The impact of certification on ant-biodiversity in smallholder coffee systems.

Ant species as indicators for diversity

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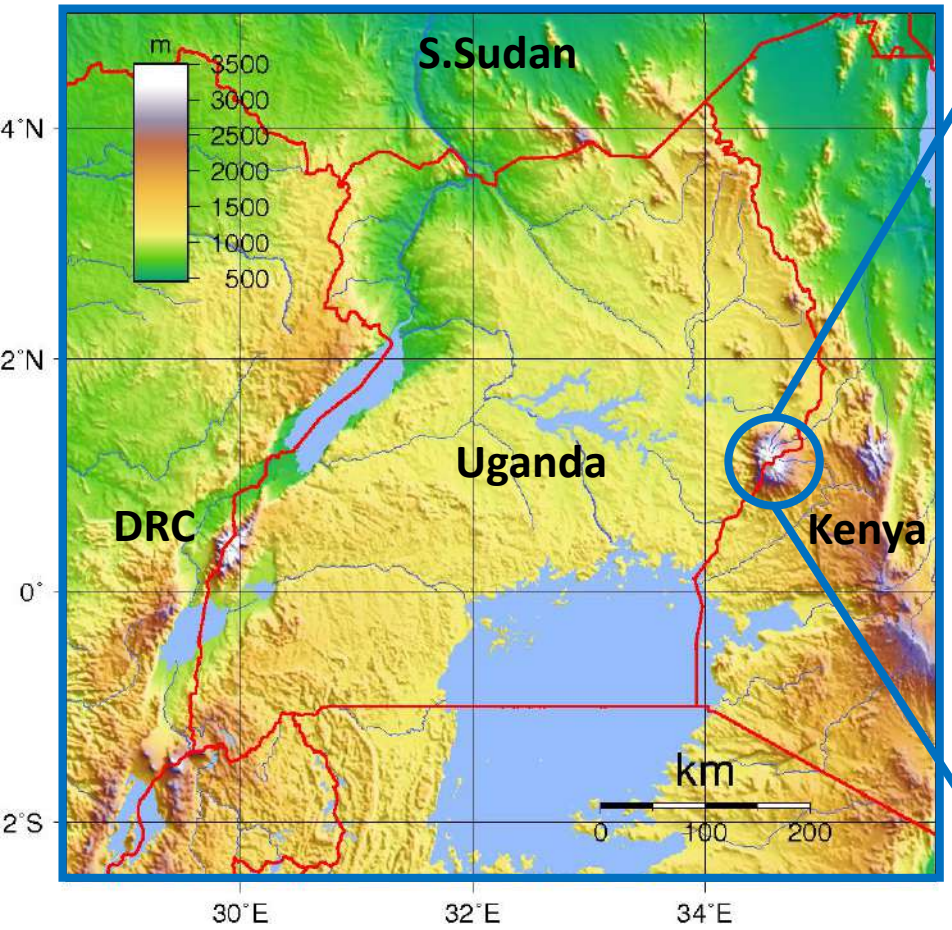
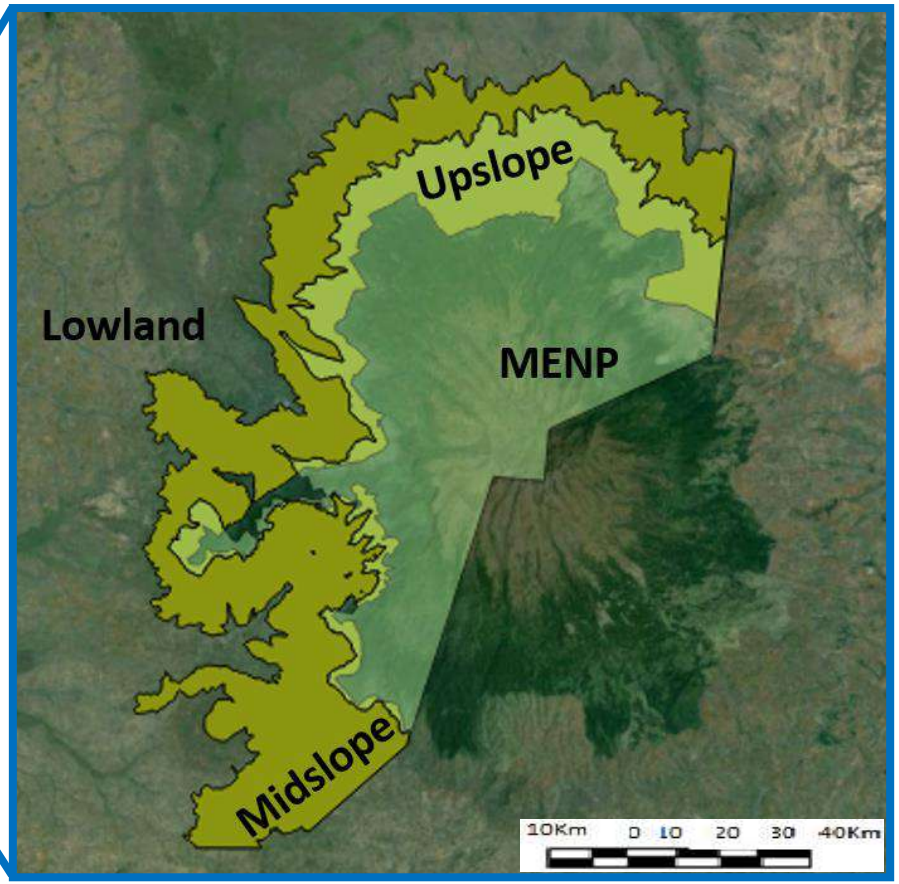
Index

- Introduction
- Hypothèses
- Matériaux et Méthodes
- Résultats et Discussion
- Ongoing research
- Future research et projects

Research Area





MONT ELGON NATIONAL PARK

Coffea arabica L.

