Walmon

FINAL WORKSHOP
27-28 JUNE 2025
Instituto Superior de Agronomia (ISA),
University of Lisbon

Sofia Conde [CEF/LEAF (ISA, UL)]

27 Junho

WHO IS HIDING AMONG THE GRAINS OF RICE?

PESTS AND DISEASES OF MANGROVE RICE IN GUINEA-BISSAU, FROM STORAGE TO THE FIELD

ADVISORS | Marina Temudo (CEF/ISA), Sónia Ferreira (CIBIO/InBIO), Filipa Monteiro (LEAF/ISA, UL)

Hinc Patriam Sustinet · TERRA · cef Centro de Estudos Florestais · Linking Landscape Environment Agriculture and Food LEAF Research Center · CIBIO · InBIO REDE DE INVESTIGAÇÃO em Biodiversidade e Biologia Evolutiva · BIOPOLIS · DeSIRA PARTNERSHIPS FOR INNOVATION · Funded by the European Union

Grant | FOOD/2019/412-700

Ph.D. tasks

01
Task

Systematic review of pests and diseases of rice

02
Task

Diseases in stored rice seeds

03
Task

Pest in stored rice seeds

04
Task

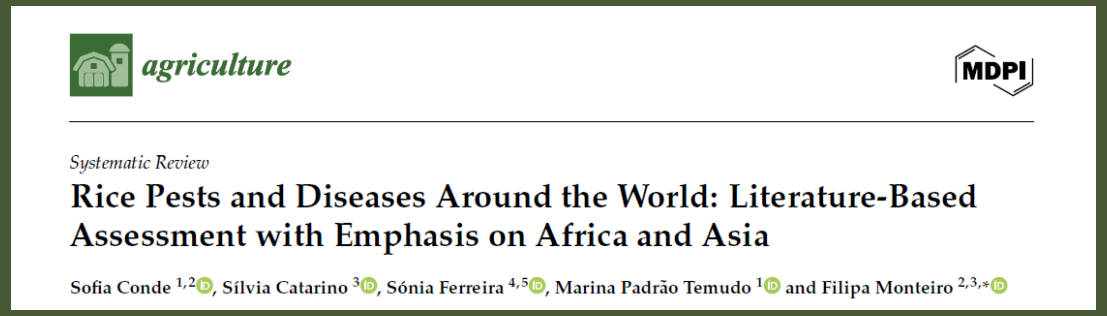
Diseases in the mangrove rice fields

05
Task

Pests in the mangrove rice fields

Ph.D. scientific outputs *(published)*

01
Task



agriculture

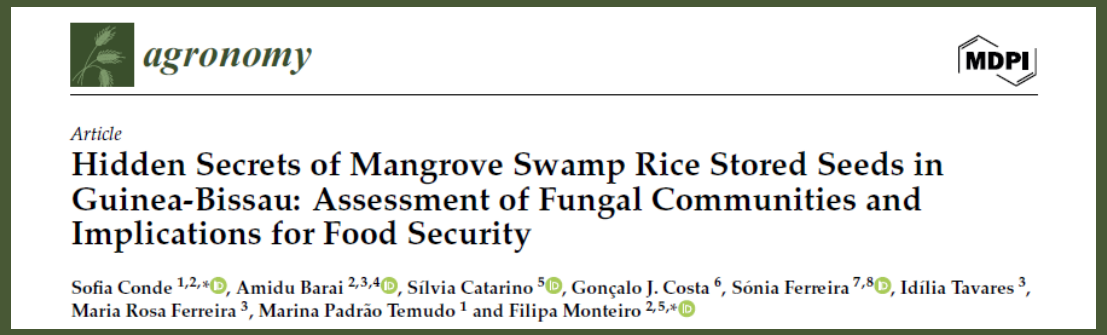
MDPI

Systematic Review

Rice Pests and Diseases Around the World: Literature-Based Assessment with Emphasis on Africa and Asia

Sofia Conde [1,2], Sílvia Catarino [3], Sónia Ferreira [4,5], Marina Padrão Temudo [1] and Filipa Monteiro [2,3,*]

02
Task



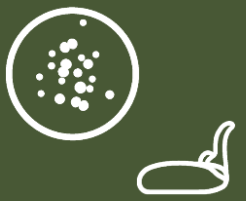
agronomy

MDPI

Article

Hidden Secrets of Mangrove Swamp Rice Stored Seeds in Guinea-Bissau: Assessment of Fungal Communities and Implications for Food Security

Sofia Conde [1,2,*], Amidu Barai [2,3,4], Sílvia Catarino [5], Gonçalo J. Costa [6], Sónia Ferreira [7,8], Idília Tavares [3], Maria Rosa Ferreira [3], Marina Padrão Temudo [1] and Filipa Monteiro [2,5,*]



03
Task

Journal of Stored Products Research 111 (2025) 102567

Contents lists available at ScienceDirect

Journal of Stored Products Research

journal homepage: www.elsevier.com/locate/jspr

Uninvited guests: New stored mangrove rice insect pests in Guinea-Bissau

Sofia Conde [a,b,*], Filipa Monteiro [b,c], Sílvia Catarino [c], Maria Rosa Ferreira [d], Sónia Ferreira [e,f,**]

Ph.D. scientific outputs *(in prep.)*

04
Task

The Fungal World of Mangrove Swamp Rice: Insights into Guinea-Bissau's Crop Cycle
(article in preparation)

05
Task

Uncovering the Pest World of Mangrove Swamp Rice: A Glimpse into Guinea-Bissau's Crop Cycle
(data under analysis)

01
Task

Systematic review of pests and diseases of rice

Material and Methods

Data Filtration

3 Databases

PubMed CABI Clarivate Web of Science™

33 sets of key words

Restricted to Title and Abstract

Cleaning

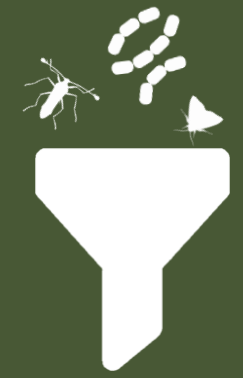
Exclusion Criteria

1. Duplicates removed
2. Records not related to rice pests and diseases

Full Article Reading

or abstract whenever the full article was not available

Data Extraction



Data Curation

Scientific names of pests and diseases have been revised in order to standardize according to accepted names

