Production and Processing of Edible Insects for Improved Nutrition

Mini-rearing of edible *Gryllus bimaculatus* at farmers' level in Madagascar to have healthy and sustainable protein

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Background

FOOD SECURITY AND NUTRITION

- In Madagascar, 1/3 of households live in a situation of severe food insecurity.
- The vast majority of the population has insufficient food in quantity or quality.
- The Amoron'i Mania region is among the most affected, with a food insecurity rate of 30% (PNAN III/ONN).

ENTOMOPHAGY

- Insects contain 28g of protein per 100g of fresh matter (as compared to meat: 19g/100g of fresh matter) (FAO, 2012f)
- 2,100 species are eaten in 130 countries worldwide, including Madagascar (Dürr, Andriamazaoro, Nischalke,et al., 2019; Jongema,2017 ;Randrianandrasana & Berenbaum, 2015 ; Van Itterbeeck et al., 2019).
- Nutritional value of *G. bimaculatus* adult *(*per 100g dried insect):Protein = 58.3g, Fat = 11,9g, Fiber = 9,5g (V. B. Meyer-Rochow *et al* 2021).

INSECT REARING

- Rearing insects is easier and cheaper compared to other types of livestock .
- Crickets are the most successful example of rearing insects for human consumption in the tropics. (A. van Huis et al, 2014)
- *G. bimaculatus*, a species naturally occurring in the region, was chosen for this study.

LOCATION AND CLIMATE SITE

- The Amoron'i Mania region is in the central highlands of Madagascar, our study site is in Sandrandahy.
- Sandrandahy has a tropical climate with large variations in temperature between day and night which can be a problem for insect rearing.

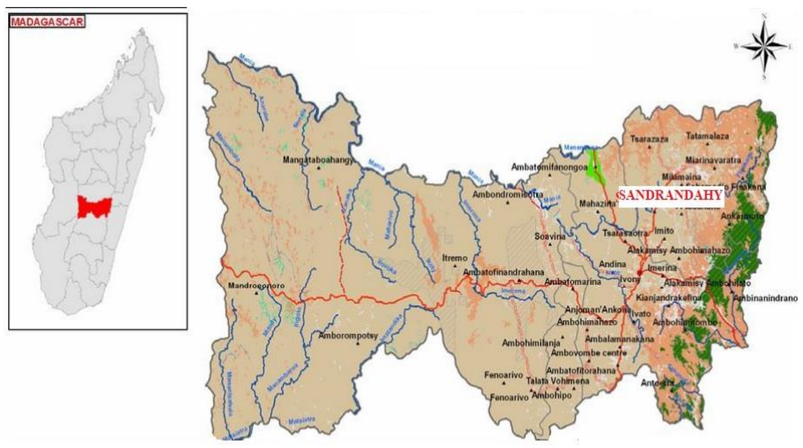

Fig. 1: Map of the region Amoron'i Mania and Sandrandahy village. *(Author: ONE)*

Objectives

- To optimize rearing conditions:
  - Temperature and relative humidity inside the rearing room for mass production of insects.
  - To test different feeds available on the premises for successful rearing.
- To have a healthy and sustainable protein at the farmer level.

Fig. 2: Overview of the rearing room *(Author: A. Lalaina)*

Material and Methods

- Rearing room construction
  - Dimension of 2m x 2.50m x 2.45m
  - Room characteristics:
  - Two brick walls, separated by a space filled with sawdust.
  - Ventilation system (in upper and lower part of the wall).
  - In the middle of the roof, a transparent sheet allows sunlight to enter.
- Control room
- Available feeds to test
  - Complete feed for poultry.
  - Kitchen waste.
- Data to be collected:
  - Temperature (°C), relative humidity (morning - noon- evening)
  - Number of alive and dead larvae
  - Length of development cycle
  - Total adult weight.

Fig. 3: Exterior of the rearing room. *(Author :A.Lalaina)*

Results

REARING PARAMETERS

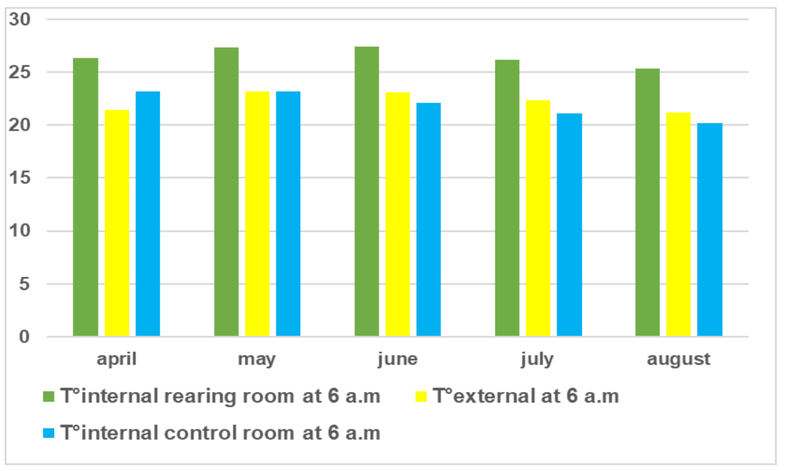

Fig. 4: Average internal and external temperature (°C) of rearing room and control room

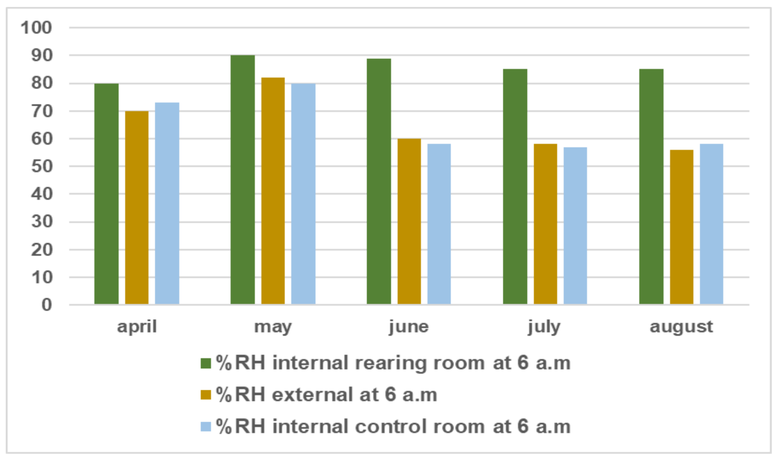

Fig. 5: Average internal and external relative humidity of the rearing room and control room

Feed	Nb of larvae at the start	Nb of adult at the end	Average adult weight	Development time larva – adult
Chicken feed	200	132	1,50 g	30 days
Kitchen waste	200	130	1,06 g	43 days

Feed	Feed costs	Production costs for 1 kg of insects	amount og insects per 1000 ar of feed
Chicken feed	4320 ar	21818 ar	45,83 g
Kitchen waste	1 ar		

1 Euro = 4500 ariary

Conclusion

This study shows that :

- The values of the climatic parameters of the rearing room are different from the control room.
- The characteristics of the rearing room provide optimal conditions for rear *G. bimaculatus*.
- The two types of feed will be offered to the farmer for further cricket rearing.
- The sustainability of this rearing will be ensured by the local availability of feed and the performance of the room.

TROPENTAG 2021 :Towards shifting paradigms in agriculture for healthy and sustainable protein. September 15-17, 2021,

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ProciNut is financially supported by the German Federal Ministry of Food and Agriculture (BMEL) based on the decision of the Parliament of the Federal Republic of Germany through the Federal Office for Agriculture and Food (BLE)

With support from
Federal Ministry of Food and Agriculture
by decision of the German Bundestag