Coffea arabica L

- Perennial crop + souvent dans le système agricultural

- Services Ecosystème
  - enrichissement du sol
  - Augmentation qualité air et eau
  - Important dans cycle carbone
  - « Biodiversity conservation »

Arabica Coffee is usually grown in mixed farms with food crops for home consumption like beans,peanuts and Bananas. It is mainly grown under shade trees that ensure sustainable coffee production. The leaves that fall from the shade trees provide manure for the coffee plants.

Certification

- Socio-Economic study:
  - PhD Kevin Teopista Akoyi
- Biophysical study:
  - PhD chapter Koen Vanderhaegen

Gumutindo Ltd

"ORGANIC certified"

Kyagalanyi Ltd

"NON-ORGANIC certified"

Hypothèses

1. Certified coffee fields have a higher carbon stock than non-certified coffee fields.

2. Certified coffee fields conserve a higher biodiversity than non-certified coffee fields.

Hypothesis

Certified coffee fields conserve a higher biodiversity than non-certified coffee fields.

- **Organic certified coffee fields conserve a higher ant biodiversity than non-organic certified fields.**
- Tree species composition in coffee gardens is driven by certification.

Materials and Methodology

- Sampling design:

- **Treatment group**

  Stratified random sampling

  - Group of farmers
  - Soil type
  - Elevation

- **Control group**

  Matching

  - Elevation
  - Rainfall
  - Distance main road
  - Distance MENP
  - Age household head
  - Ethnic group
  - Religion
  - Education household head

Materials and Methodology

Gumutindo Ltd

"ORGANIC certified"

Kyagalanyi Ltd

"NON-ORGANIC certified"

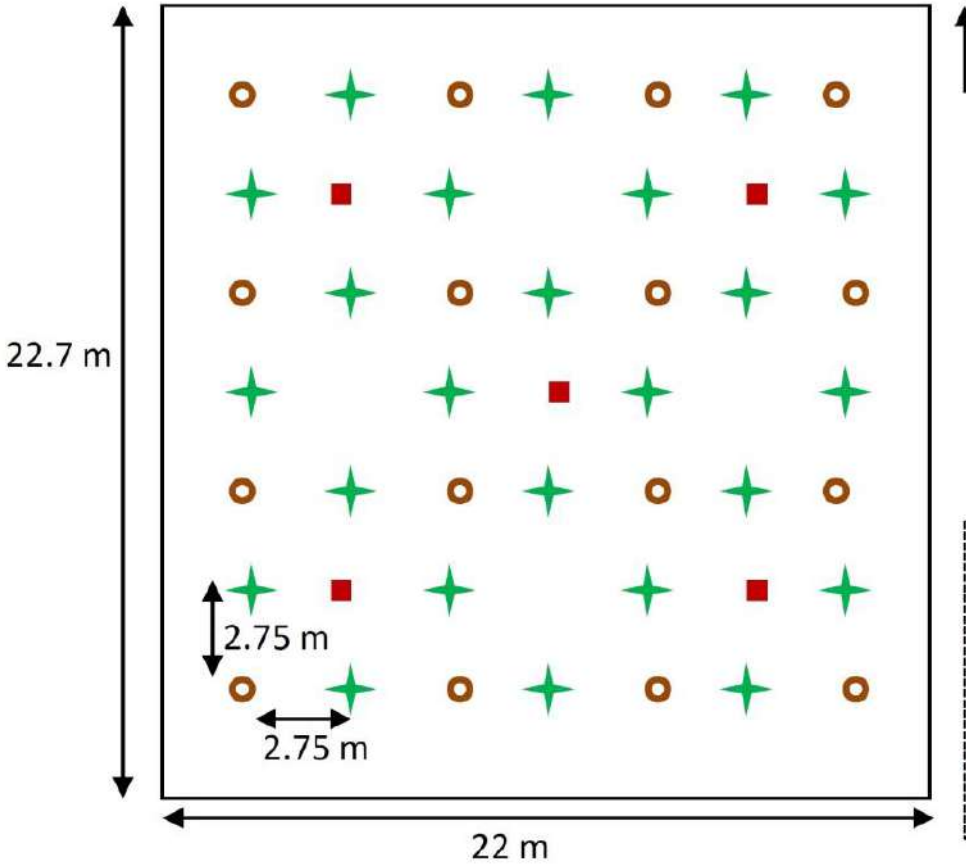
74 coffee gardens inventoried

37 Certified, 37 Control

18 Gumutindo, 19 Kyagalanyi

Materials and Methodology

- Entomofauna inventory (ALL protocol)



Materials and Methodology

- Entomofauna inventory (adapted ALL protocol)

Materials and Methodology

- Entomofauna inventory (adapted ALL protocol)