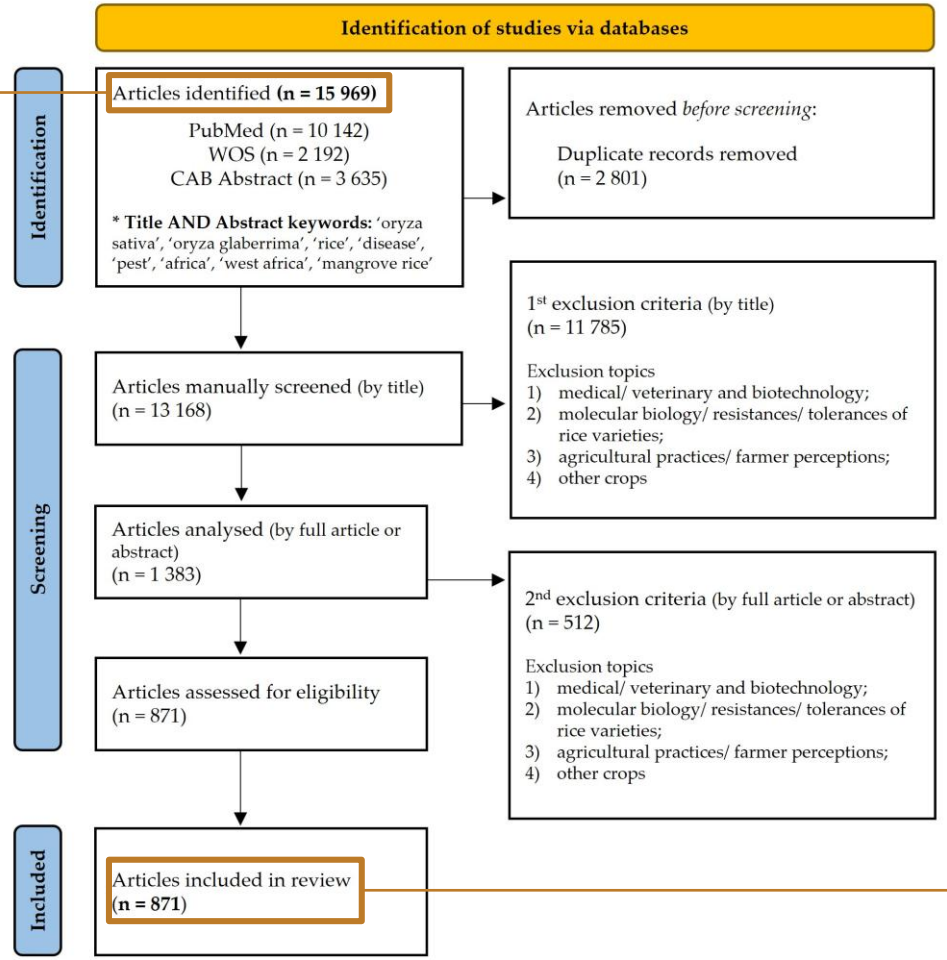
GBIF Global Biodiversity Information Facility

NCBI National Center for Biotechnology Information

Systematic review of pests and diseases of rice

Material and Methods

Articles identified **(n = 15 969)**

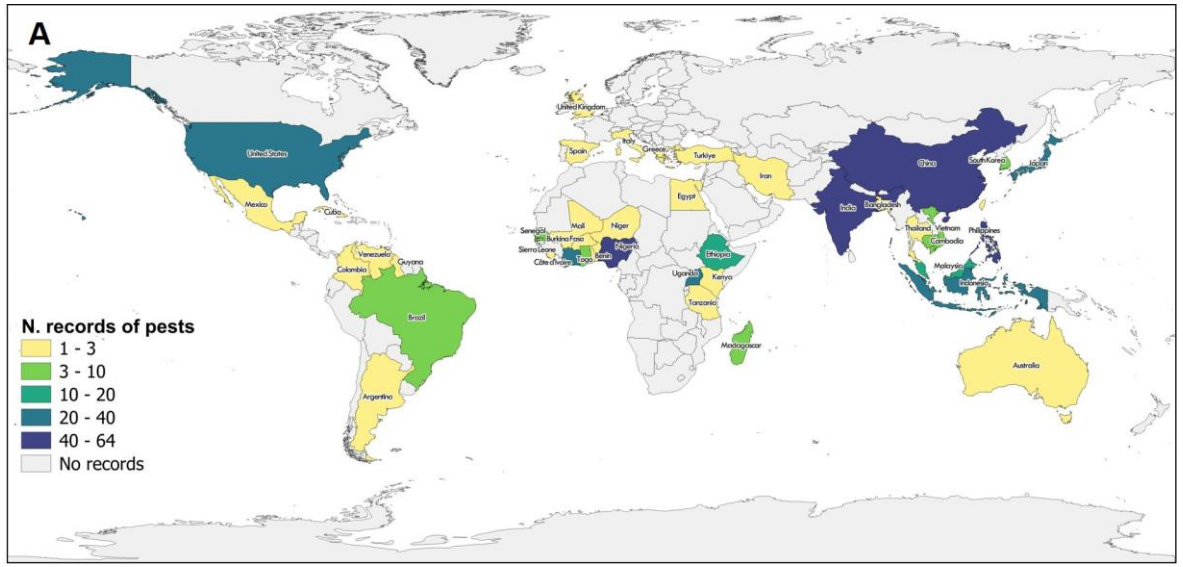


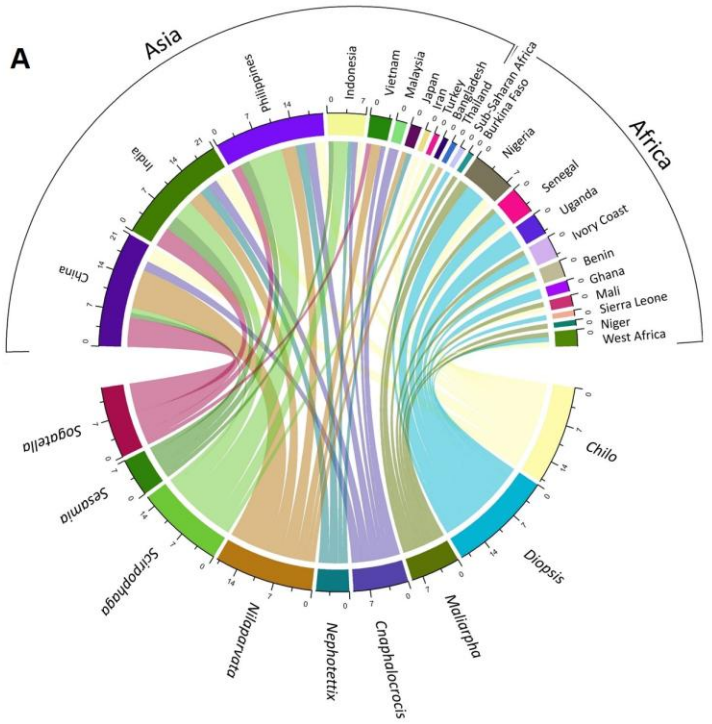
Articles included in review **(n = 871)**

