact: martialdoreta@yahoo.fr*

Abstract

Malagasy terrestrial ecosystem has recognized a great diversity of edible fungi. However, they are still wild harvested in Madagascar and only appear during the rainy season. This study is mainly aimed to different media such as MNM, Malt and Oats on the growth of mycelium and spores germination of the malagasy edible wild mushrooms (*Lentinula*, *Lentinus tuberugeanum, Cericeomyces serenus, Pleurotus ostreatus, Pleurotus sajor caju, Volvariella volvaceae, Lepista sp, Amanita rubenscens*) in order to produce edible fungi strains. Results showed that all edible fungi can growth on the three culture media (MNM, Malt, Oats) tested where MNM media presented a best mycelia growth of the majority edible mushrooms like *C. serenus, L. tuberugeanum, P. sajor caju* and *P. ostreatus*, after 10 days of cultivation compared of Malt and Oats. In the same culture media, the higher spores germination were recorded on *P. sajor caju*, *V. volvaceae* and *A. rubenscens* after 8 days of incubation. None spores germination were recorded on *Lepista* sp. Also, betwen the three culture media, Oats gave a highest spores germination rate than MNM and Malt. The results of this study revealed basic information for the further researches on cultivation and fruit bodies production of malagasy wild edible mushrooms.

Key words: *Edible fungi, Mycelium growth, Medium, Culture, Madagascar.*

Screening of ligninolytic enzymes of some native fungi from the Noun division in the western highlands of Cameroon

Ematou Njiki Leontine Nicole[1*]

1. University of Yaounde I, Yaounde, Cameroon

*Corresponding author's contact: ematounikileontinenicole@yahoo.com / alnjouonkou@yahoo.fr

Abstract

Ligninolytic enzymes produced by mushrooms are applicable in various biotechnological fields. Their activities in the majority of tropical African mushroom species are unknown. Lignin peroxidase, manganese peroxidase and laccase activities of 21 wild mushrooms including saprotrophic, ectomycorrhizal and termite associated species from the savannah and forest galleries of the Noun Division in Cameroon was screened from their fresh fruit bodies. Their specific activities were determined spectrophotometrically using their corresponding substrates respectively ABTS, methylene blue and guaiacol for laccase, lignin peroxidase and manganese peroxidase. Eighteen species presented the activities of all enzymes tested. The highest enzyme content was found in Coriolopsis polyzona with activities of laccase, manganese peroxidase and lignin peroxidase being 17.5994 U/mg, 0.1336 U/mg and 0.0007 U/mg respectively. Specific activity of laccase was highest (0.0220 – 17.5994) followed by that of manganese peroxidase (0.0005 – 0.1992 U/mg) and lignin peroxidase (0.0005 – 0.0278). Different levels of lignin peroxidase, manganese peroxidase and laccase activities were produced by both saprotrophic and ecto-mycorrhizal species. Extensive studies especially the screening of enzymes from mushroom mycelium are needed for the potential valorization of local mushrooms in various biotechnological fields such as bioremediation, reagent development in medical and environmental fields.

Key words: *Secondary metabolites, enzymes, mushrooms, Cameroon.*

Edible Indigenous Mushrooms for Food, Nutrition and income security in Kenya

Mercy Korir[1*], Joyce Mnyazi Jefwa[1], Michael Sakha[1], Victor Otieno[1]

1. *National Museums of Kenya, Botany Department (East African Herbarium), Nairobi, Kenya*

**Corresponding author's contact: mercykorir3317@gmail.com*

Abstract

The baobab mushroom, *Volvariella volvacea,* is a popular in Coastal Kenya. It thrives on wild decomposing Baobob (*Adansonia digitata*) trees. The mushroom is most preferred and rare. Exotic mushroom cultivation is common in Kenya and this has instigated the need to cultivate the indigenous *Volveriella volvaceae*. A study was conducted to generate high quality and low cost spawn for use by local communities. The experiment was conducted at the National Museums of Kenya. Experimental factors were culture media (Potato dextrose agar (PDA) and Malt Extract Agar (MEA)) and *Volvariella* spp. (Coastal and Nairobi). The rate of mycelial spread was assessed from inception until the petri dishes were fully colonized. Data analysis was conducted using Genstat 15th edition software and means were separated using Tukey's test. Mycelial spread was significantly ($p \leq 0.05$) faster with MEA media for both species compared to PDA media. Mycelial spread through entire petri-dish was complete by the fourth day for both species. The study concludes that MEA should be adopted for mycelial generation. This study is in progress to recommend further test of the mycelia in different substrates used for generation of spawn and evaluate locally available agricultural residue and industrial waste to achieve domestication.

Key words: *Indigenous mushrooms, MEA, PDA, Mushroom spawn.*

Spawn production and cultivation of lignicolous mushrooms in Kisangani (case of *Lentinus tuber-regium* and *Pleurotus squarosulus*)

Yassine Mwinyi Waziri[1*]

1. *Université de Kisangani, Kisangani, RD Congo*

**Corresponding author's contact: kiumbewaziri@gmail.com / mwinyi.waziri@yahoo.fr*

Abstract

Our study concerned the production of spawn and the cultivation of edible wood fungi. The objectives of this study were to produce spawn locally and to grow mushrooms in Kisangani climatic conditions regardless of the season. The species were isolated using the method proposed by Dibaluka (2005). The fruiting substrates consisting of *Gilbertiodedron dewevrei* sawdust and rice fane were soaked in water for 24 hours and fermented under cover for 15 days. The filling was carried out in heat-resistant plastic bags with a moisture content of 65% and then pasteurized in an ember autoclave for 1h 20 min at a pressure of 1 atm. The lardage was performed aseptically in the HEPA filter due to 1 teaspoonful per bag. The incubation took place in the cabinets in total darkness and continued until the total invasion of the plastic bags by the mycelium and the appearance of primordia. The result obtained for the first production was satisfactory with 2 kg 352 g (13%) of the harvested fruiting body. This proves a possibility of producing mushrooms in the local conditions of Kisangani.