Materials and Methodology

- Sample processing

Sorting

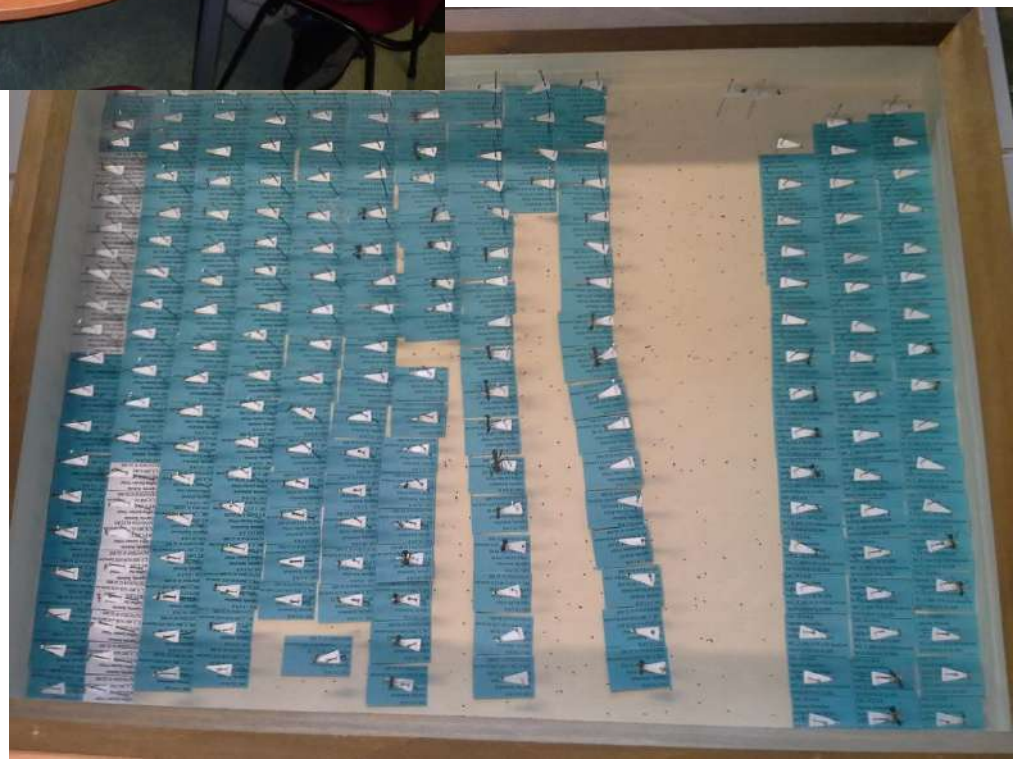
Mounting

Labelling

Materials and Methodology

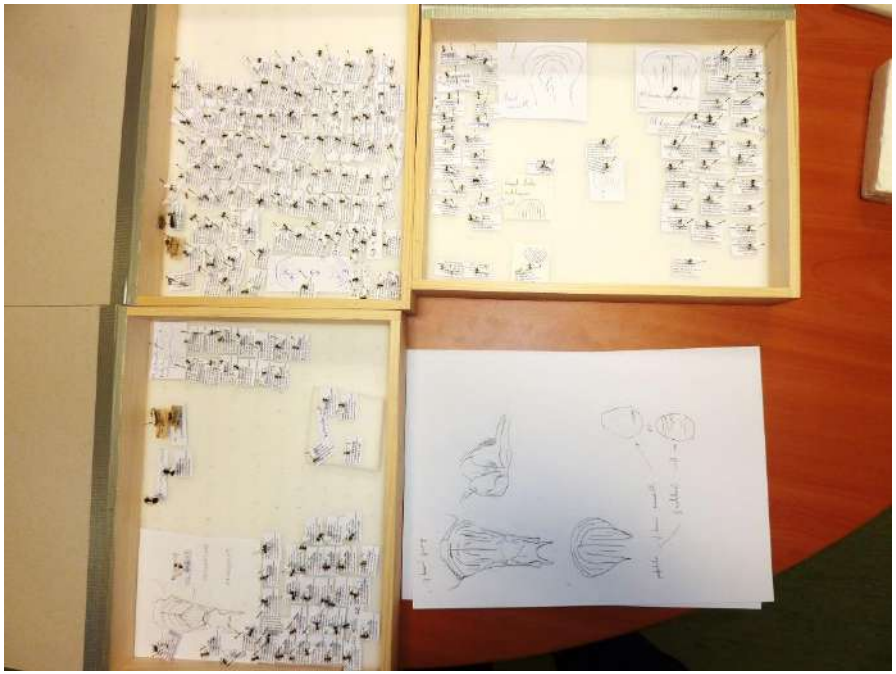
- Sample processing

Uganda, Bulambuli
Coffee Garden Baits
Uganda, Bududa
Coffee Garden Litter
Uganda, Manafwa
Coffee Garden Litter
Uganda, Sironko
Coffee Garden Litter
Uganda, Bulambuli
Coffee Garden Winkler
Uganda, Bududa
Coffee Garden Litter