Systematic review of pests and diseases of rice

Results

Pests





A. *Diopsis* sp.

D. macrophthalma, D. apicalis, D. collaris

B. *Maliarpha* sp.

M. separatella

C. *Chilo* sp.

C. zacconius

D. *Nilaparvata* sp.

N. lugens, N. bakeri

E. *Scripophaga* sp.

S. incertulas, S. innotata

I. *Sesamia* sp.

S. inferens

J. *Nephotettix* sp.

N. virescens, N. cincticeps

F. *Sogatella* sp.

S. furcifera, S. kolophon, S. vibix

G. *Chilo* sp.

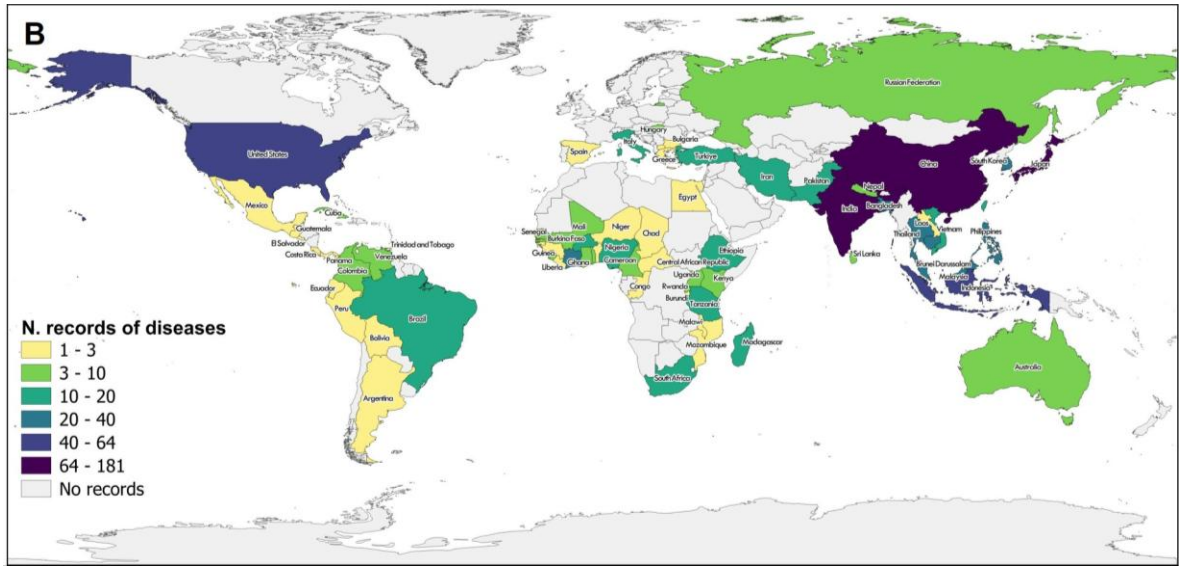
C. suppressalis, C. auricilius, C. polychrysus