Key words: *Spawn production, lignicolous mushrooms, Kisangani.*

Production of indigenous mushrooms spawn using agricultural substrates

Pauline Njeru[1*], Isabel Wagara[1], Samuel Kariuki[1]

1. *Egerton University, Nakuru, Kenya*

**Corresponding author's contact: polinjeru@yahoo.com*

Abstract

Indigenous oyster mushrooms occur naturally when conditions are favourable. Good quality spawn is a major challenge for the small scale farmers who would like to domesticate indigenous mushrooms. The use of wheat grain in mushroom growing industries for spawn production causes a threat to food security. The aim of this study was to test agricultural wastes as alternative substrates for indigenous mushrooms spawn production. Different agricultural wastes including straws of wheat, barley and beans, maize cobs and sawdust were sterilized and tested for spawn production. All the experiments were conducted in CRD design and the data was analysed using SAS software and means were separated using LSD.

Key words: *Indigenous oyster mushroom, spawn, substrate, pinning, colonization, flush, CRD, SAS, LSD, mycelia.*

Cultivation and assessment to nutritional contents of *Lentinus sajor-caju* and *L. squarrosulus* on some agricultural wastes in the western highlands of Cameroon

André-Ledoux Njouonkou[1*], Idriss Nchare Pokassa[2], Christopher Suh[3], Gaston Noumbo Tsopmbeng[2]

1. *University of Bamenda, Bamenda, Cameroon*
2. *University of Dschang, Dschang, Cameroon*
3. *Institut de Recherche Agricole pour le Développement (IRAD), Yaounde, Cameroon*

**Corresponding author's contact: alnjouonkou@yahoo.fr / grnoumbo@yahoo.fr*

Abstract

Lentinus sajor-caju and *L. squarrosulus* are two important wild edible saprotrophic mushrooms used in tropical Africa. However, they have not yet been domesticated and their uses depend largely on the environmental conditions. In order to improve the management of agricultural wastes and contribute to insure food security in Cameroon, a research was performed to assess the production of those mushrooms on different agricultural wastes in rural condition and their nutritional value according to substrate. Tissues of young wild sporophores was used to produce the spawns that were used to cultivate fruiting bodies on corn cobs, coffee husks, rice husks, sawdust and mixture of sawdust with rice husks. Also, the nutritional values of wild and cultivated samples were analyzed. For spawn production, mycelia growth was successful on all substrates. Fruiting of the mushrooms started averagely 90 days after inoculation. The best biological efficiency was obtained on corn cobs and sawdust for *L. sajor-caju* and *L. squarrosulus* respectively. Nutritional analyses showed that both wild and cultivated samples important quantities of carbohydrates, proteins, phenol, flavonoïdes, lipids and ash that varies according to substrate. This study supported the fact that native edible *Lentinus* can be produced on some agricultural wastes with good nutritional value.

Key words: *Edible mushrooms, organic wastes, spawns of production, fruiting bodies, organoleptic properties.*

Domestication of Saprophytic Wild Edible Mushrooms from Burundi Indigenous Forests

Vincent Nteziryayo[1*], Donatha Damian Tibuhwa[2], Tatien Masharabu[1], Prosper Kiyuku[1], Robert Muvunyi[1]

1. *University of Burundi, Bujumbura, Burundi*
2. *University of Dar es Salaam, Dar es Salaam, Tanzania*

**Corresponding author's contact: vincent.nteziryayo@yahoo.fr / nteziv83@gmail.com*

Abstract

In Burundi, mushroom industry has significant potential to support food and nutritional security and income generation. However, minimum work has been done to comprehensively identify and commercialize high yielding mushroom strains from indigenous forests in the country. Most of the studies that were carried out on mushroom cultivation focused on exotic strains. This is the first research on domestication of saprophytic wild edible mushrooms (SWEM) from Burundi indigenous forests. Nine SWEM samples were collected during the rain season in 4 localities namely the Kibira National Park, the forest natural reserve of Rumonge, the protected landscape of Makamba and the Ruvubu National Park. Isolation of the germplasm by tissue culture and spawn production was successful to six species while development of tertiary mycelium and final fruit body production was successful to only four out of nine species namely *Pleurotus citrinopileatus, Lentinus squarrosulus, Hypholoma fasciculare* and *Laetiporus sulfureus*. Two other species namely *Macrolepiota dolichaula* and *Trametes polyzona* remained at the secondary mycelium stage while *Amanita zambiana, Lactarius delicious* and *Amanita verna* did not develop even the primary mycelium. Burundi indigenous forest harbors SWEM potential for domestication. More research should be conducted to domesticate them for food and nutritional security.

Key words: *Domestication, saprophytic wild edible mushrooms, germplasm, spawn, Burundi indigenous forests.*

Spawn Production and Outdoor Cultivation of Edible Indigenous Mushrooms using Agricultural Wastes and Simple Technologies in Kenya

Isabel Wagara[1], Samuel Kariuki[1]

1. *Egerton University, Nakuru, Kenya*

**Corresponding author's contact: inwagara@yahoo.com*

Abstract

Mushroom utilization in rural Kenya is limited and primarily seasonal depending on the rainfall pattern. A study was undertaken with the aim of improving cultivation and utilization of edible indigenous mushrooms through availing affordable spawn and provision of easy and cheap mushroom production technologies to the small-holder farmers. Two edible oyster mushroom species (C2 and C13) collected from Kakamega equatorial rain forest in Kenya were successfully cultured in the laboratory on potato dextrose agar (PDA) and their spawn produced on wheat grains and sawdust. The ability of the spawn to produce fruit bodies was tested on various agricultural wastes, both indoor and outdoor. Fruit bodies of the two species successfully formed both indoors and outdoors to various degrees on agricultural wastes including wheat straw, barley straw, bean straw, crushed maize cobs, sawdust and compost. The most vigorous fruiting was obtained on bean straw. The results of this study indicate that indigenous edible mushrooms can be successfully cultivated outdoors on various agricultural wastes using simple technologies to ensure a sustainable supply throughout the year.