Materials and Methodology

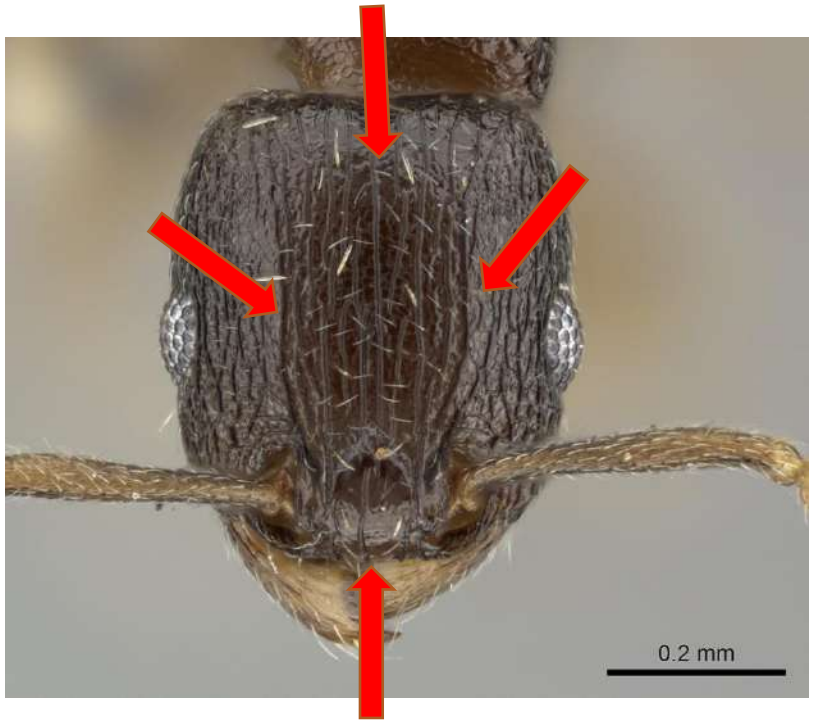
- Sample processing

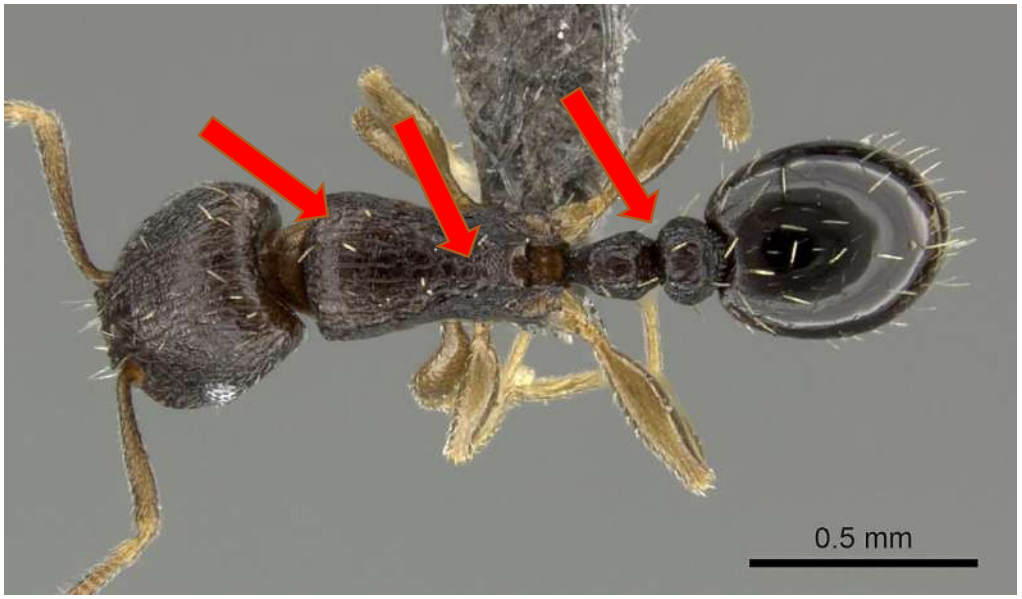


Species Identification

Digitizing

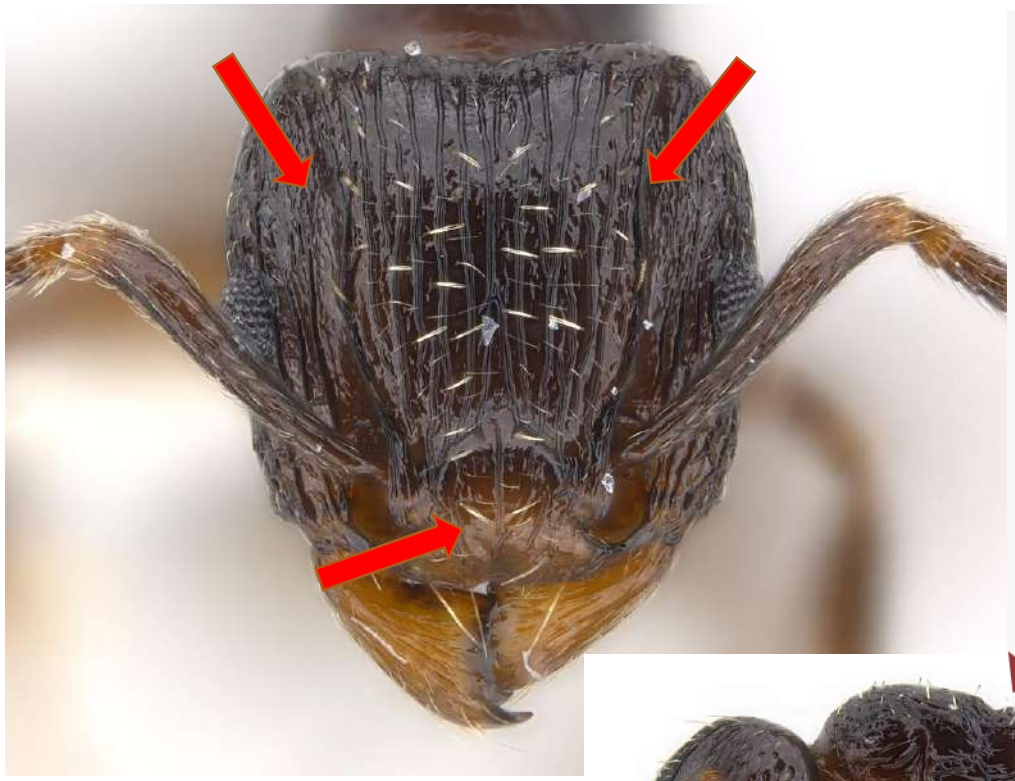
Tetramorium SP002= Tetramorium afrc-tz22