H. *Cnaphalocrocis* sp.

C. medinalis, C. exigua, C. patnalis

Results

Diseases

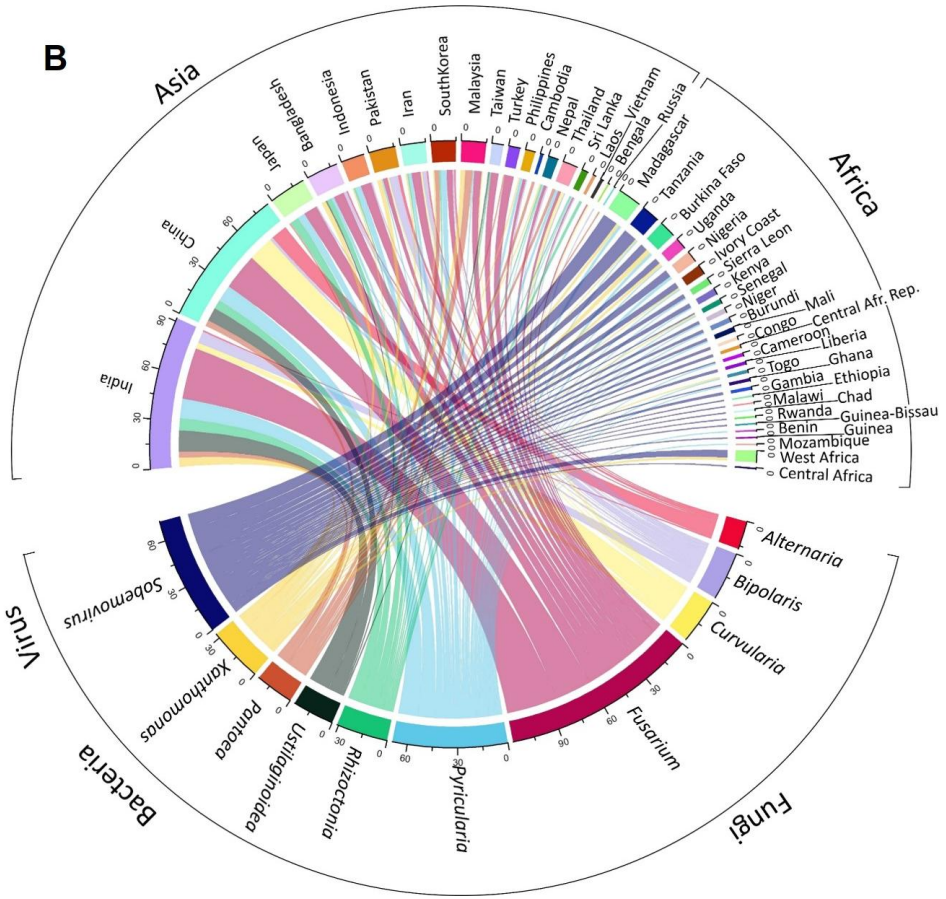


Africa

Pyricularia
Xanthomonas
Sobemovirus

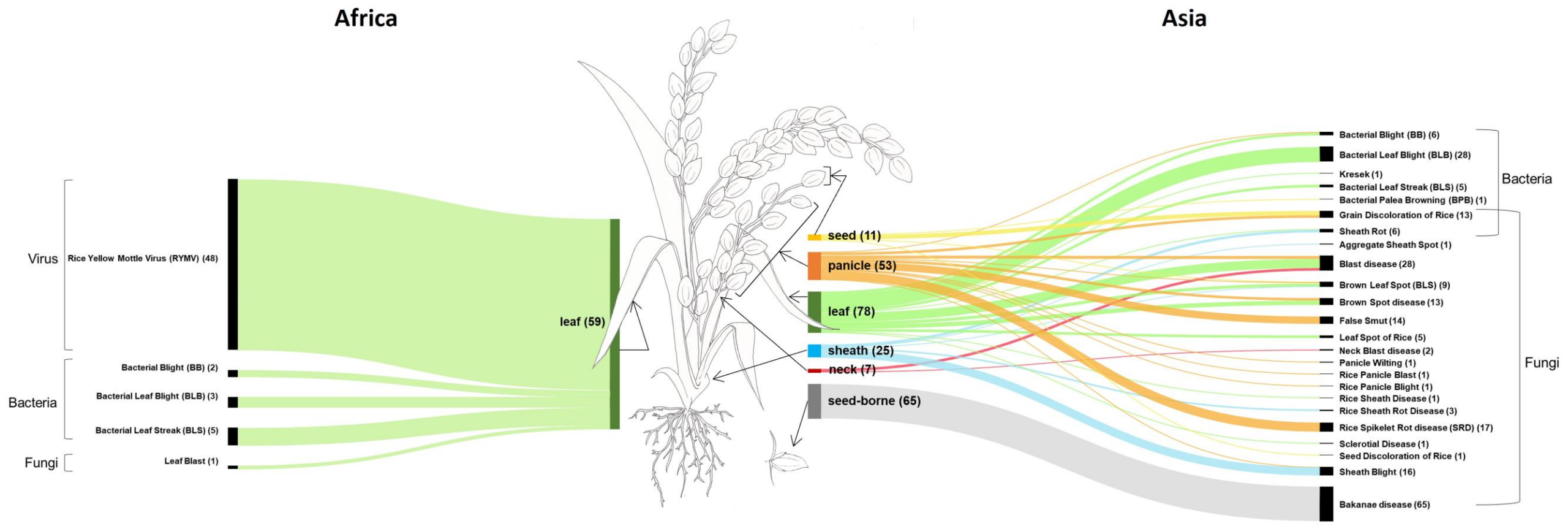
Asia

Fusarium
Bipolaris



Systematic review of pests and diseases of rice

Results

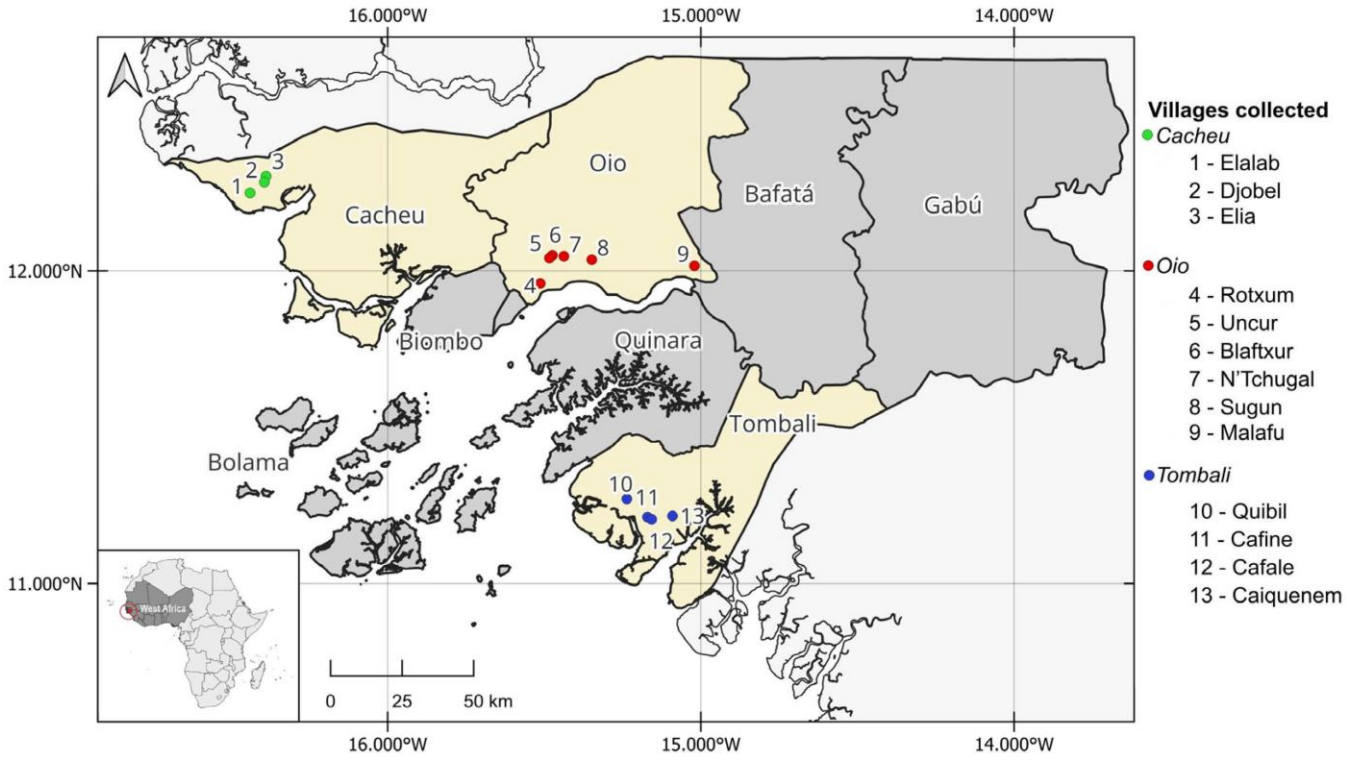


Material and Methods | Sample Collection

1 Sample Collection

3 Regions | 13 Villages | 30 Farmers

Samples:
≠ varieties and/or
≠ storage structure



Material and Methods | Laboratory Analysis

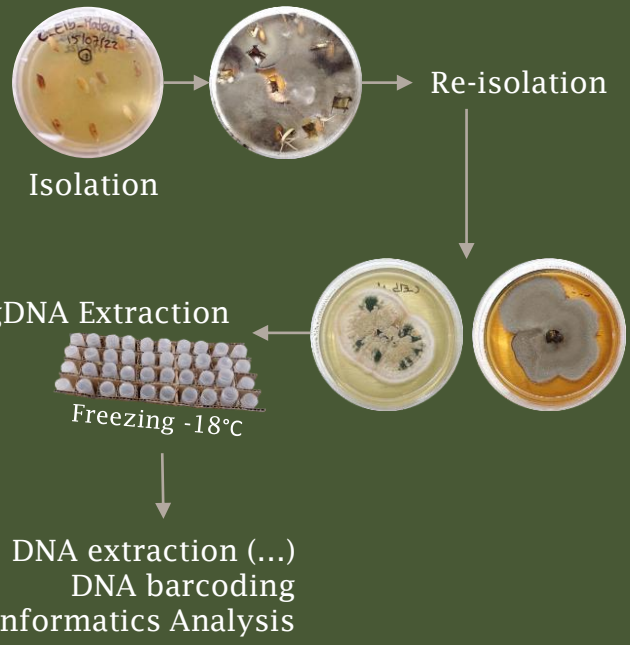
2

Germination rate

64 samples x 3 repetitions = **192 trials**
100 seeds / Petri dish
Measurements at day 3, 5, 10 and 14

