

*Pessoas e Natureza: Investigação em Sustentabilidade |
People and Nature: Research on Sustainability*



A journey through mangrove swamp
rice pests and diseases: from storage
to field in Guinea-Bissau

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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



Scientific outputs (published)

01 Task



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



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

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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,*}

Scientific outputs (in prep.)

04 Task

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



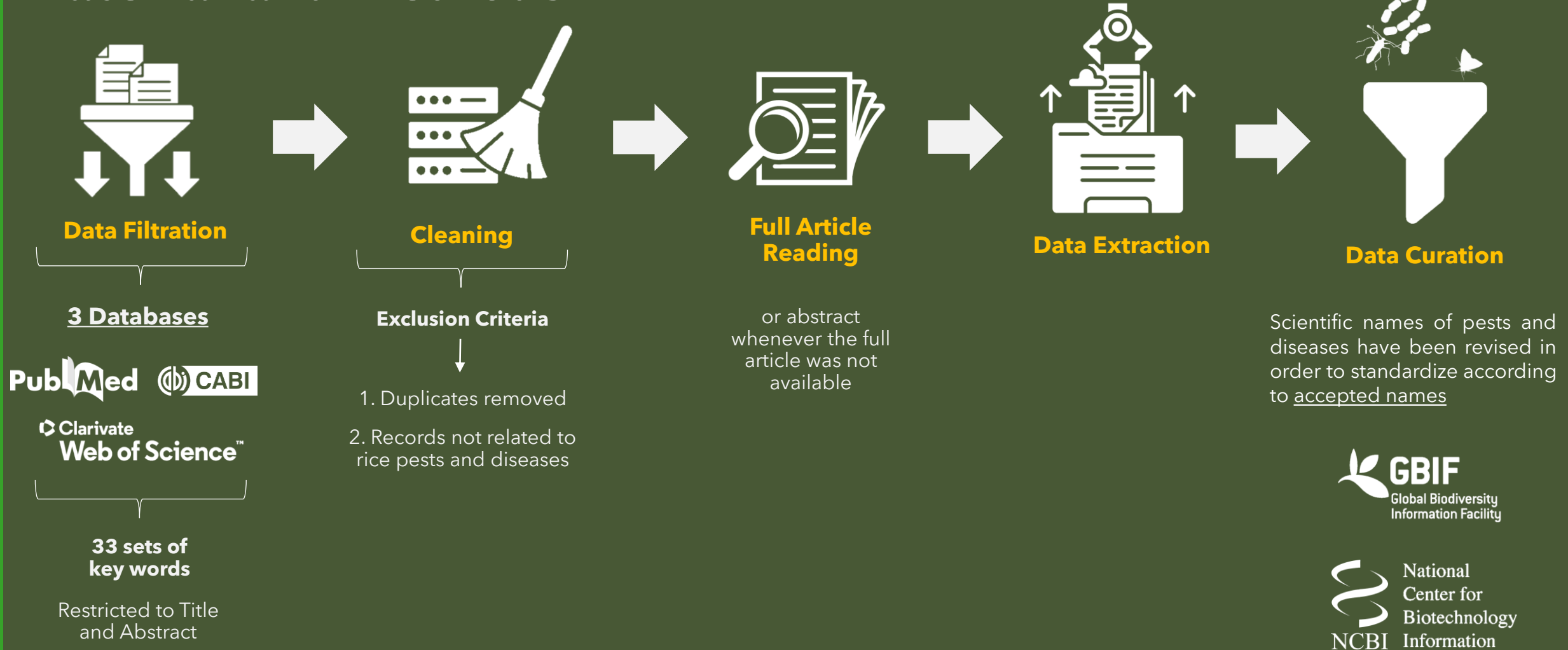