Key words: *Bean straw, Fruit bodies, Indigenous mushroom, Outdoor cultivation, Tissue culture.*

POSTERS

Effect of harvesting areas, growth stage and parts on the nutrient and antioxidant contents *Termitomyces letestui* (Lyophyllaceae) from Cameroon

Edouard Nantia Akono[1*], André-Ledoux Njouonkou[1], Tosi Solveig[2], Mariama Mbouh[1], Aphrodite Choumessi Tchewonpi[1]

1. *University of Bamenda, Bambili, Cameroon*
2. *University of Pavia, Pavia, Italy*

**Corresponding author's contact: akonoed@yahoo.fr*

Abstract

Termitomyces letestui is an edible mushroom that grows symbiotically with termites. Though this species is present in Cameroon markets, few investigations have been carried to clearly assess its nutrient content. This study aimed to evaluate the effect of harvesting areas, growth stage and parts on its macronutrients and some antioxidants. Mushroom samples were collected from three localities: Ndop (North-West region), Njingoumbe and Mbouda market both in West region. Their protein, lipid, carbohydrate, vitamin C, total phenols, flavonoid and ash contents were evaluated using appropriate analytical methods. The mushroom caps were richer in proteins than the stipes and mushroom samples from Ndop contained the highest protein levels. Mushroom development stages 1 and 2 exhibited the highest levels of nutrients and antioxidants. The Ndop samples showed the lowest total carbohydrates but the highest lipids. The mushrooms from Mbouda displayed high content of antioxidants. Samples from the 3 localities showed high levels of flavonoids in cap than stipe portion while mushrooms from Mbouda contained lowest amount of ash. Conclusively, this study demonstrated certain variability in the *T. letestui* nutrients as function of the localities, parts and stages of development with the mushrooms from Ndop and Mbouda being richer in proteins and antioxidants, respectively.

Key words: *antioxidants, localities, nutrients, proteins, stage development, Termitomyces letestui.*

Session 10: Mycorrhizal symbiosis and regeneration of tropical African forests

Session Key Note Speaker: Prof. Dr. Amadou Bâ, University of Antilles (West Indies, Guadeloupe, France)

About Prof. Amadou Bâ

Full professor in Soil Microbiology and Plant Physiology at University of Antilles (West Indies, Guadeloupe, France) and head of the plant biology and physiology laboratory. He has an interest in mycorrhizal symbioses with a specific focus on the diversity, ecology and functional traits of ectomycorrhizal fungi associated with African tree species.

ORAL TALKS

Diversity and functional traits of ectomycorrhizal fungi associated with African tree species

Amadou Bâ

University of Antilles (West Indies, Guadeloupe, France), email: Amadou.Ba@ird.fr

Abstract

Ectomycorrhizas (ECMs) are the most frequent mycorrhizal type in temperate and boreal forests. In contrast, they concern an economically and ecologically important minority of plants in African tropical forests such as caesalpionioid Fabaceae, Sarcolaenaceae, Dipterocarpaceae, Asterpeiaceae, Phyllantaceae, Sapotaceae, papilionoid Fabaceae, Gnetaceae and Proteaceae distributed in open, gallery and rainforests of the Guineo-Congolian basin, Zambezian Miombo woodlands of East and South-Central Africa and Sudanian savannah woodlands of the sub-Sahara. Overall, ectomycorrhizal (EM) status was confirmed in approximately 26% among tree species belonging to EM genera. As in temperate forests, the /russula–lactarius and /tomentella–thelephora lineages dominated EM fungal flora in tropical Africa. A low level of host preference and dominance of multi-host fungal taxa on different African adult tree species and their seedlings were revealed, suggesting a potential for the formation of common ectomycorrhizal networks. Moreover, the EM inoculum potential in terms of types and density of propagules (spores, sclerotia, EM root fragments and fragments of mycelial strands) in the soil allows opportunistic root colonization as well as long-term survival in the soil during the dry season. These are important characteristics when choosing an EM fungus for field application. In this respect, Thelephoroid fungal sp. XM002, an efficient and competitive broad host range EM fungus, possesses these characteristics and appears to be a good candidate for artificial inoculation of caesalpinioid Fabaceae and Phyllanthaceae seedlings in nurseries.

Key words: *Ectomycorrhizal fungi, diversity, succession, inoculation, growth response, tree recruitment, reforestation.*

Using mycorrhizal fungi as tools to select nurse plant for ecological restoration of natural forests in Madagascar

R. H. Rondro[1,5], I. Ratsizafy[1, 4], M.D. Andrianandrasana[1], H. Randriambanona[1], A.T. Razakatiana[4], E. Miasa[5], J.B. Ramananjato[3], F. Randriatafika[3], R. Duponnois[2], H. Ramanankierana[1]

1. *Laboratoire de Microbiologie de l'Environnement-Centre National de Recherches sur l'Environnement BP 1739 Fiadanana Antananarivo 101*
2. *Laboratoire des Symbioses Tropicales & Méditerranéennes UMR 113 IRD/CIRAD/INRA/SupAgro Montpellier/UM Campus International de Baillarguet TA A-82/J. 34398 Montpellier Cedex 5*
3. *Qit Madagascar Minerals Villa 3H-Lot IIJ 169 Ivandry Antananarivo 101*
4. *Mention Biochimie Fondamentale et Appliquée BP 906 Faculté des Sciences University of Antananarivo*
5. *Institut Supérieur en Sciences, Environnement et Développement Durable University of Toamasina Madagascar*

**Corresponding author's contact: ninish.rondro@yahoo.fr*

Abstract

Here, mycorrhizal fungi associated with pioneer plant species were used as indicators for nurse plants selection. We selected five pioneer plant species within three degraded natural forests: *Leptolaena bojeriana* for the sclerophyllous forest (central part), *Urena lobata, Rubus molucanus, Psiadia altissima and Conyza sumentrensis* for the natural rainforest (eastern part) and *Mimosa latispinosa* for a natural rainforest (southeastern part). Phillips and Hayman (1970) as well as Gerdemann & Nicolson (1963) methods were used for AMF observation and spores isolation. Diversity, density and infectivity of AMF spores were described according to Walker (1983); Schenck & Perez (1990) and INVAM criteria's.