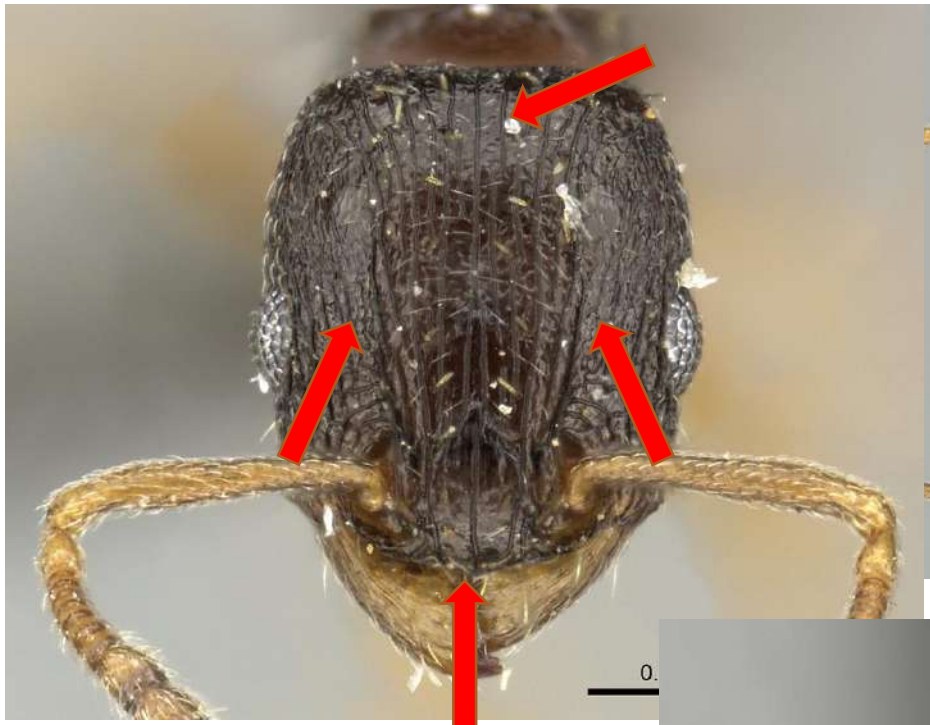


Tetramorium SP002= Tetramorium zambezium

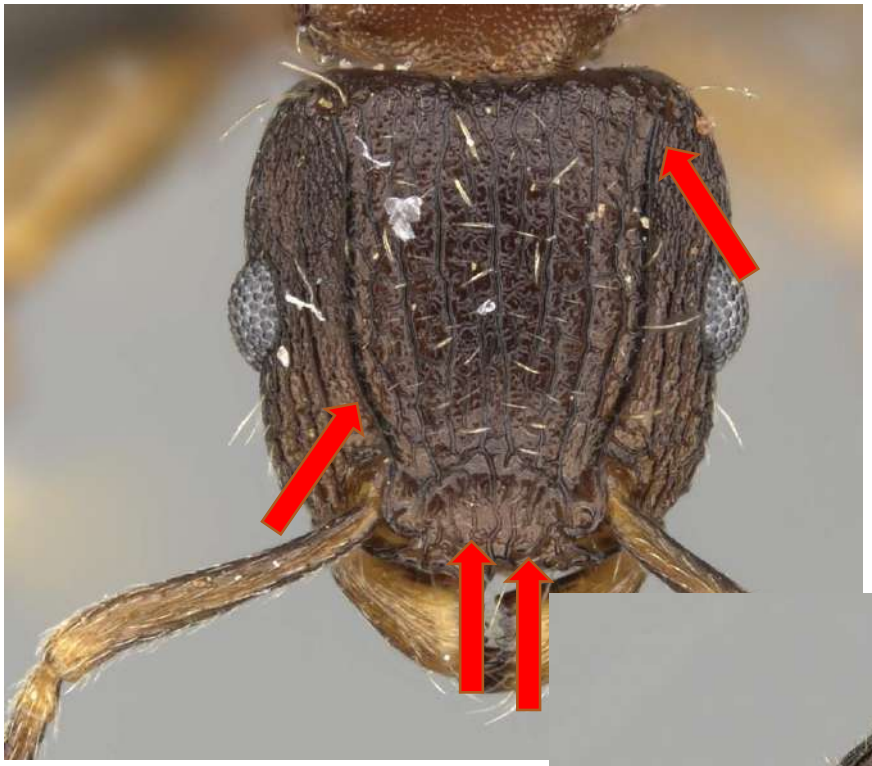
Tetramorium zonacaciae= Tetramorium SP003



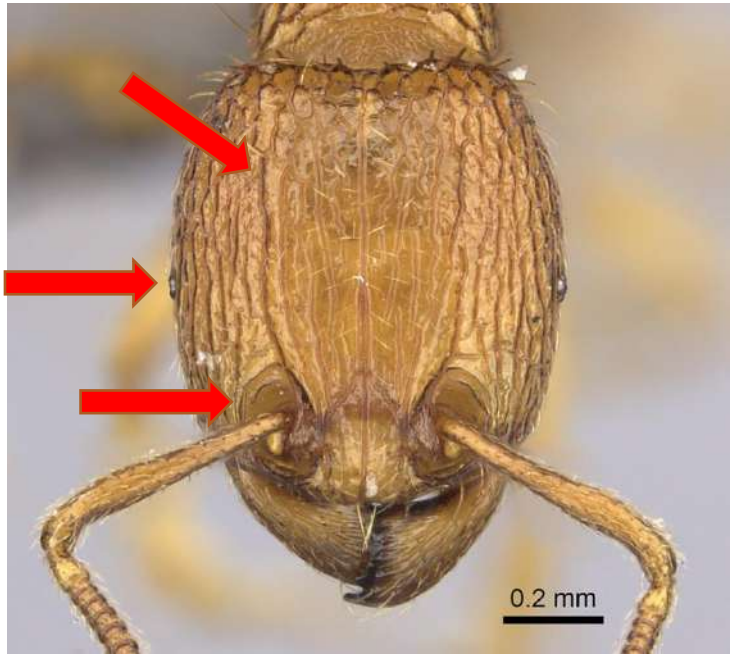
Tetramorium altivagans=Tetramorium SP004