05 Task

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



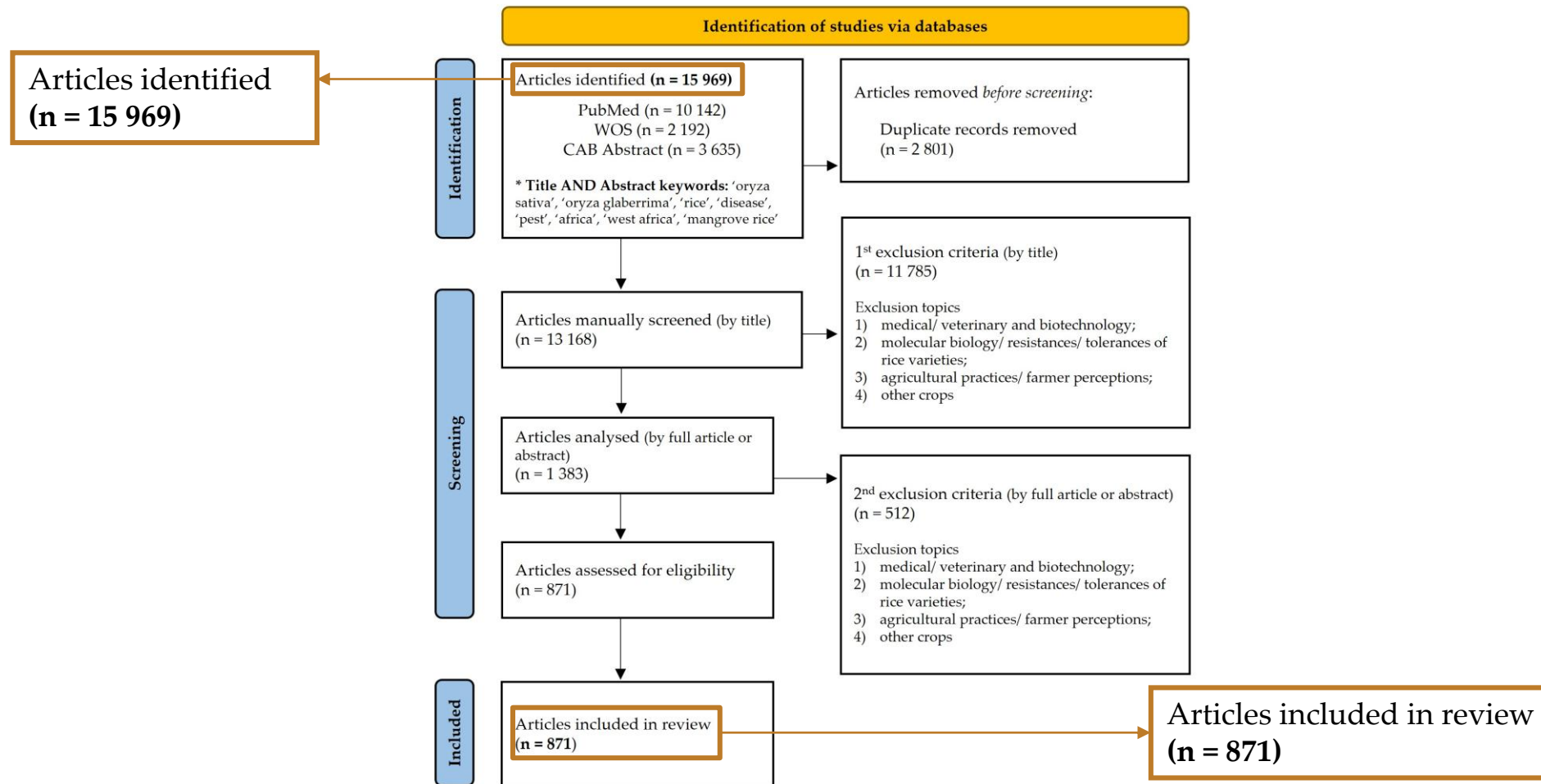


Material and Methods



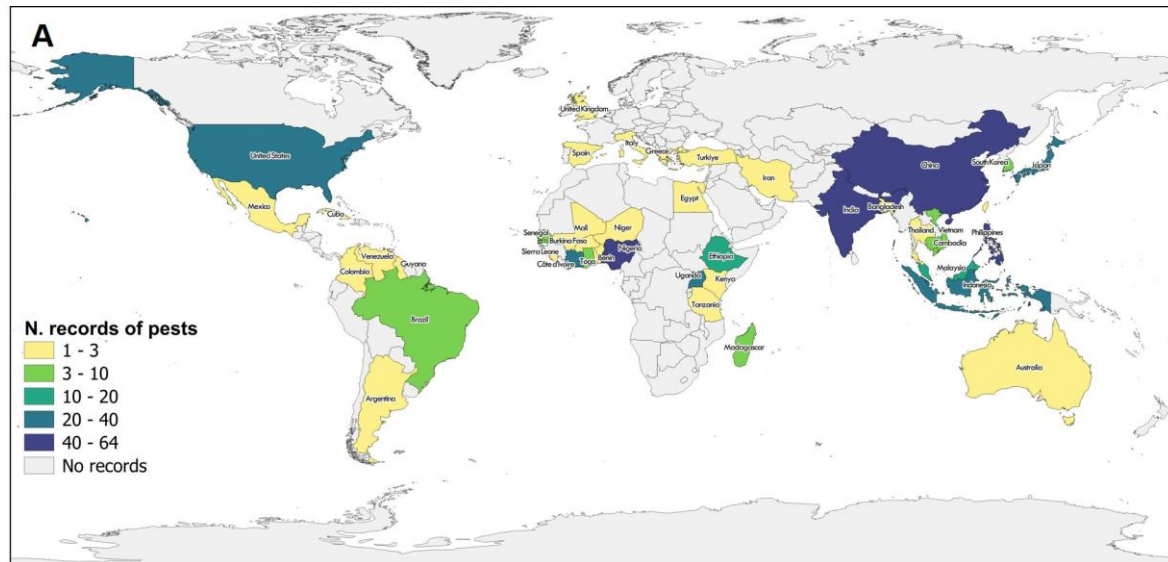


Material and Methods



Results

Pests



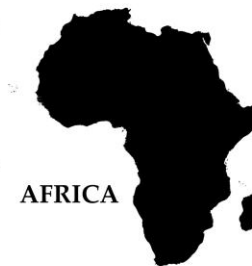
A. Diopsis sp.
D. macrophthalmia,
D. apicalis, *D. collaris*



B. Maliarpha sp.
M. separatella



C. Chilo sp.
C. zacconius



D. Nilaparvata sp.
N. lugens, *N. bakeri*



E. Scripophaga sp.
S. incertulas, *S. innotata*



F. Sogatella sp.
S. furcifera, *S. kolophon*,
S. vibix



G. Chilo sp.
C. suppressalis,
C. auricilius, *C. polychrysus*



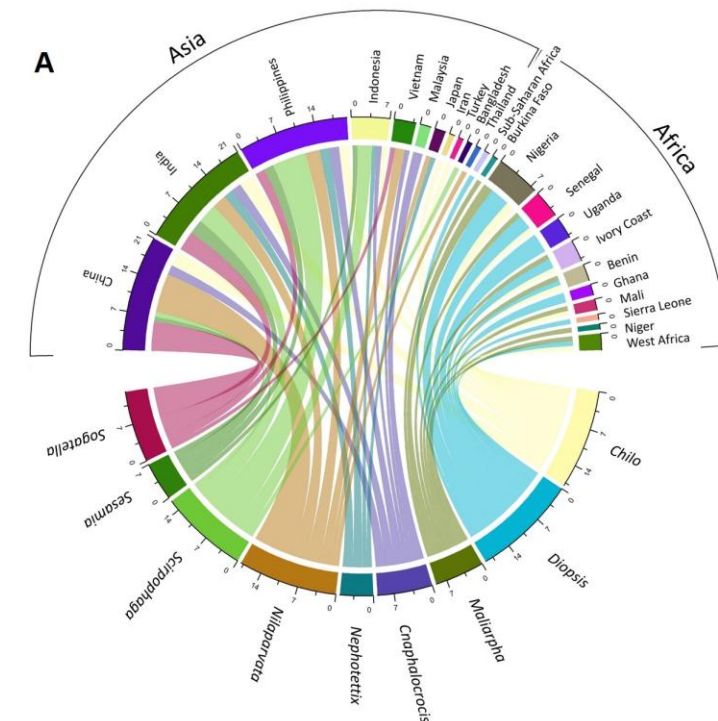
H. Cnaphalocrocis sp.
C. medinalis, *C. exigua*,
C. patnalis