Results show that density and diversity of VAM fungi shift significantly according to the pioneer species and site location. It has also highlighted that there is no direct correlation between the spore density and spores infectivity. However, we observed that black spores are significantly abundant in soil previously colonized by pioneer species for all sites. Sometimes and especially in the mining site soil, this VAM species tend to be monospecific. There are only few pioneer plant species that manage to promote the propagation of several species of AMF in their rhizospheric soil and could be used as basis for restoration scheme.

Key words: *VAM Fungi, Nurse plant, Mining soil, Natural forest, Ecological restoration, diversity.*

Potential and limitation of *Scutellonema bradys* (Tylenchida) control with arbusular mycorhizal fungi by using clean and infested seed yam cultivar

Atti Tchabi[1], Etienne Blaise M'boumba[1], Nicolas Olowotche[1]

1. *Institut Supérieure des Métiers de l'Agriculture, Université de Kara*

Abstract

Tuber yields of an important tropical staple crop, yam (*Dioscorea* spp.), per unit area, have declined in West Africa, mainly due to increasing land pressure, decreasing soil fertility and nematodes infestation. Yam roots were recently established to be highly mycorrhizal and associated with a wide range of arbuscular mycorrhizal fungi (AMF). Thus, AMF inoculation of yam may present an option to increase tuber yields, above all nematode control. The present study aims at evaluating the effect two commercial arbuscular mycorrhizal fungi (*Glomus mosseae and Glomus dussii*) inoculation at the nursery stage on the yield of infested and cleaned seeds from two cultivars (Amula , Tda 98/165), and on damage severity of *Scutellonema bradys* under field conditions. The results showed that, there was no significant different in number of tubers and tuber weight in respects to different treatments with amula cultivar. Yam clean minisetts treated with *G. dusii* prior to nematode inculation had highest significant effects in mealy bug's effect, gall roots, insect's damage, mechanical damage and crack of tubers compared with other treatments. Concerning the cultivar Tda 98/165, there is no significant different in number of tubers, tuber weight, tuber rot, mechanical damage and cracking using clean planting material inoculated with both AMF. Infested minisetts with cultivar Tda 98/165 no inoculated with AMF had highest significant different in mealy bug effect, gall roots, insects damage and termite damage compared with other treatments.

We concluded that the effect of AMF on yam nematode are limited when seed yam where infested before inoculation.

Key words: *Commercial AMF, Glomeromycota, Growth, Tuber crop, infested tubers.*

Arbuscular Mycorrhizal Fungi Spore Density and Root Colonization along an Altitudinal Gradient in Church Forests of western Tigray, Ethiopia

Emiru Birhane[1*], Teklemariam Gebregergs[1], Mengisteab Hailemariam[1]

1. *Mekelle University, Mekelle, Ethiopia*

**Corresponding author's contact: emiru.birhane@mu.edu.et / emiru.birhane@gmail.com*

Abstract

Arbuscular mycorrhizal fungi (AMF)-spore density and root colonization are sensitive to host species and abiotic factors. The aim of the study was to quantify the AMF spore density and root colonization along altitudinal gradients in three agro-ecological zones in church forests of western Tigray, Ethiopia. Data were collected from 45 plots measured 20 m X 20 m, that were established systematically. Samples for AMF spore density and root colonization were collected from four sides of each tree and replicated three times at two soil depths. The relationships between AMF spore density and root colonization with soil physicochemical properties and tree dendrometric parameteres were determined by Pearson's correlation analysis. All the surveyed church forest species were colonized by AMF. Species in the lowland were the highest suitable hosts for AMF and had significantly.

Key words: *Arbuscular mycorrhizal fungi, Spore density, Root colonization, Physicochemical soil properties, Altitudinal gradient, Church forest.*

Soil salinity affects the arbuscular mycorrhizal fungal community structures of *Sporobolus robustus* Kunth and *Prosopis juliflora* (Swartz) DC

Fatoumata Fall[1*], Hervé Sanguin[2], Diégane Diouf[3], Dioumacor Fall[4], Amadou Bâ[5]

1. *Laboratoire Commun de Microbiologie IRD/ISRA/UCAD, Centre de recherche de Bel-Air, Dakar, Sénégal*
2. *BGPI, CIRAD, INRA, Montpellier, France*
3. *Université du Sine Saloum El Hadj Ibrahima Niass (USSEIN), UFR Environnement, Biodiversité et Développement Durable, Kaolack, Sénégal*
4. *Centre National de Recherches Agronomiques (CNRA), Institut Sénégalais de Recherches Agricoles (ISRA), Bambey, Sénégal*
5. *LSTM/Laboratoire de Biologie et Physiologie Végétales, Université des Antilles, Guadeloupe, France*

**Corresponding author's contact: fal1481@yahoo.fr*

Abstract

In the Sine-Saloum Delta in Senegal, seedlings of the multipurpose legume, *Prosopis juliflora*, grow often in the tussocks of *Sporobolus robustus,* a salt tolerant grass providing forage. Both plants form a sylvopastoral system which remains poorly investigated. We hypothesized that (i) *S. robustus* shares with *P. juliflora* salt-adapted arbuscular mycorrhizal fungal (AMF) communities that could be beneficial to regenerate legume seedlings and (ii) environmental factors such as season and salinity structure AMF communities of S. robustus and *P. juliflora*. The objective of this study was to analyze the AMF diversity and community composition in *S. robustus* and *P. juliflora* roots growing under different salinity levels at dry and rainy seasons. AMF communities were characterized in 48 root samples of *S. robustus* and *P. juliflora* using Illumina Miseq sequencing of the small subunit (SSU) rDNA gene. A total of 1.125 operational taxonomic units (OTUs) from 6.451.593 total reads were affiliated with 10 Glomeromycota families and 16 genera. The majority of AMF OTUs belonged to Glomeraceae (91 of Glomeraceae reads), Rhizophagus (7.46), Funneliformis (0.02). Shannon diversity index and richness (number of OTUs observed) significantly decreased with salinity. Permutational multivariate analysis of variance revealed that soil salinity significantly affects the AMF community structures, but not season. In the future, it will be interesting to evaluate if native AMF taxa shared or not between both plants from high salinity conditions could constitute highly efficient bio-inoculants in saline soil restoration programs.