Fungal Identification

64 samples x 3 repetitions = **192 trials**
- Fungi re-isolation
- gDNA extraction and storage for DNA barcoding (**N=70**)



Aflatoxins Content

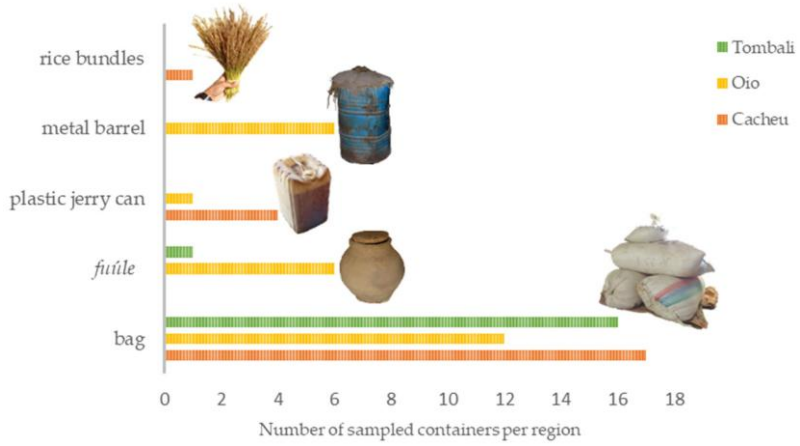
Mixed samples per village
Sub-samples for aflatoxin analysis (B1, B2, G1, G2)

Task 02

Diseases in stored rice seeds

Results | Sample Collection

- Farmers select and separate rice seeds by specific characteristics, then dry, thresh, and store them.
- Storage containers vary widely, including bags, barrels, and traditional structures like *fuúle* and *biré*/psangá.
- Polyethylene bags are the most used rice storage containers across all ethnic groups and regions.



02 Task

Diseases in stored rice seeds

Results | Germination Rates

- **High Germination Rates:** All rice varieties tested had strong germination, achieving over 95% by day 14.
- **Variations by Species:** No significative variations were found between *Oryza glaberrima* and *Oryza sativa.*

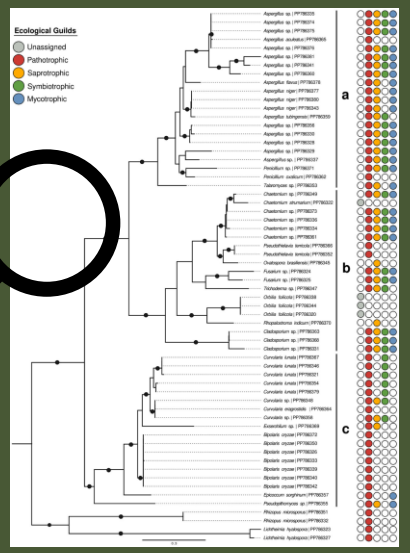
Rice species	Rice Varieties [Vernacular Name]	Language	Region
Oryza glaberrima	*Edjur*	Baiote	C
	Etele		C
	Malu rassa	Balanta	O
	Bakongabu		C
	Balenabu	Felupe	C
	Batumpaiabo		C
Oryza sativa	*Tanham/Atanham*	Balanta	O
	Caublak/Caublac		C/O/T
	DEPA		O
	Seli/Sili		O
	Var 29 (landa Arruz project)	Creole	T
	Yaca branco		T
	Yaca ieie		O
	Yaca sau/xau		O/T
	Tomor/Etomoray	Felupe	C
	Iacai branco		C
	Iacai adi	Felupe/Baiote/Creole	C
	Iacai preto		C
	Iacai vermelho		C
	Barakonde	Mandinga	O
	Mamusso	Susu	T
	Sampena/Quisampena		O

Task 02

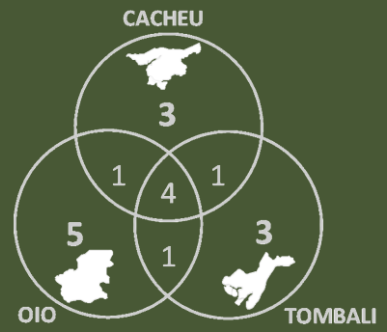
Diseases in stored rice seeds

Results | Fungal Identification (DNA barcoding)

- **Fungal taxa:** N=26 (18 genera, 16 species)
- **Main genera:** *Aspergillus*, *Curvularia*, and *Bipolaris*
- **Health-Related Genera:** mycotoxin production (*Aspergillus & Fusarium*)
- **Regional Fungal Correlations:** Similarities between the fungal compositions of Oio and Cacheu.



| Ecological guilds



| Number of fungal genera between regions

Task 02

Diseases in stored rice seeds

Results | Aflatoxin content

- Results obtained from all 13 villages screened revealed an aflatoxin content (total and B1, B2, G1, and G2) of **< 1.0 µg/kg for all samples**

Task 02

Diseases in stored rice seeds

Discussion

- Traditional rice storage practices are declining, replaced by modern containers.
- Key mycotoxigenic fungi were detected, yet aflatoxin levels remain safe.

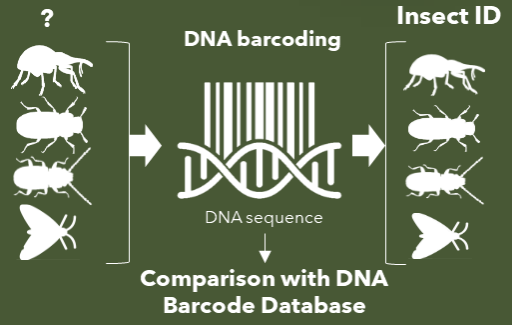
Conclusions

- Study reveals high germination rates, safe fungi levels, and potential for improved post-harvest management innovations.
- **First baseline of fungal communities present in stored rice seeds from mangrove swamp rice production in Guinea-Bissau.**

Material and Methods | Laboratory Analysis

2

- Storage insect screening
- Preliminary taxonomic ID
- Selection & Isolation of the samples to genomic ID
- DNA barcoding analysis