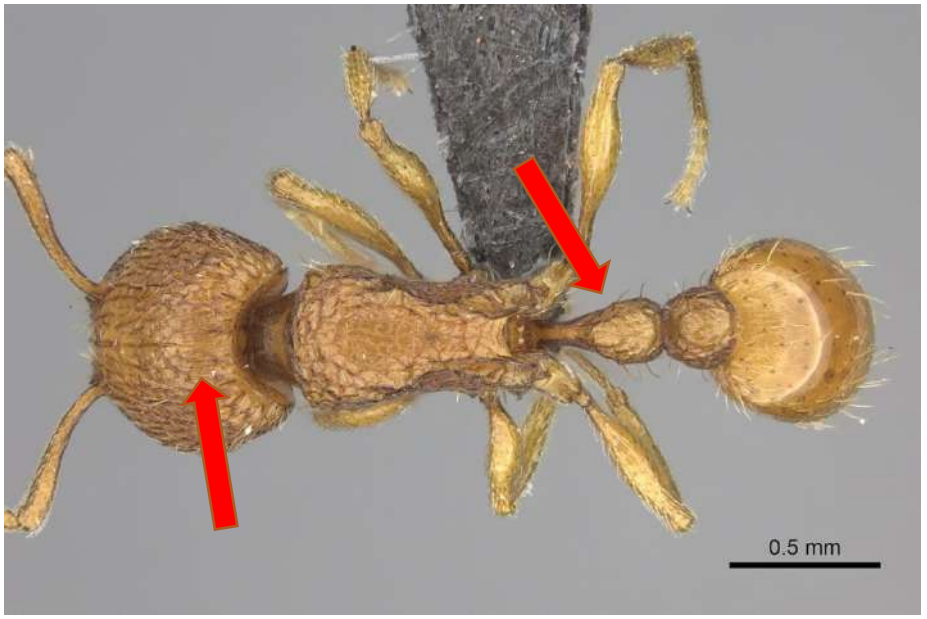


Tetramorium weitzeckeri = Tetramorium SP005



Tetramorium SP006 = Tetramorium afrc-tz05



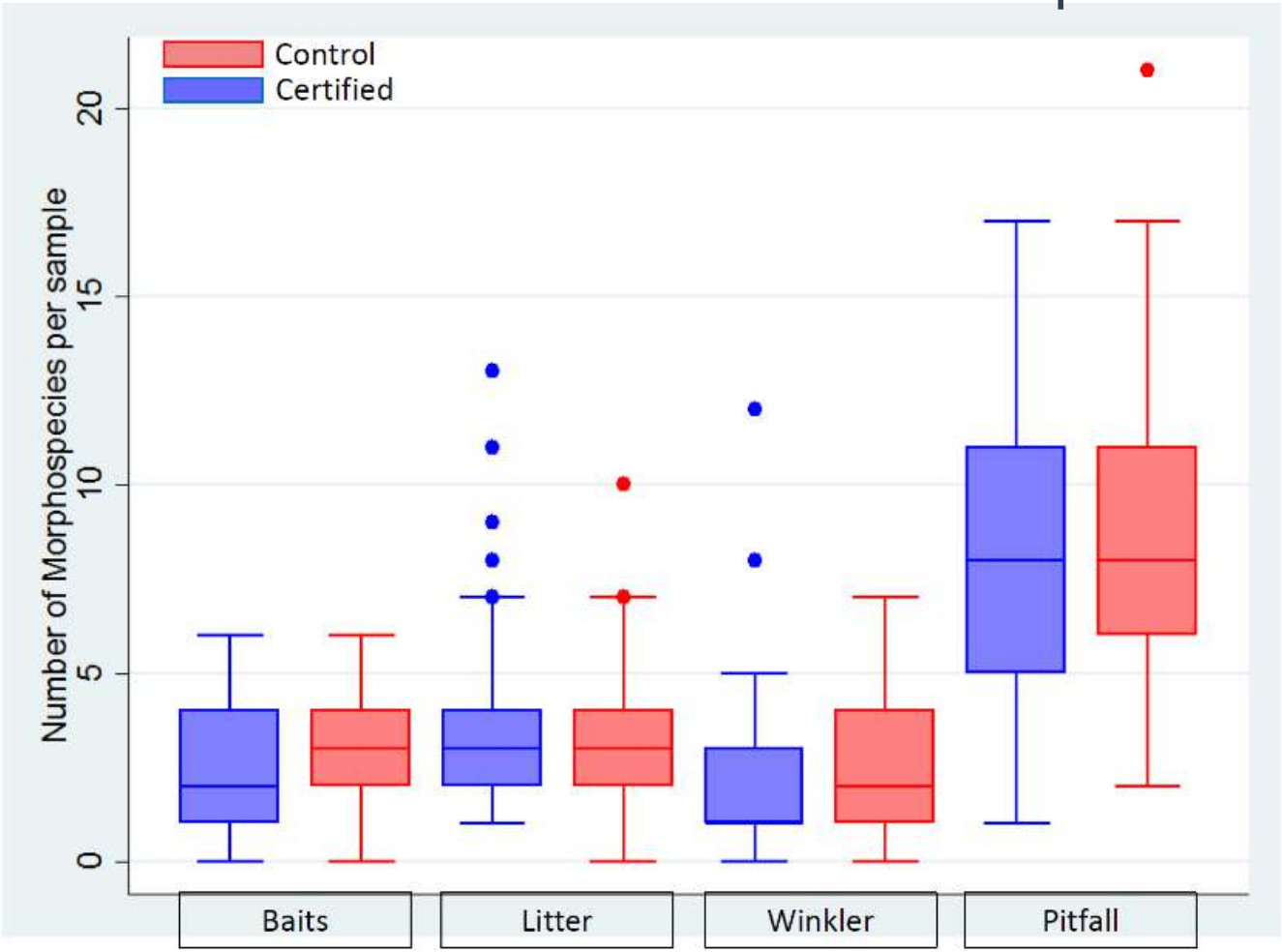


Results and Discussion

- 74 coffee gardens inventoried
  - 37 Certified, 37 Control
  - 18 Gumutindo, 19 Kyagalanyo
- 52,616 insects sorted out
- 36,716 ants grouped in morphospecies

Results and Discussion

- Species richness based on individual sample data



Results and Discussion

- Based on Baits: in general, reduced species richness under certification
- But! Opposite trends expected.

Method	Certified	Control	Prob > |z|
Baits	2.59(±1.77)	3.41(±1.62)	0.045**
Litter	3.95(±2.66)	3.49(±2.02)	0.332