Key words: *Glomeraceae, Diversity, Species richness, Illumina sequencing.*

Selection of native Arbuscular Mycorrhizal Fungi to promote production of maize (*Zea mays*) grown in agricultural soils of South Kivu, D. R. Congo

Réussite Malembaka[1*], Joyce Mnyazi Jefwa[2], Fredrick Ayuke[1], Richard Onwonga[1], Leon Nabahungu[3]

1. *University of Nairobi, Nairobi, Kenya*
2. *National Museums of Kenya, Botany Department (East African Herbarium), Nairobi, Kenya*
3. *International Institute of Tropical Agriculture, Bukavu, DR Congo*

**Corresponding author's contact: bugalechite@gmail.com*

Abstract

Maize (*Zea mays*) is largely grown in Congo, across agroecologies. Major production constraints are low soil fertility and poor management. Mycorrhizal inoculation improves growth of maize in low fertility soils. Native AMF have not been extensively explored in South Kivu, D.R. Congo. The study investigated the occurrence, diversity of AMF and natural mycorrhizal potential of soils, in three maize growing sites differing in climatic conditions and soils types. Rhizosphere soils were sampled for assessment of native AMF communities. Data analysis assessing natural clusters were determined for soils properties and PCA analysis was done using canonical. Infectivity assay and roots colonization was done for inoculum potential assessment. This study shows preliminary results on AM fungal morphotypes in maize rhizosphere. Forty eight AMF morphotypes in 11 genera were evenly spread across ecologies, though the diversity and densities were highly variable within ecologies and more concentrated in acidic soils. The Gigasporaceae, Acaulosporaceae and Glomeraceae were dominant and some species were probably found for the first time. *Acaulospora rhemii, Funneliformis mosseae, Glomus sp., Scutellospora pellucida, Scutellospora castanea Dentiscutata heterogama* and *Gigaspora margarita* were ubiquitous. This indicates adaptation to a wide range of physicochemical environments and could also reduce the cost of production of inoculants. 22% of field soils were as effective as commercial AMF inoculant for roots colonization. The potential of selected native AMF to promote maize growth, P uptake and drought resistance is being evaluated under greenhouse conditions.

Key words: *Arbuscular Mycorrhizal Fungi, Diversity, Phosphorus, Maize, South Kivu.*

Mycorrhizal symbiosis, host families and associated mycoflora to compliment restoration of disturbed environments

Joyce Mnyazi Jefwa[1*], Quentin Luke[2], Michael Sakha[3], Mercy Korir[1]

1. *National Museums of Kenya, Botany Department (East African Herbarium), Nairobi, Kenya*
2. *Base Titanium, Kwale, Kenya*
3. *Kenyatta University, Nairobi, Kenya*

**Corresponding author's contact: joycejefwa@gmail.com / jjefwa@yahoo.com*

Abstract

Trends in restoration of degraded environments advocates for use of Indigenous plant species. Symbiosis is a key component in plant species adaptation to degraded environments. A study is examining the role of microbial symbiosis in restoration of Base Titanium mining site in Kwale, Kenya. A preliminary survey was undertaken to examine the status of 250 indigenous plant species targeted for restoration of the site. The study was prompted by disparities noted on tree species growth in conventional nursery media. Challenges included stunted growth leading to death, curling of leaves followed by wilting, and infestation by sooty molds and insects. However, Seedlings survived when transferred to forest soil. The nearest Gongoni and Buda Mafisini forests characterized by among others ectomycorrhizal trees *Brachystegia spiciformis, Afzelia quanzensis, Julbernardia magnistipulata, Guiboutia schliebenii, Erythrophleum suaveolens, Scorophloeus fischeri*, *Omocarpum sennoides*, and *Cleistanthus beentjei* among other species. The forests are associated with ectomycorrhizal mushrooms *Cantherellus* spp., *Russula* spp., *Amanita* spp., *Lactarius* spp., and *Boletus* spp. among other mushroom species. Non- destructive sampled roots of nursery seedlings were evaluated for mycorrhiza and nodules and information of the two forests and associated mycoflora. Results of seventy six species distributed in thirty families showed distribution of twenty four Ectomycorrhizal, four ectomycorrhiza-like, forty two endomycorrhizal, and fourteen nodulating species. The study indicates variety of symbiotic adaptations suggesting different nutrient acquisition strategies.

Key words: *Microbial symbioses, Degraded environments, Habitat restoration, Indigenous plants.*

Shift on Arbuscular mycorrhizal fungi dynamics along different topsoil in a Madagascar mining site: case of Mandena Fort Dauphin

Irinah Ratsizafy[1*], Rondro Harinisainana Baohanta[1], Martial Doret Andrianandrasana[1], Faly Randriatafika[2], Heriniaina Ramanankierana[1], Randriambanona Herizo[1], Duponnois Robin[3]

1. *Laboratoire de Microbiologie de l'Environnement-Centre National de Recherches sur l'Environnement, Antananarivo, Madagascar*
2. *Qit Madagascar Minerals, Antananarivo, Madagascar*
3. *Laboratoire des Symbioses Tropicales & Méditerranéennes UMR 113 IRD/CIRAD/INRA/SupAgro Montpellier, France*

**Corresponding author's contact: ratsizafy.irinah@gmail.com*

Abstract

This work aimed to highlight the effects of extraction activities and changes in plant community on the density, diversity and effectiveness of these symbiotic fungi. Topsoil were collected from 5 different zones: the conserved forest or TFC (no extraction activity), the disturbed forest or TFM inside the mining zone, the restoration area or TFd (stripped topsoil), the population of Erica sp (TE) and demineralized sand or SD (after mining). Gerdemann and Nicolson method (1963) was used for spore extraction. Diversity, density and effectiveness of AMF pores were described according to walker,1983 and the IMVAM database.