I. Sesamia sp.
S. inferens



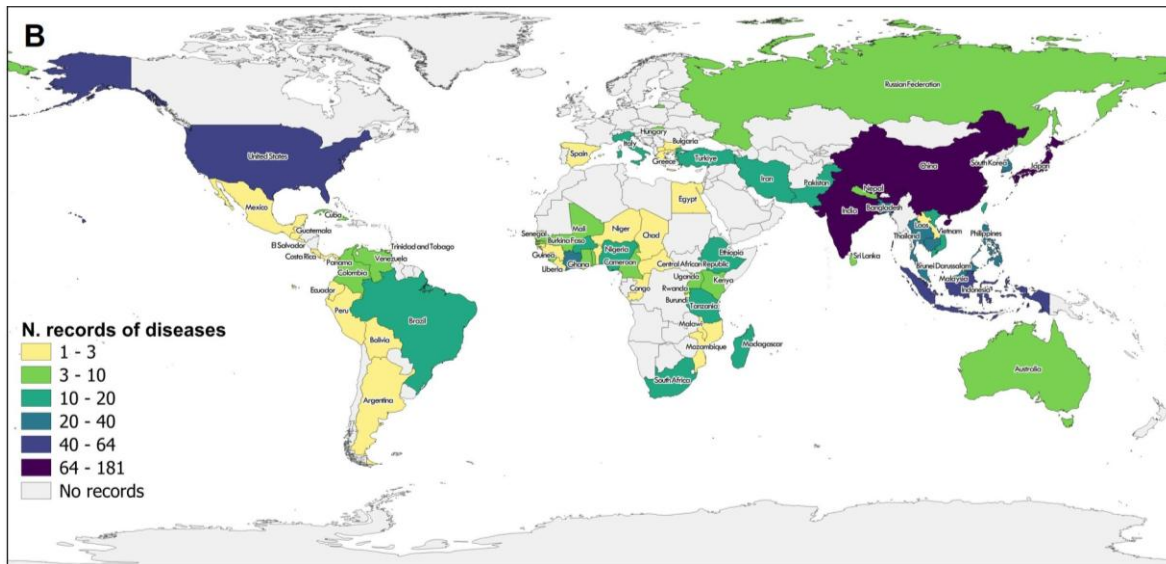
J. Nephotettix sp.
N. virescens, *N. cincticeps*