Winkler	1.97(±2.39)	2.24(±1.82)	0.254
Pitfall	8.3(±3.96)	8.57(±3.8)	0.681

Average (±SD) amount of morphospecies counted in samples collected using 4 methods in certified and matched control coffee gardens and the probability that these averages are significantly different based on Wilcoxon matched-pairs signed-ranks test (Prob > |z|).

Results and Discussion

- Baits (Diversity, Evenness)

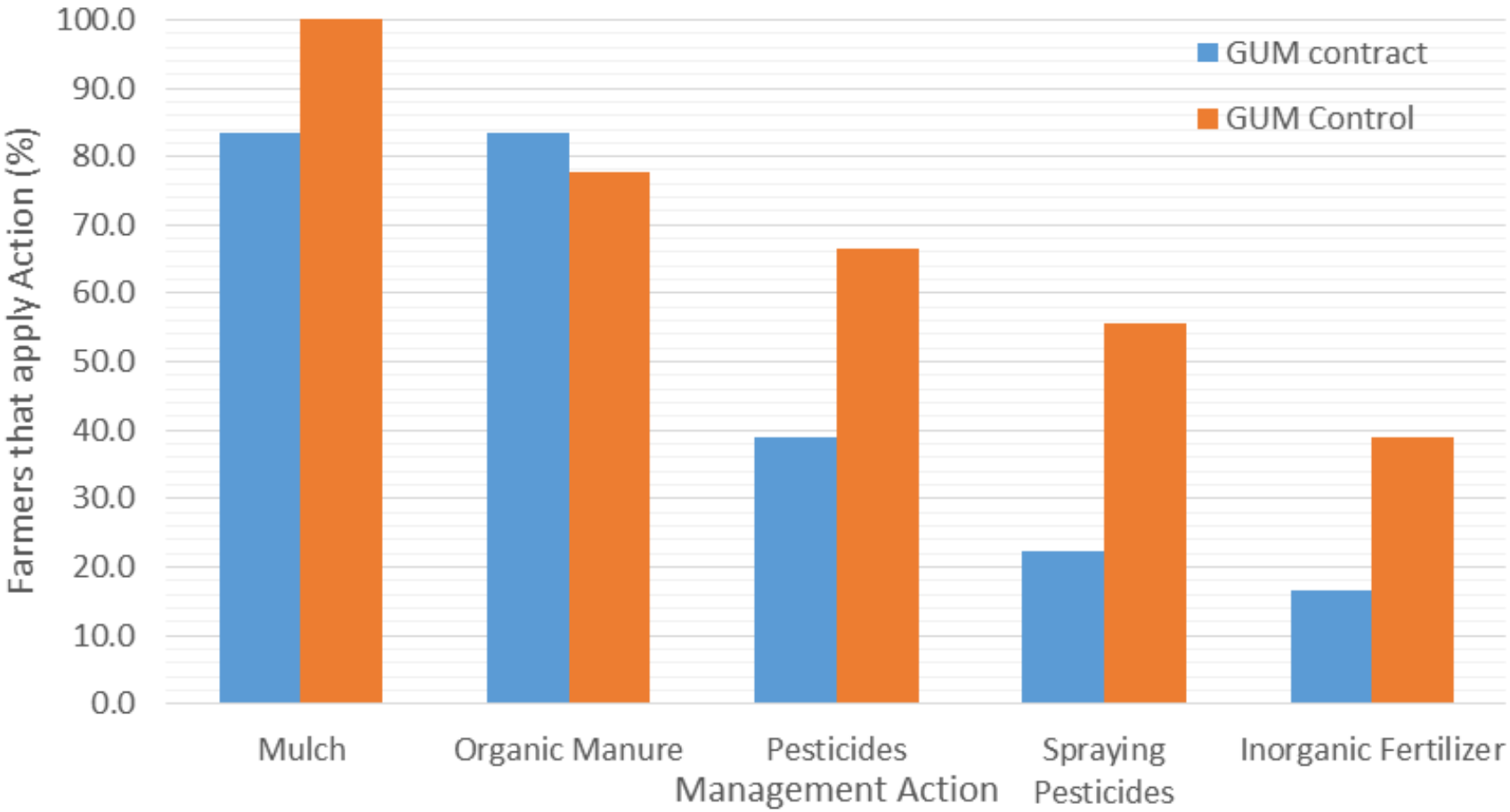
	Gumutindo		Kyagalanyi	
Index	**Certified**	**Control**	**Certified**	**Control**
H'	0.39 (±0.38)*	0.67 (±0.43)*	0.27 (±0.32)**	0.52 (±0.46)**
p50	0.23	0.78	0.15	0.57
E_p	0.3 (±0.27)**	0.54 (±0.33)**	0.24 (±0.28)	0.38 (±0.31)
p50	0.21	0.64	0.18	0.43