The results showed spore density was significantly low in the SD compared to the other topsoils. Morphotype black 50µm and black 80 µm where the most dominative. The effectiveness of living propagules was also significantly low in the SD. The same tendency was observed in TFd (300 MPN/100 g of soil) against more than 500 MPN for the other topsoils. The diversity and effectiveness of AMF propagules decrease also when the vegetation community changes. However, it was observed that AMF in the topsoil from Erica sp seem to be as competitive as those on the TFC soil in term of density, diversity and effectiveness.

Key words: *Arbuscular mycorrhizal, topsoil, mining in Madagascar.*

Role of arbuscular mycorrhizal fungi inoculation on nutrients uptake of sweet potatoes varieties in Nairobi County, Kenya

Michael Sakha[1]*, Joseph P. Gweyi-Onyango[2], Joyce Mnyazi Jefwa[1]

1. *Department of Agricultural Science and Technology, Kenyatta University, P O Box 43844-00100; Nairobi, Kenya*
2. *The National Museums of Kenya Herbarium Department, P.O. Box 40658- 00100; Nairobi, Kenya*

**Corresponding author's contact: sirher.sakha225@mail.com*

Abstract

Sweet potatoes is an important nutritious food security crop adapted to low soil fertility and increase in yield can be enhanced by the bio-inoculant, Arbuscular mycorrhiza fungi (AMF). A study was conducted to establish the role of AMF inoculation on nutrient use efficiency in low fertility area of Nairobi County, Kenya. A field experiment was conducted at Kenyatta University during short rains of November to March 2018. Experimental design was 2X2 factorial combinations replicated three times with variety (Kemb-10 and Bungoma) and AMF inoculation (with and without) in randomized complete block design. AMF root colonization intensity was significantly different between the two varieties ($p \leq 0.05$) with Kemb-10 variety being superior (92.33%). On the other hand, the shoot nutrient uptake of Kemb-10 was highest in Ca (5.86mg/100g), Fe (8.72 mg/100g), and N (2.87%). On the contrary, Bungoma variety was highest in K (213.1 mg/100g). Storage root nutrient uptake was significantly higher in Kemb-10 ($p \leq 0.05$) for Fe (10.08 mg/100g). The results also revealed significant ($p \leq 0.05$) increase in shoot nutrients uptake with Ca (56%) and N (13%). Further, AMF inoculation resulted in significance difference on storage root nutrient uptake resulting in N (17%), Ca (11%) and Fe (6%). Results demonstrate that AMF inoculation improved nutrient uptake in sweet potatoes with the improved variety responding more than non-improved variety.

Key words: *Crop management, Soil fertility, Microbial inoculants, Nutrient uptake.*

Management of the ectomycorrhizal symbiosis between *Coccoloba uvifera and Scleroderma bermudense* for coastal plantations in Senegal

Seynabou Sene[1*], Momar Seye[2], Marc-André Selosse[3], Samba Ndao Sylla[1], Amadou Bâ[4]

1. *LMI-LAPSE/Commun Laboratory of Microbiology IRD/UCAD/ISRA, BP 1386, Dakar, Senegal*
2. *Water and Forestry Service of Guediawaye, Dakar, Senegal*
3. *National Museum of Natural History, Sorbonne Universities, 57 rue Cuvier, 75005, Paris, France*
4. *Laboratory of Plant Biology and Physiology, University of Antilles, PO Box 592, 97159, Pointe-à-Pitre, France*

**Corresponding author's contact: senseynabou@gmail.com*

Abstract

In Senegal, coastal ecosystems are highly vulnerable due to poor soils, high winds and sea spray. Reforestation of these coastal ecosystems by mycorrhizal exotic plants have often been an alternative due to the lack of native tree species adapted at this context. Thousands of hectares were planted with mycorrhizal *Casuarina equisetifolia* and *Eucalyptus camadulensis* in the Niayes area and along the littoral to stabilize sand dunes and to protect cultivated areas. Casuarina plantations do not regenerate and are threatened by the anthropic pressions. To diversify theses plantations, the water and forestry services of Senegal are introduced the Caribbean non-invasive ectomycorrhizal (ECM) tree *Coccoloba uvifera*, namely seagrape, as windbreak, for their edible fruits and to prevent road covering by sand. In its native area in Guadeloupe (French West Indies), seagrape is associated with 15 ECM fungi including *Scleroderma bermudense*. In Senegal, seagrape is exclusively associated with *S. bermudense*. Population genetics analysis showed that fungal populations *S. bermudense* from Senegal where seagrape is introduced are little differentiated from the Caribbean ones, separated by thousands of kilometers, suggesting a relative recent introduction. Moreover, a scanning microscopy electron analysis showed that seeds carry *Scleroderma* spores, probably because, when drying on beach sand, they aggregate spores from the spore bank accumulated by semi-hypogeous *Scleroderma* sporocarps. Seagrape displays two predispositions for co-introduction, namely its specificity (making it irresponsive to local ECM fungi) and its unusual pseudo-vertical transmission of *Scleroderma* spores aggregating on seeds. This explains when seeds germinate, seedlings of seagrape are spontaneously colonized by *S. bermudense* in nursery and plantation without the need to bring fungal inoculum.

Key words: *Seagrape, Ectomycorrhiza, co-introduction, exotic trees, plantations.*

POSTERS

Micronutrients may influence the efficacy of ectomycorrhizas to support tree seedlings in a lowland African rain forest

David McClintoch Newbery[1*], Neba Godlove Ambe[2]

1. *Institute of Plant Sciences, University of Bern, Altenbergrain 21, CH-3013 Bern, Switzerland*
2. *University of Buea, Buea, Cameroon*

**Corresponding author's contact: david.newbery@ipc.unibe.ch / Tel (+237) 677674051*

Abstract

In the lowland rain forest of SW Cameroon, field experiment tested whether ectomycorrhizal hyphal connections might affect the growth and survival of seedlings of a principal tree species, *Microberlinia bisulcata,* close to its adults. Nursery-raised seedlings were planted into fine-, medium-, and coarse-mesh root bags, and as no-bag controls, in replicate subplots. Bags prevented fungal hyphae, and fine- and medium-sized roots, respectively, from outside forest floor root mat. Harvests were taken after 1 and 2 yrs, with non-destructive recording in between. Survivorship did not differ between treatments (33 higher than controls, respectively. Positive effect of ectomycorrhizas on growth was 13.6. Elemental analysis of seedling parts showed few differences between treatments, but phosphorus was high in stems, aluminum and iron were very high in roots, and copper deficiently low in leaves. Soil analyses revealed very low copper levels, suggesting that this element was critically limiting for seedlings. Ectomycorrhizas are probably important for copper uptake. The efficacy of ectomycorrhizal networks for at least seedling establishment in this forest is low.