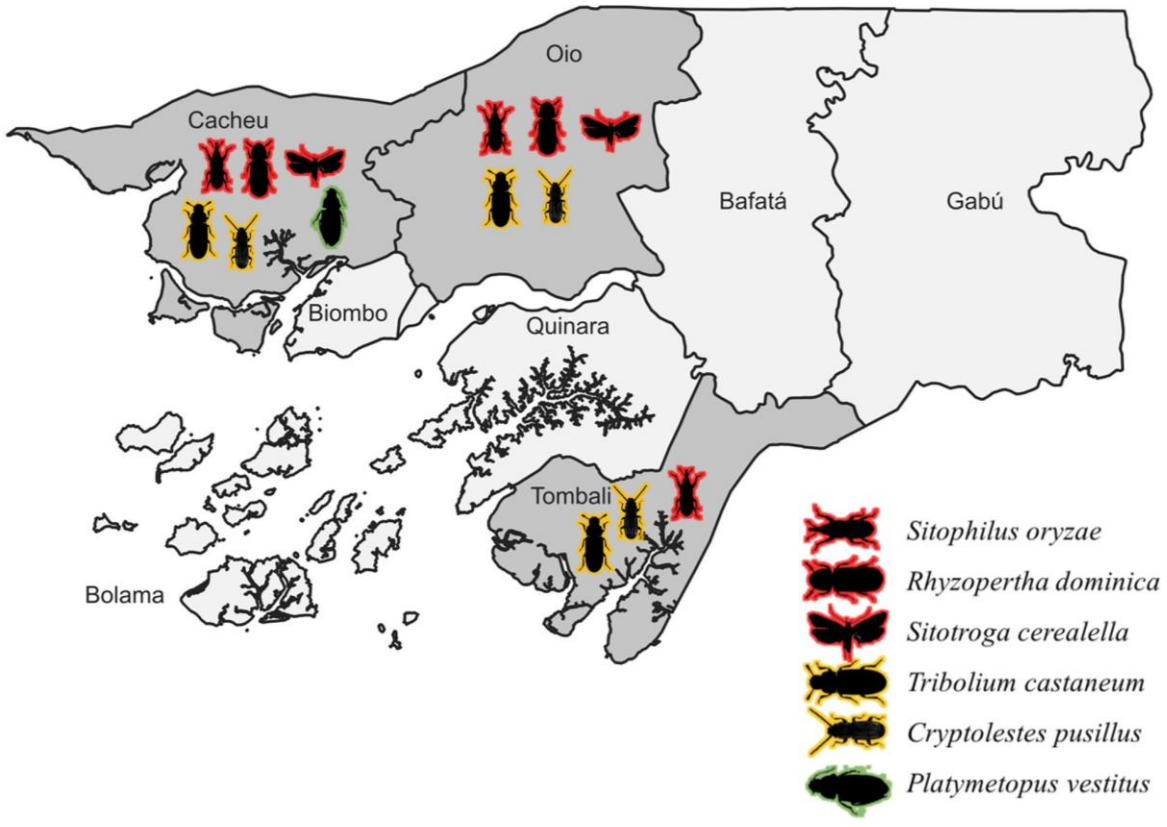
Task 03

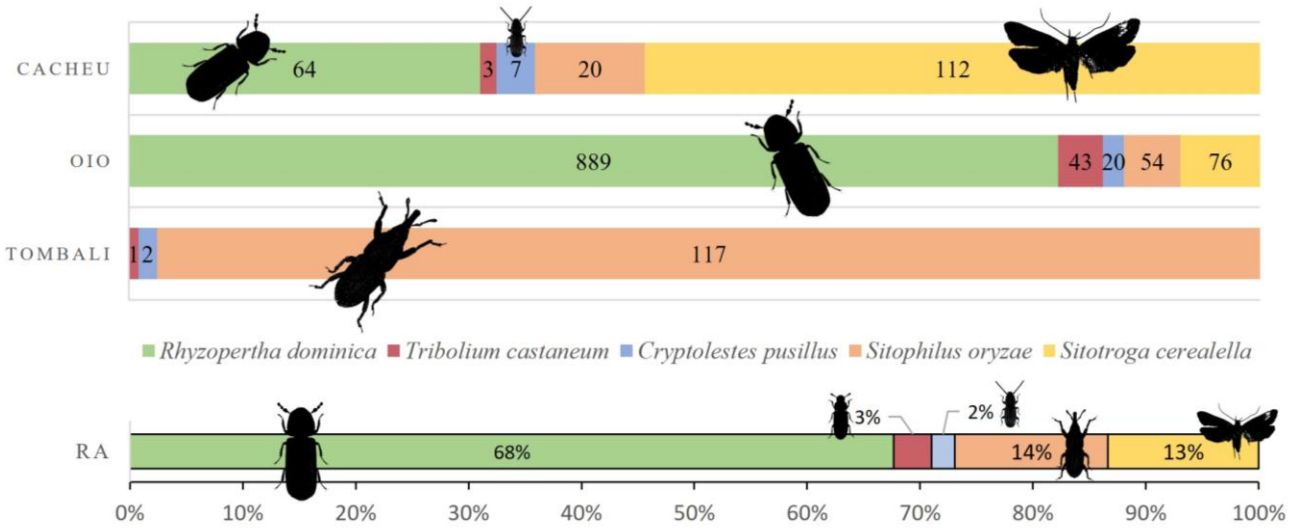
Pests in stored rice seeds

Results

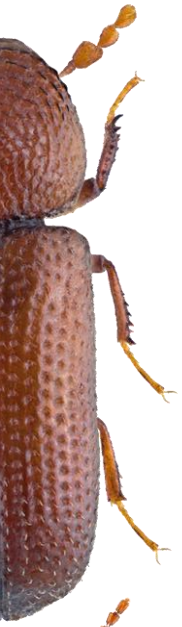
Pests in stored rice seeds

Results





Discussion



6 identified species

4 new species to GB and MSR

Sitophilus oryzae

Cryptolestes pusillus

Platymetopus vestitus

Sitotroga cerealella

reflects a notable gap in biodiversity knowledge in the country

Discussion

Insect Pests

- Five of the six species (excluding *P. vestitus*) are recognized global pests of stored grains.
- *R. dominica* is particularly destructive and most abundant.

Tribolium castaneum

Cryptolestes pusillus

Rhyzopertha dominica

Sitophilus oryzae

Sitotroga cerealella

Storage Practices and Pest Risk

- Traditional storage methods are being replaced with commercial options (bags, barrels, jerry cans), increasing contamination risks.
- Risks arise from poorly cleaned containers or prior use (e.g., old flour bags), and contamination from imports.
- There's a need to evaluate storage hygiene and sealing effectiveness.