Results

Diseases

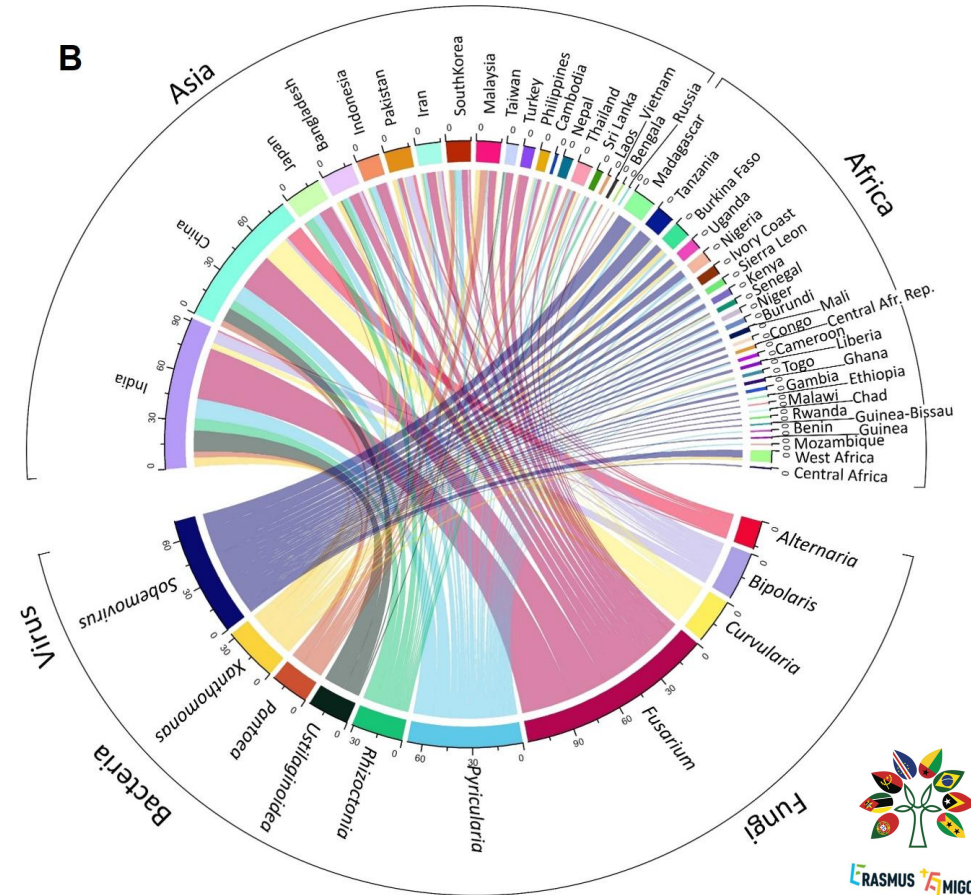


Africa

Pyricularia
Xanthomonas
Sobemovirus

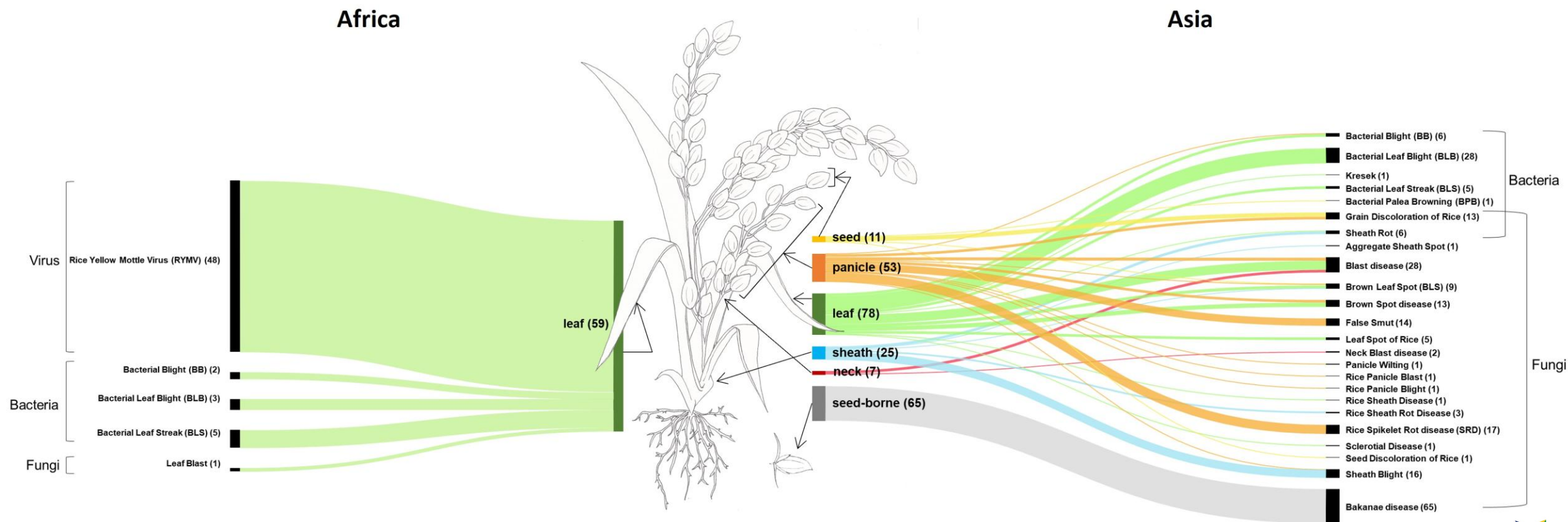
Asia

Fusarium
Bipolaris





Results



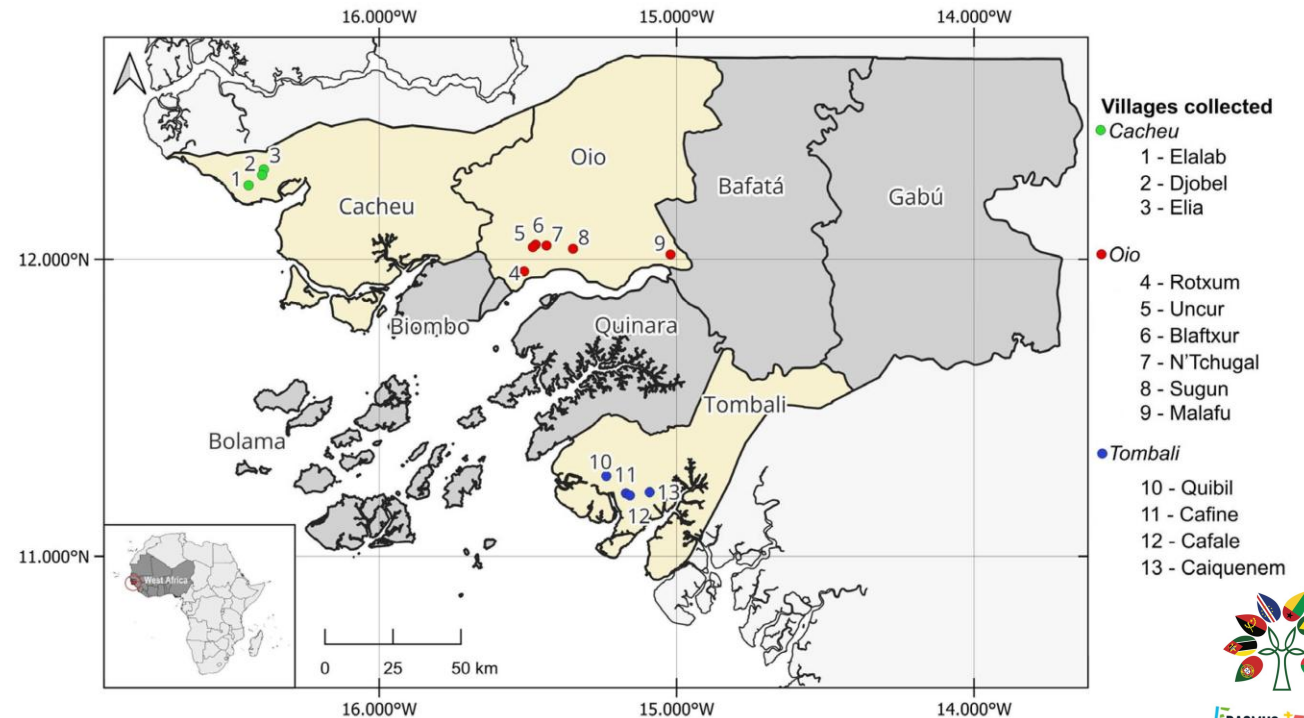


Material and Methods | Sample Collection

1 Sample Collection

3 Regions | 13 Villages | 30 Farmers

Samples:
 ≠ varieties and/or
 ≠ storage structure





Material and Methods | Laboratory Analysis

2

Germination rate

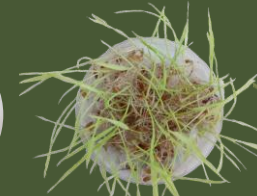
64 samples x 3 repetitions = **192 trials**
 100 seeds / Petri dish
 Measurements at day 3, 5, 10 and 14