Key words: *copper as micronutrient; ectomycorrhizas; inhibitory soil factors; Korup National Park; lowland rain forest; rooting establishment; tree recruitment.*

Assessing the impact of different cropping systems practice on the Arbuscular Mycorrhizal Fungi restoration in maize field infested by *Striga asiatica* L. Kuntze in Madagascar

Razafindrasoa[1*] M.A., Andrianjaka[1] A., Razafindrabe[1] C., Rakotoarisoa[1] N.V., Ratsimiala Ramonta[1] I., Rasoamampionona[1] B.

1. *Plant Biology and Ecology-Faculty of Sciences and Technology- University of Antananarivo, Antananarivo, Madagascar*

**Corresponding author's contact: alitina02@yahoo.fr*

Abstract

The main problem of maize plantation is the attack of *Striga asiatica* in the poor soil, leading to the reduction of maize yield. The Arbuscular Mycorrhizal Fungi or AMF protect the host plants against the attack of biotic stress, increasing the water and their nutrient element. The objective of this study was to enhancing maize production by restoring the AMF in soil under *Striga asiatica* infestation. During 03 years period since 2015 to 2018, three cropping systems were installed on an experimental field of FOFIFA station – Madagascar, using Plata maize variety such as: Mulch based - Cropping System of Stylosanthes or MCS, and Green Cover System using *Vigna unguiculata* (GCS) and a Control Plot (CP). A laboratory study was also conducted to determine the mycorrhization rate in maize roots. The best result on root mycorrhization was found in MCS 16.53% against 2.01% for the CP. The average number of *Striga* plants per $3m^2$ minimal area emerging soil is 1 for MCS, 3 for GMS and 15 for Control Plot. The yield production for MCS, GCS and CP were respectively 4.43 t/ha, 2.56 t/ha and 1.40 t/ha. The high roots colonization mycorrhizal of 16.53% reduces the average *Striga* plants number emerging 1 per $3m^2$ and increases maize grain production of 4.43 t/ha for MCS. The use of MCS is the best way to increase the maize yield, reduces Striga plants emerging and to improve the AMF restoration in maize culture.

Key words: *Restoration, Arbuscular Mycorrhizal Fungi, maize, Striga, Stylosanthes, Vigna unguiculata.*

Arbuscular mycorrhiza root colonization characteristics response to different forms of Phosphorus

Michael Sakha[1]*, Joseph P. Gweyi-Onyango[2], Joyce Mnyazi Jefwa[1]

1. *Department of Agricultural Science and Technology, Kenyatta University, P O Box 43844-00100; Nairobi, Kenya*
2. *The National Museums of Kenya Herbarium Department, P.O. Box 40658- 00100; Nairobi, Kenya*

**Corresponding author's contact: sirher.sakha225@mail.com*

Abstract

Arbuscular mycorrhiza fungi (AMF) determine efficiency in phosphorus (P) uptake, drought, toxicity and salinity alleviation, and pathogens control. Percentage root colonization (frequency and intensity) is the main parameter used to determine mycorrhiza efficiency. This approach may overlook the role of different colonization characteristics in functional efficiency. The study was carried to inform on the role of AMF in the nutrient use efficiency and advice on the kind of inputs that are compatible. A study was conducted to evaluate the effects of phosphorus forms on AMF colonization characteristics I sweet potatoes in the short rains of November to March 2018. A field experiment was established at Kenyatta University in Nairobi County, Kenya. It consisted of 3x2 factorial treatment combinations with two factors arranged in a randomized complete block design (RCBD) replicated three times. The factors were (1) Phosphorus (P) forms Triple super phosphate (TSP), mijingu rock phosphate (MRP) and control, and (2) AMF inoculations (with and without). Results indicated significant differences at $p \leq 0.05$ on AMF characteristics recorded. Phosphorus forms interacting with AMF inoculation indicated MRP to have the highest arbuscule and frequency of colonization 25 and 29% in the fifth month. MRP without inoculation recorded highest 61% appresoria. Non-inoculated TSP had the highest vesicles 21%. The highest coils were observed in inoculated control in the third month. In conclusion, the results show that MRP form induced highest appresoria which suitable for colonization. MRP also induced highest arbuscules and coils indicating highest efficiency of nutrient uptake in sweet potato.

Key words: *Sweet potato, Phosphorus, Inoculation, Colonization characteristics, Efficiency.*

Session 11: Termites-Fungi interactions in tropical Africa

Session Key Note Speaker: Associate Professor Michael Poulsen, Department of Biology, University of Copenhagen

About Associate Professor Michael Poulsen

Michael Poulsen is an Associate Professor at the Department of Biology, University of Copenhagen. He is interested in the evolutionary origin and stability of symbioses, including conflict and cooperation within beneficial symbiotic associations. His work focuses on host-symbiont interactions, and the coevolutionary history of fungus-growing insect-microbe associations, primarily in African fungus-growing termites. He did his PhD at the Department of Population Biology (Copenhagen University) from 2002-2005. He subsequently spent time in the USA where he was postdoc at the Department of Bacteriology, University of Wisconsin-Madison until returning to the University of Copenhagen in 2010, where he leads the Social and Symbiotic Evolution Group (https://www.socialsymbioticevolution.com/). Michael has published more than 70 peer-reviewed publications that have been cited 2863 citations and with h=30 (Google Scholar).