Pests in stored rice seeds

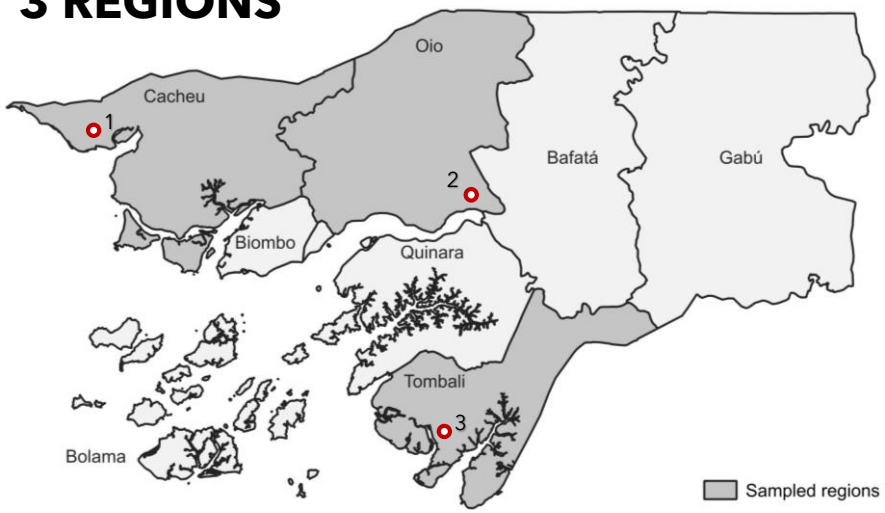
Conclusions

- First documentation of several storage pest species in MSR seeds in GB
- Highlight into knowledge gaps in pest biodiversity in GB
- Findings are crucial for improving rice storage, supporting breeding programs, and promoting food security.

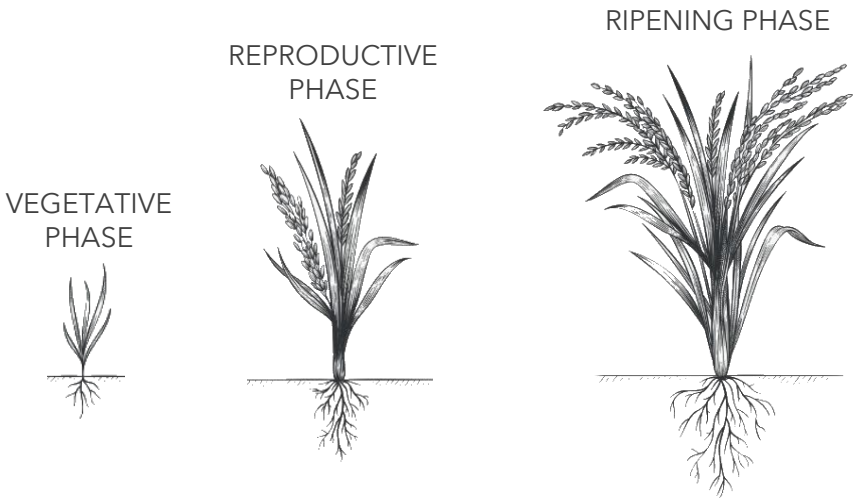
Material and Methods | Sample Collection

1 Sample Collection

3 REGIONS



3 RICE CYCLE PHASES



Task 04

Task 05

Diseases in the mangrove rice fields

Pests in the mangrove rice fields

Material and Methods | Sample Collection

Task 04

Task 05

Diseases in the mangrove rice fields

Pests in the mangrove rice fields

Material and Methods | Sample Collection

Task 04

Task 05

Diseases in the mangrove rice fields

Pests in the mangrove rice fields

Material and Methods | Sample Collection

Task 04

Task 05

Diseases in the mangrove rice fields

Pests in the mangrove rice fields

Material and Methods | Sample Collection

QUADRAT METHOD

GENERAL

- GPS location
- Phenological State
- No. of hills per quadrat
- Water parameters (T°C; mS/cm; ppt; pH)
- Photographic register

DISEASES

- Record, photography and collection of tissues with disease symptoms
- Incidence and severity

PESTS

Insects with poor escape ability
(stem borers; defoliating caterpillars; other larvae)

- Record and collection of present pests
- Record of damage caused by pests and respective level of damage (+ / ++ / +++)

Material and Methods | Sample Collection

TRANSECTS

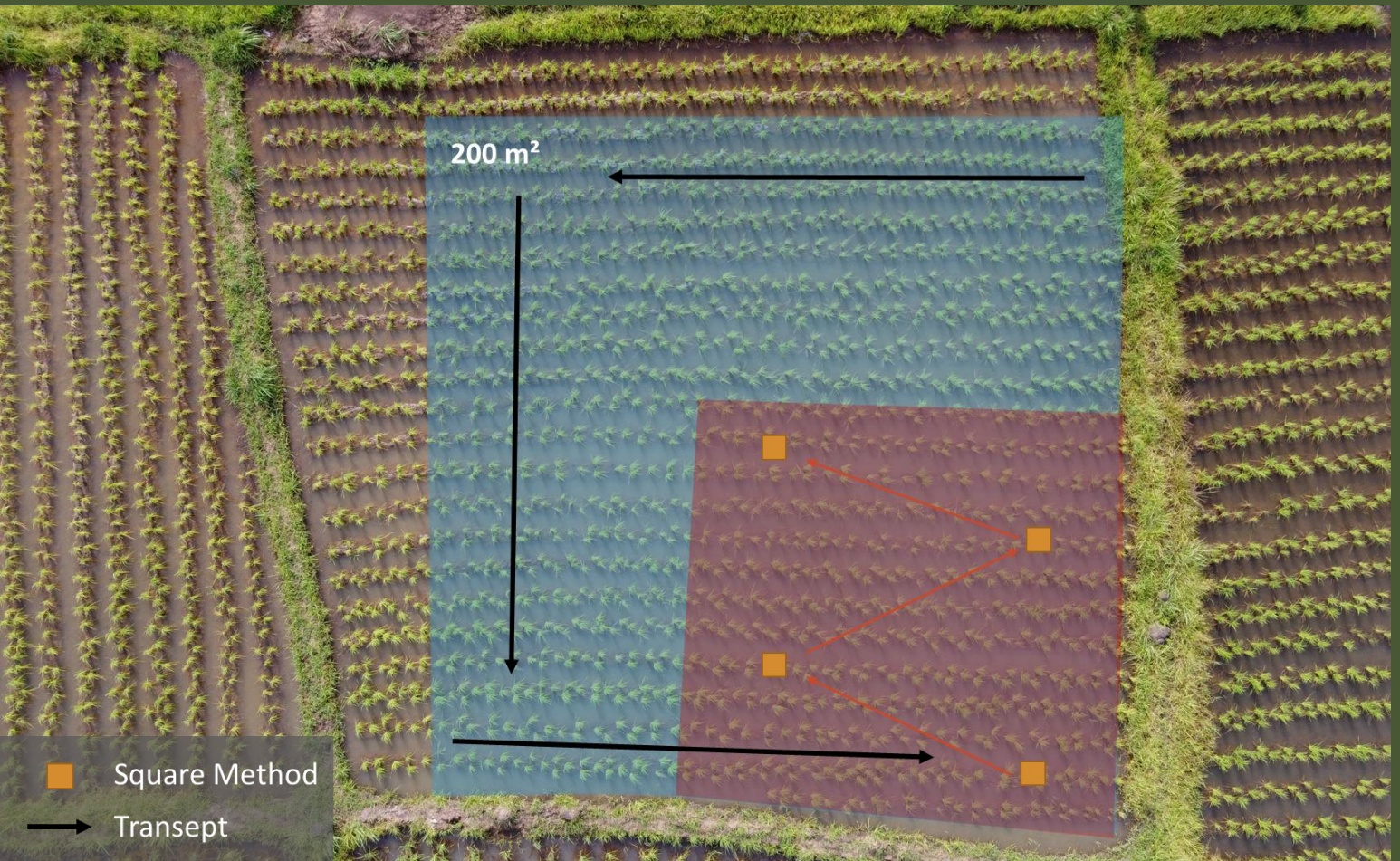
10 meters / 10 minutes

PESTS

Insects with the ability to escape: winged

- Record and collection of the pests

Material and Methods | Sampling Effort



Number of Sampling Points (SP) calculated according to the area of each rice field in the different villages.