3 days



5 days



10 days



14 days

Fungal Identification

64 samples x 3 repetitions = **192 trials**

- Fungi re-isolation
- gDNA extraction and storage for DNA barcoding (N=70)



Isolation



Re-isolation



gDNA Extraction



Freezing -18°C

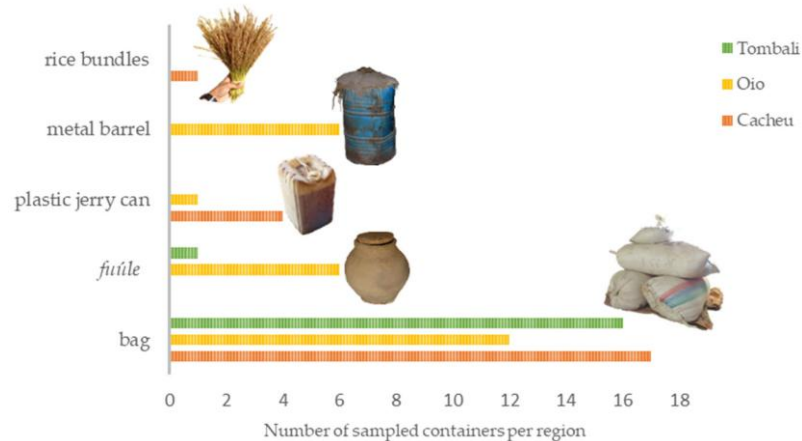
Aflatoxins Content

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

DNA extraction (...)
 DNA barcoding
 Bioinformatics Analysis

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.



Results | Germination Rates

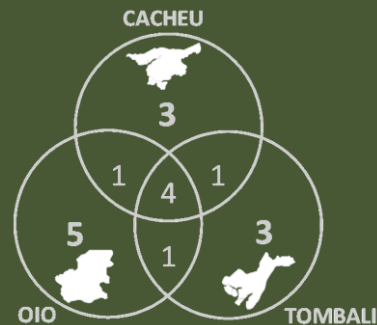
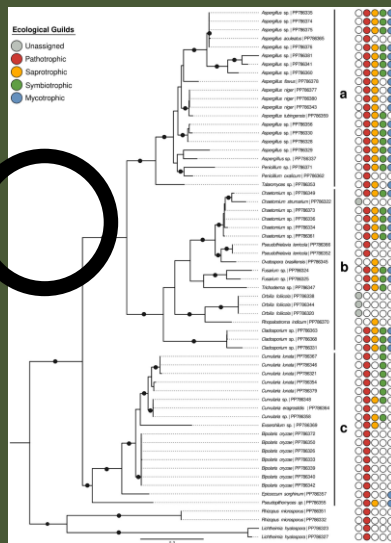
- **High Germination Rates:** All rice varieties tested had strong germination, achieving over 95% by day 14.
- **Variations by Species:** No significant variations were found between *Oryza glaberrima* and *Oryza sativa*.

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



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.