ORAL TALKS

Thirty million years of co-evolutionary interactions in an African termite-fungus-bacteria symbiosis

Michael Poulsen

University of Copenhagen, Denmark, email: mpoulsen@bio.ku.dk

Abstract

Farming of fungi in the genus *Termitomyces* originated approximately thirty million years ago in a sub-family of higher termites (the Macrotermitinae) in Sub-Saharan Africa. Since then, the association has evolved and diversified to inhabit most of sub-Saharan Africa and large parts of Southeast Asia, becoming the dominant decomposer of plant biomass and playing important roles in nutrient turnover in arid and semi-arid environments. This success has been accomplished through intricate symbiotic association with the plant-biomass degrading *Termitomyces* fungi and complex gut bacterial communities that complement each other metabolically. This symbiotic association is incredibly efficient in utilizing plant substrates harvested by the termites and appears to avoid contracting diseases; two focal areas of work in my group. Here, I will review our current understanding of how this complex symbiosis accomplishes near-complete degradation of plant material and how the association remarkably manages to avoid specialized diseases of their monoculture fungus crop.

Key words: *Macrotermitinae, plant-biomass degradation, microbiomes, Termitomyces, co-evolution, metabolomics, metagenomics.*

The role of gut passage in keeping fungus-growing termite gardens disease free

Nick Bos[1], Leandro Guimaraes[2], Romen Palenzuela[3], Michael Poulsen[4]

1. *University of Copenhagen*

**Corresponding author's contact: nbos@bio.ku.dk*

Abstract

Eusocial insects, including ants, bees, wasps, and termites live in dense groups, and many advantages of group living and sociality have been proposed, such as increased efficiency of foraging, brood care, and defence. However, group living also increases the chance of rapid spread of disease, a risk that may be aggravated by the high relatedness among individuals within colonies. For fungus-growing termites, this risk of disease is increased due to their farming of a monoculture of *Termitomyces* fungus, meaning both the termites and the fungus have to remain disease free to ensure proper colony functioning. Termite workers ingest collected foraging material, which undergoes a quick gut passage and is then deposited on the fungus garden. It has been proposed that this gut passage would eliminate pathogenic fungi present within the plant forage. We tested this hypothesis by dissecting the guts of young minor workers of *Macrotermes bellicosus*. Their gut was sectioned into foregut, midgut and hindgut, and we used a culture-based method to assess viable spores. Fungal diversity did not decrease through gut passage, implying that gut passage might not play a role in sanitizing the foraging material.

Key words: *Termites, Macrotermes, Termitomyces, pathogens, immunity, microbes.*

Overview of the mutualistic symbiosis between the fungus-growing termites (Isoptera: Macrotermitinae) and *Termitomyces* (Basidiomycota: Lyophyllaceae) in West Africa: diversity, distribution, phenology and socio-economy

N'golo Abdoulaye Koné[1*], Bakary Soro[1]

1. *UFR des Sciences de la Nature, Station de Recherche du Parc National de la Comoé, Université Nangui Abrogoua (Côte d'Ivoire), Abidjan, Côte d'Ivoire*

**Corresponding author's contact: ngolo197804@yahoo.fr / (+225) 07620384*

Abstract

Fungus-growing termites (Macrotermitinae) have developed a sophisticated mutualistic symbiosis with a fungus (*Termitomyces*), which they cultivate on combs constructed from faecal material within their nests. This mutualistic symbiosis is obligate for both partners: the termites provide a constant, highly regulated growth environment for their fungal symbionts, while the fungi provide food for the termites. This mutualistic symbiosis is also mainly characterized by the seasonal production of sporophores of the symbiotic fungus on the mounds of the host termite colony. These sporophores play an important ecosystem services since they are harvested, eaten and sold by the local inhabitants in many African countries. However, information on their diversity and socio-economic aspects is lacking on a regional scale. Here we examined Termitomyces diversity, distribution and socio-economical importance in some West African countries. A total of 19 sporophores based species were recorded with their specific host termite: 16 Termitomyces species were recorded in Ivory Coast; 7 species in Benin, 11 species in Togo and 4 species in Guinea. However, taking into account all available data on fungus growing termites and their symbiotic fungi (molecular and phylogenetic data), a conservative diversity of at least 22 species in this African region. Furthermore, three rare and endangered species were recorded in West Africa. Sporophores of three species were found fruiting abundantly (*Termitomyces medius*, *T. letestui* and *T. shimperi*); while only two them (*T. letestui* and *T. shimperi*) were found sold in huge quantities during their respective fructification periods. Both species generate a high income for the local inhabitants in West Africa and especially in Ivory Coast where this activity is really spectacular.

Key words: *Termitomyces, Fungus-growing termites, Sporophores, Diversity, socio-economy, West Africa.*

Phylogeny and structure of gene clusters related to secondary metabolites from the termite fungal crop *Termitomyces*

Suzanne Schmidt[1], Christine Beemelmanns[2], Nina Kreuzenbeck[3], Duur K. Aanen[4], Michael Poulsen[5]

1. *Social and Symbiotic Evolution Group, Section for Ecology and Evolution, University of Copenhagen*

**Corresponding author's contact: suzanne.schmidt@bio.ku.dk*

Abstract

The use of compounds produced by hosts or symbionts for defence against antagonistic organisms has been identified in many organisms, including in fungus-farming termites in the subfamily Macrotermitinae. Obligate mutualistic *Termitomyces* fungi play an essential role for the termites for plant biomass decomposition and food, but the fungus has recently also received attention as a possible contributor to symbiosis defence through the production of secondary metabolites, which could potentially serve in defensive functions. Here we use a bioinformatics approach to analyse available genomes of *Termitomyces* from a variety of African Macrotermitinae colonies to identify the presence and explore the diversity of biosynthetic gene clusters. By expanding on results obtained from fungiSMASH analysis and individual in depth blast analysis, we seek to test associations between gene clusters in Termitomyces and termite host origin based on phylogenetic analysis. We evaluate the domain organisation of the most abundant secondary metabolite-related gene clusters present among the isolates and the challenges in obtaining fungi-derived secondary metabolites. Overall, this will provide insight into the evolution of termite nests management conditions together with the identification of putative defence compounds using a genome-guided approach.

Key words: *Macrotermitinae, Symbiosis, Termitomyces, sequencing, genomic mining.*

Authors index

Taxa index