QUADRAT METHOD: 10% of the total area

TRANSECTS: 27% of the total area

Area of SP: 75 m² (SM); 200 m² (T)

Minimum of SP: 3

Distribution of SP: ZigZag

Number of replicas: 4/ SP

Material and Methods | Laboratory Analysis

2

Genomic DNA (gDNA) extraction followed the protocol of the innuPREP Plant DNA Kit, according to the manufacturer's instructions.

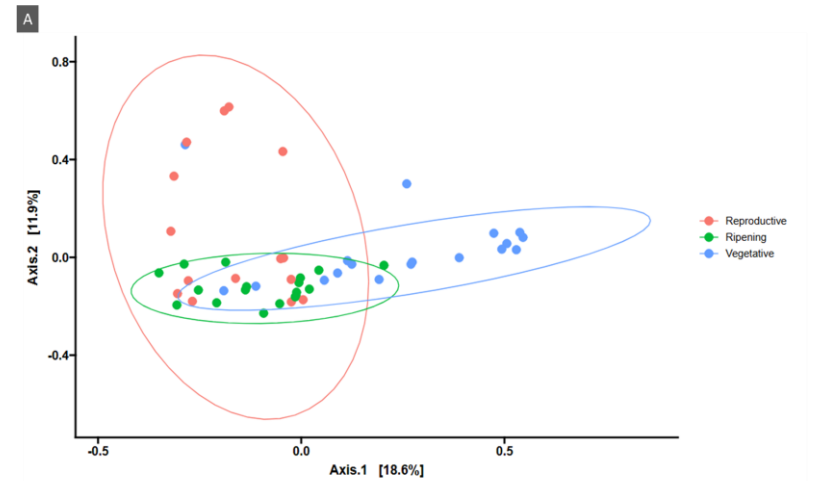
→ Sent to **biocant** company for **metabarcoding IT2 sequencing** *(under bioinformatic analysis)*

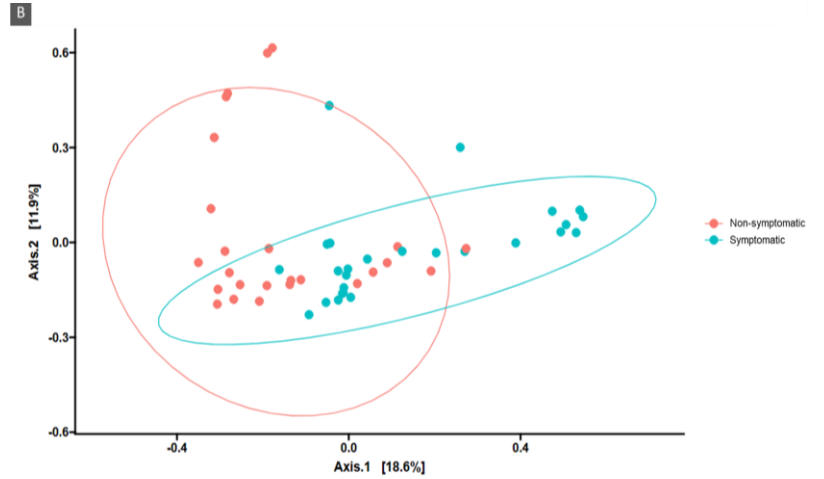
04 Task

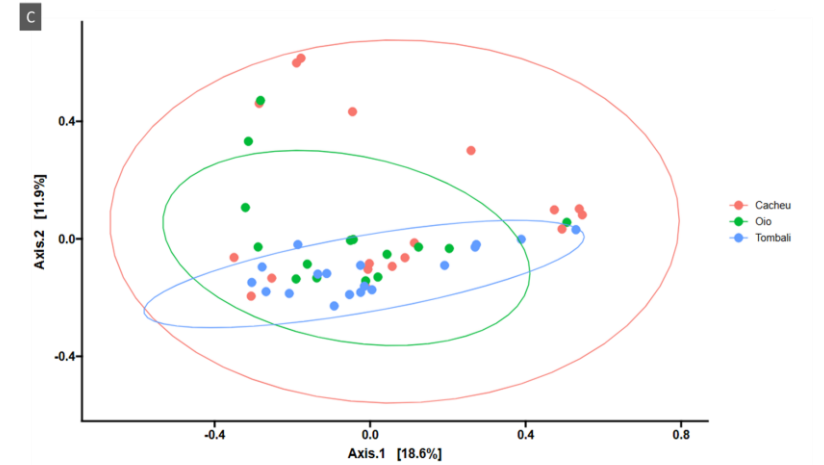
Diseases in the mangrove rice fields

Results *(in prep.)*

- Integrated approach (food and crop)
- Validation of unidentified species to Guinea-Bissau
  - *Bipolaris oryzae*







04
Task

Diseases in the mangrove rice fields

Expected outcomes

- Determination of common fungi between rice cycle phases / regions that can be pathogenic to the crop
- Distribution patterns between regions / phases of the rice cycle (occurrence maps; incidence and severity)
- ID of the diseases present in the studied mangrove rice fields
- Most important diseases that might affect rice productivity
- ID most critical cycle phase to mitigate the diseases

Pests in the mangrove rice fields

Material and Methods | Laboratory Analysis

2 Preliminary taxonomic identification in the field

↓

Identification of specimens for identification by DNA approach

↳ DNA extraction and **barcoding sequencing by CIBIO** laboratory

CIBIO

05
Task

Pests in the mangrove rice fields

Results (*under analysis*)

DNA barcode databases do not have enough sequences yet for a proper genomic identification of the samples → **Morphologic approach**

Morphologic approach

under analysis...

05
Task

Pests in the mangrove rice fields

Expected outcomes

- Identification of the insect pests present in the studied MSR field (morphotypes)
- Distribution patterns between regions / phases of the rice cycle (occurrence maps; levels of damage)
- Most important pests that might affect rice productivity

Thank you

Sofia Conde [CEF/LEAF (ISA, UL)]

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Grant | FOOD/2019/412-700