| Number of fungal genera between regions



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**



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

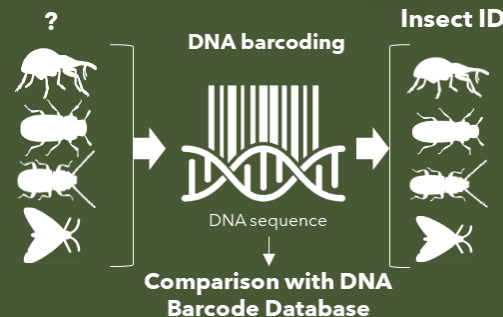
2

Storage insect screening

Preliminary taxonomic ID

Selection & Isolation of the samples to genomic ID

DNA barcoding analysis



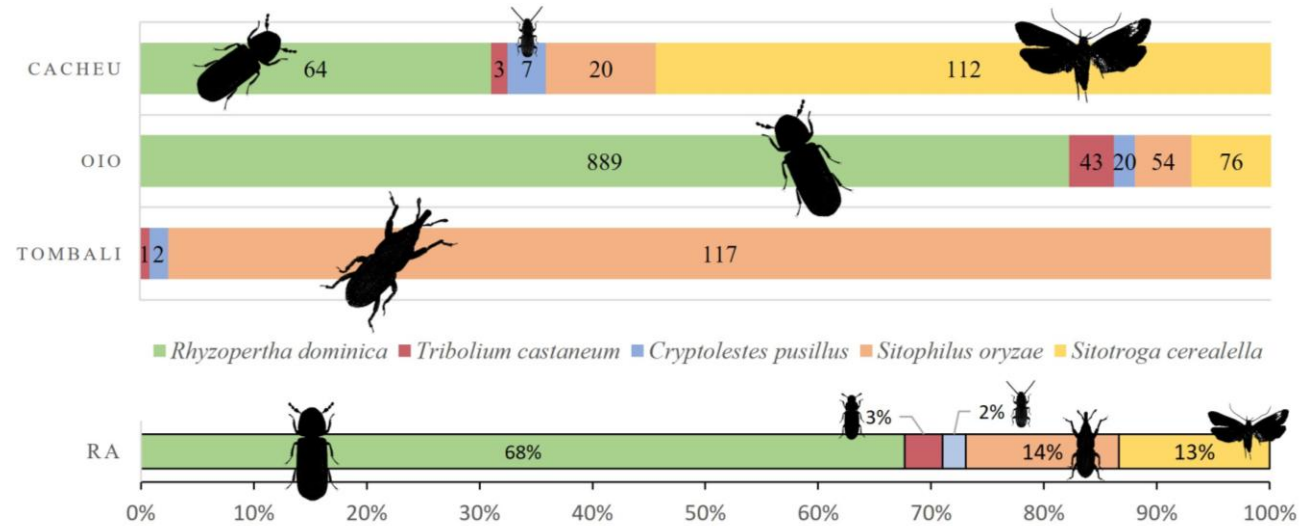
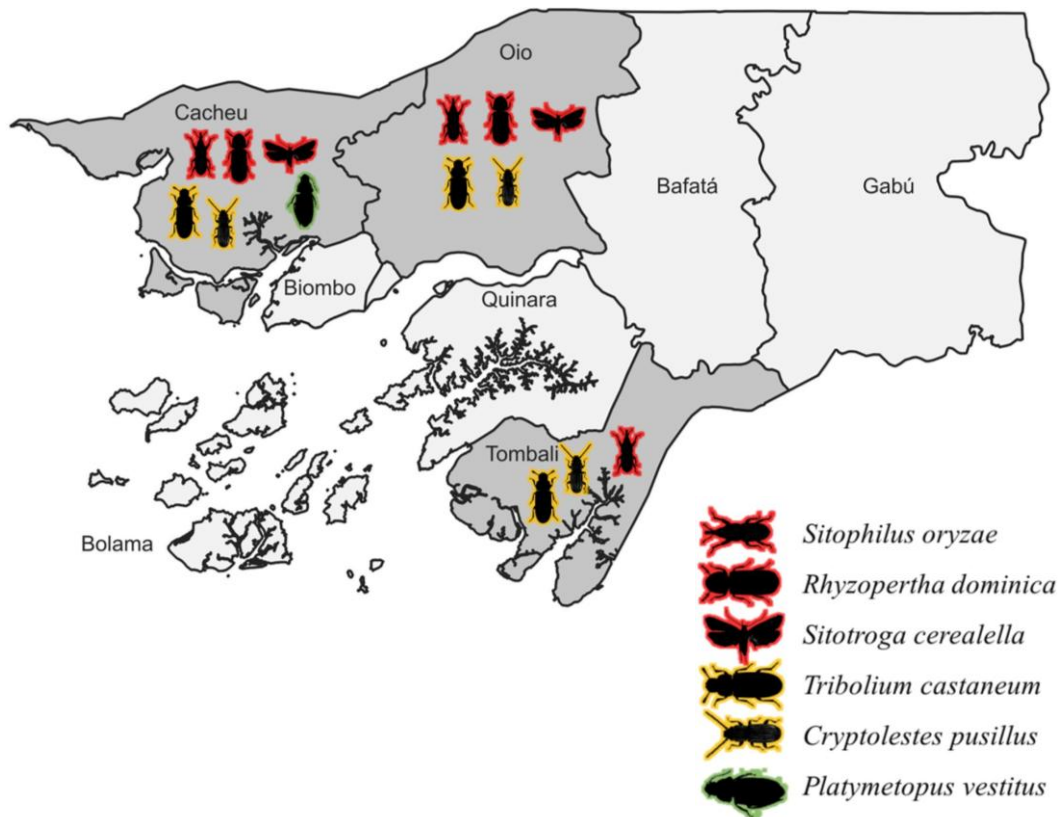


Results





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.



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.