- Both groups of certified fields **have a significantly lower Shannon Wiener species diversity**.
- Gumutindo certified fields have a **significantly lower** (Prob > |z| = 0.0429) **species evenness** (E_p) compared to their matched controls.

Results and Discussion

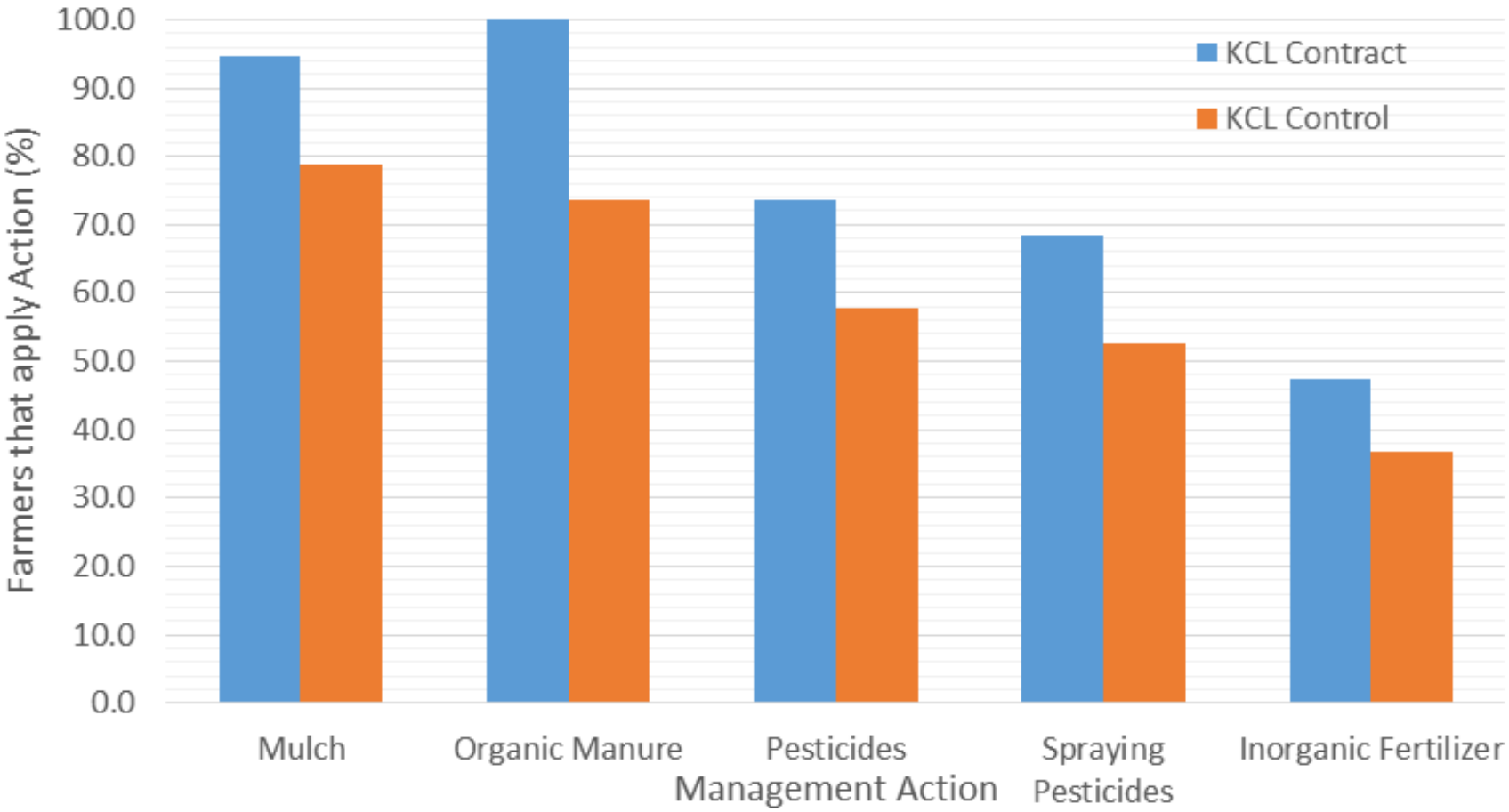
Gumutindo certification ORGANIC CERTIFICATION

- Also, certification is not a clear cut case…



Results and Discussion

Kyagalanyi certification NON-ORGANIC CERTIFICATION



Ongoing research

- Once species are identified => repeat tests for combined data all sampling methods
- Identify species communities
- Link communities with environmental factors
- Identify indicator species

Future research and projects

- Upscaling of ant diversity research to other plantations systems, habitats (forest next to plantations) (2015, 136 plots inventoried). Up-date knowledge on ant fauna in Uganda

- Donation of ant collection to NAFORRI.

- Digitizing of all observed species => Ant Web

Thanks to:

- GTI
- RBINS
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- KU Leuven
- KLIMOS
- All students and volunteers who participated