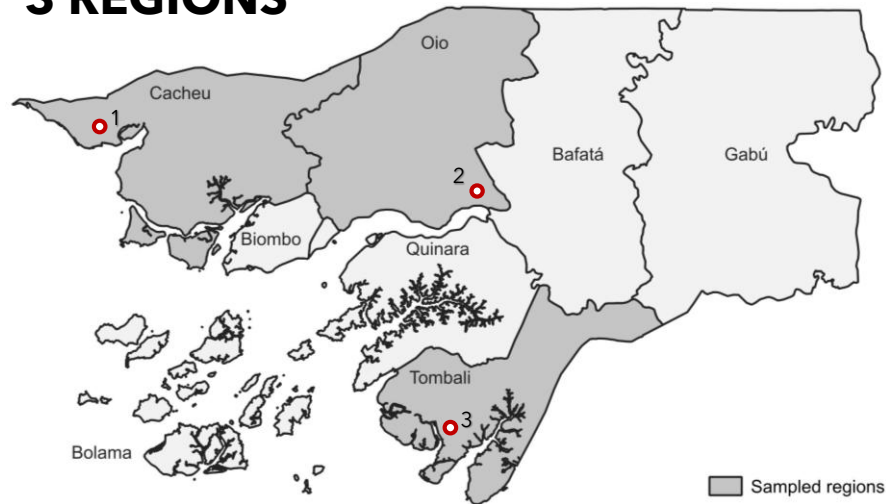


Material and Methods | Sample Collection

1

Sample Collection

3 REGIONS



3 RICE CYCLE PHASES

VEGETATIVE PHASE



REPRODUCTIVE PHASE

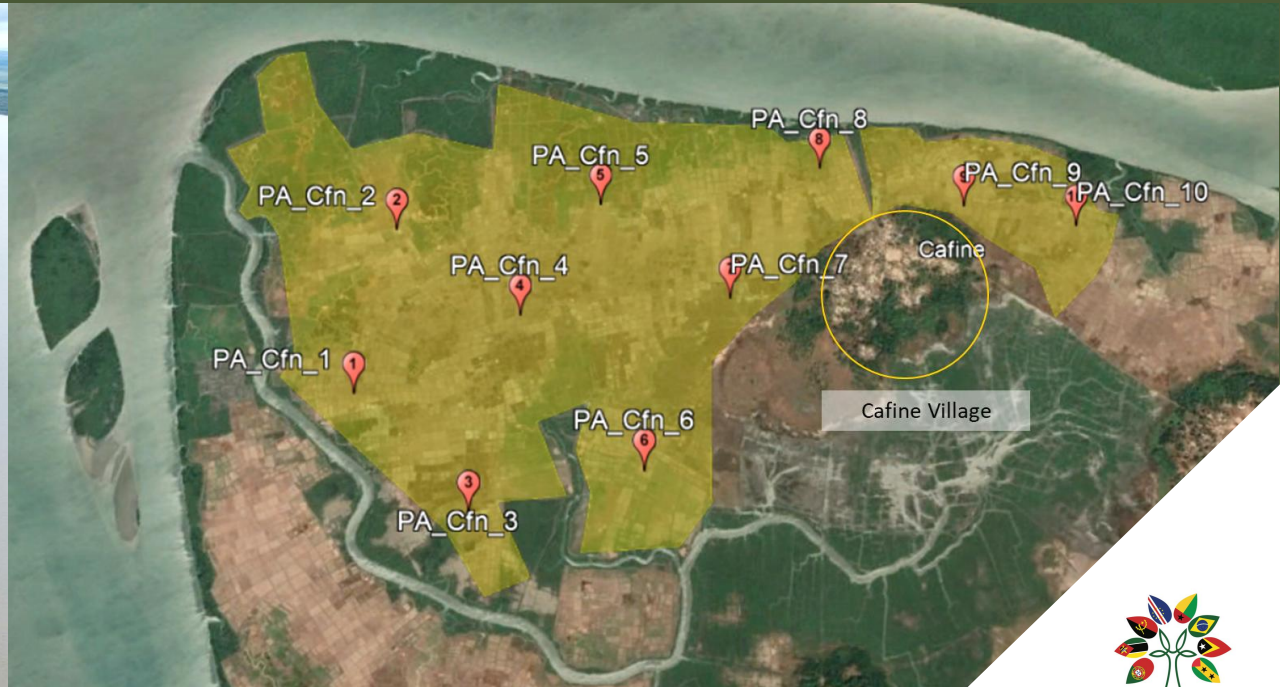


RIPENING PHASE





Material and Methods | Sample Collection





Material and Methods | Sample Collection





Material and Methods | Sample Collection





Material and Methods | Sample Collection

GENERAL

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

QUADRAT METHOD

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

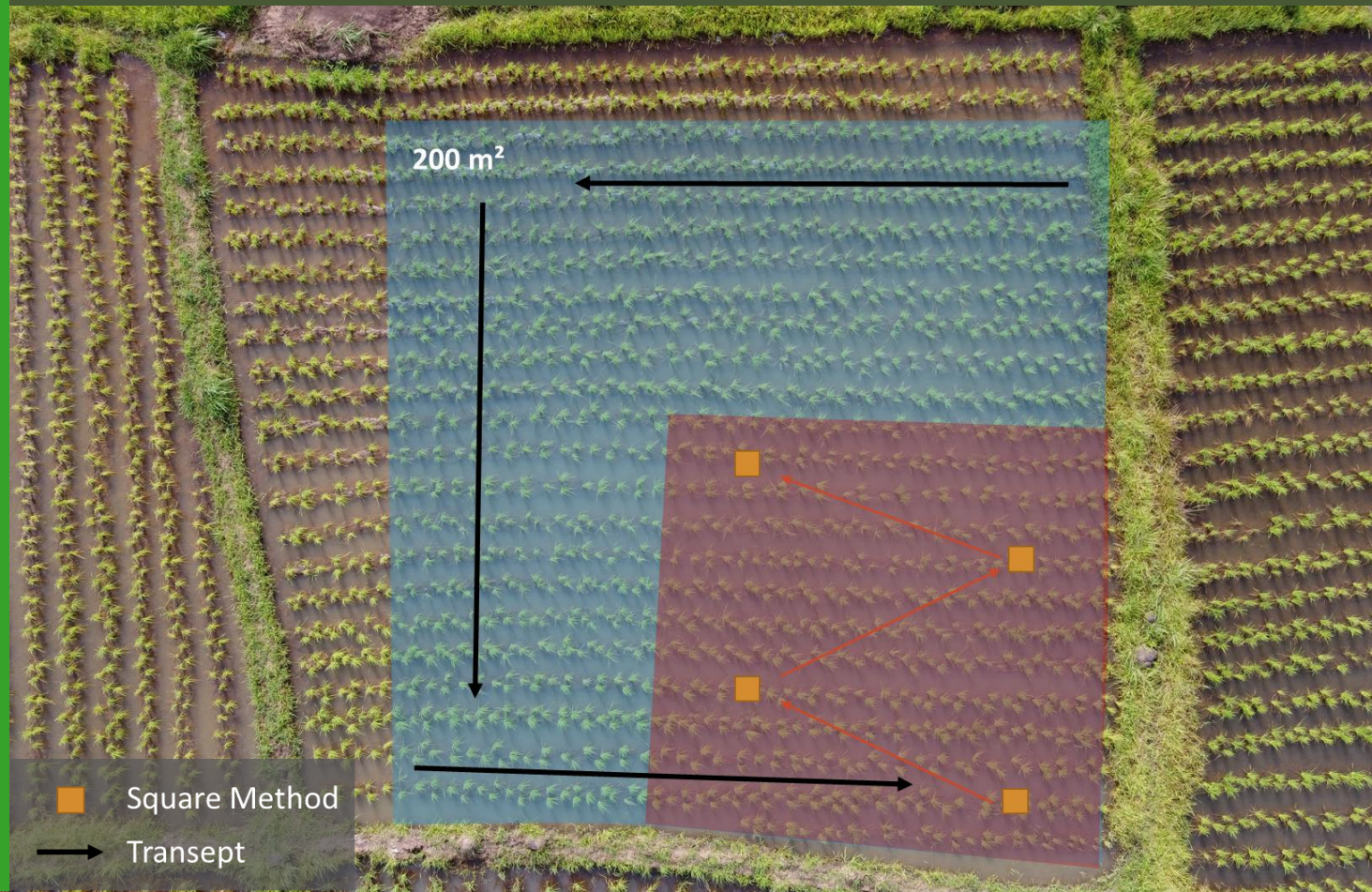
Insects with the ability to escape: winged

- 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*)





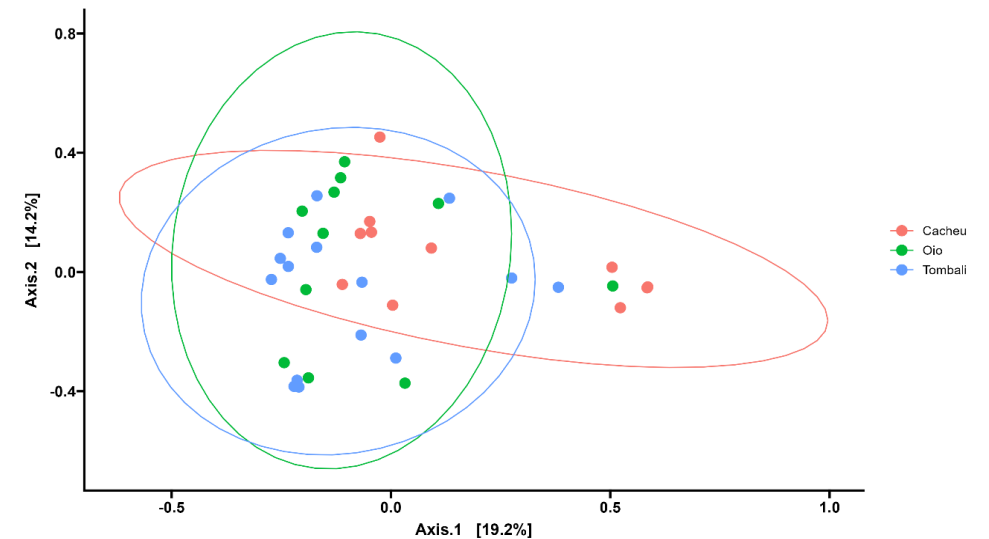
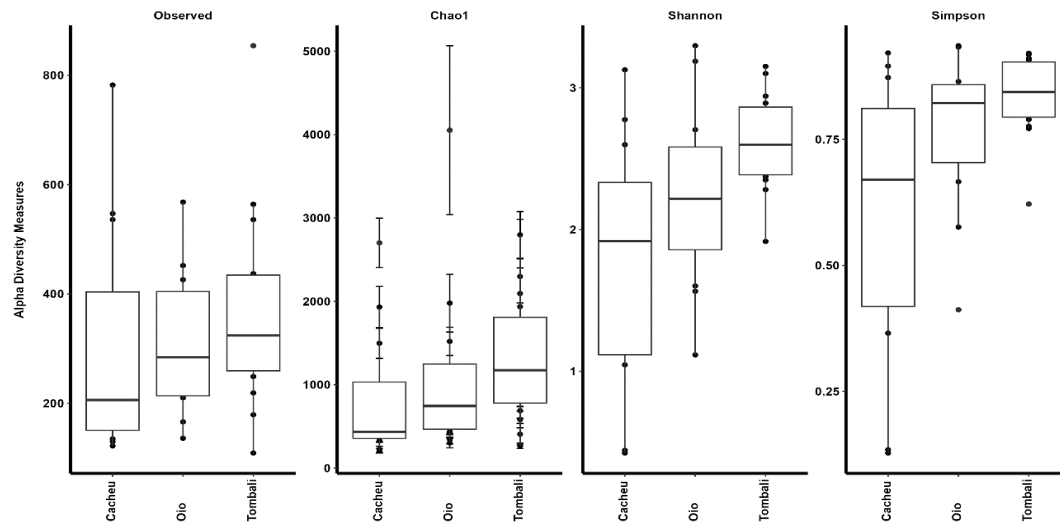
Results *(in prep.)*



Integrated approach (food and crop)

Validation of unidentified species to Guinea-Bissau

Bipolaris oryzae



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





Material and Methods | Laboratory Analysis

2

Preliminary taxonomic identification in the field



Identification of specimens for identification by DNA approach

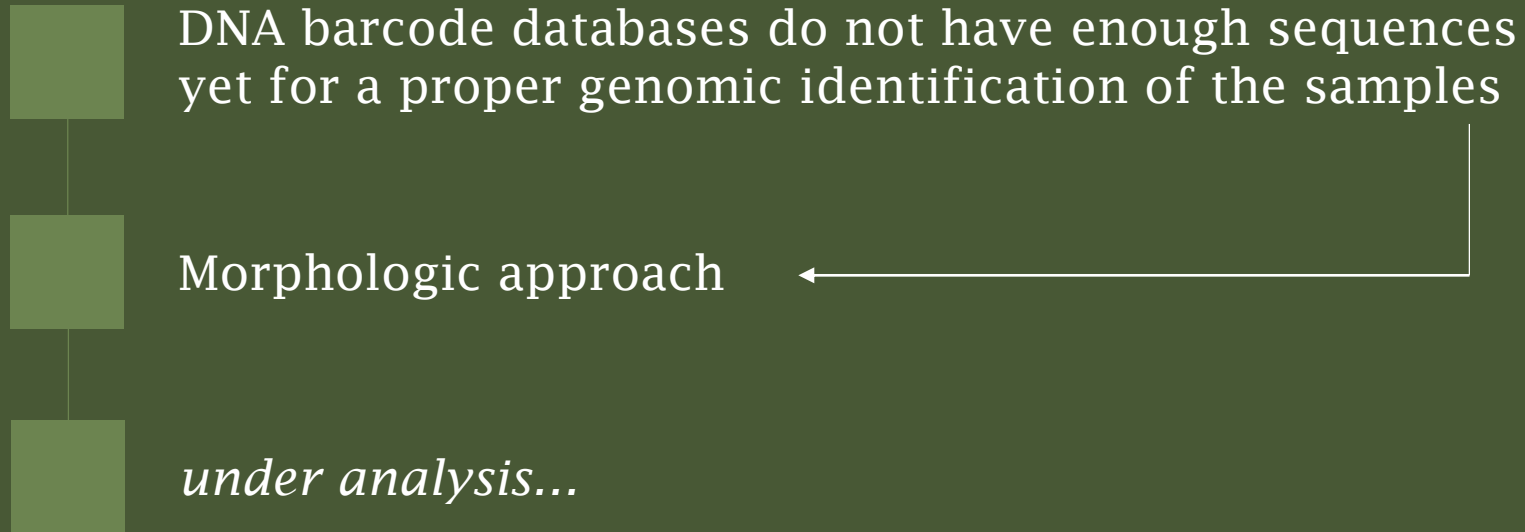


DNA extraction and **barcoding sequencing** by CIBIO laboratory





Results *(under analysis)*



Expected outcomes

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



Thank you

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