UNIVERSITI KEBANGSAAN MALAYSIA
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INSTITUT PENYELIDIKAN DAN KEMAJUAN PERTANIAN MALAYSIA
MARDI

CREATING a CONDUCIVE ENVIRONMENT FOR BREEDING AND REARING OF STINGLESS BEES

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Introduction

- A stingless bee is an insect (family: Apidae) with NO sting but prolific pollinator agent.
- *Heterotrigona itama* is one of stingless bees species - domesticated for honey production in Malaysia.
- Reaping/shifting of stingless bees colonies in large numbers from the natural habitat to agro-ecosystems caused deforestation and declination of stingless bee diversity.
- Lack of information about the environment needed by stingless bees like climatic factors could cause the loss/absconding of the domesticated colony.

Objectives

- To determine the behaviour of stingless bees
- To investigate the bees food preference in forest area and agricultural
- To relate climatic factor and stingless bee behaviour.
- To determine the foraging distance of the *H. itama*.

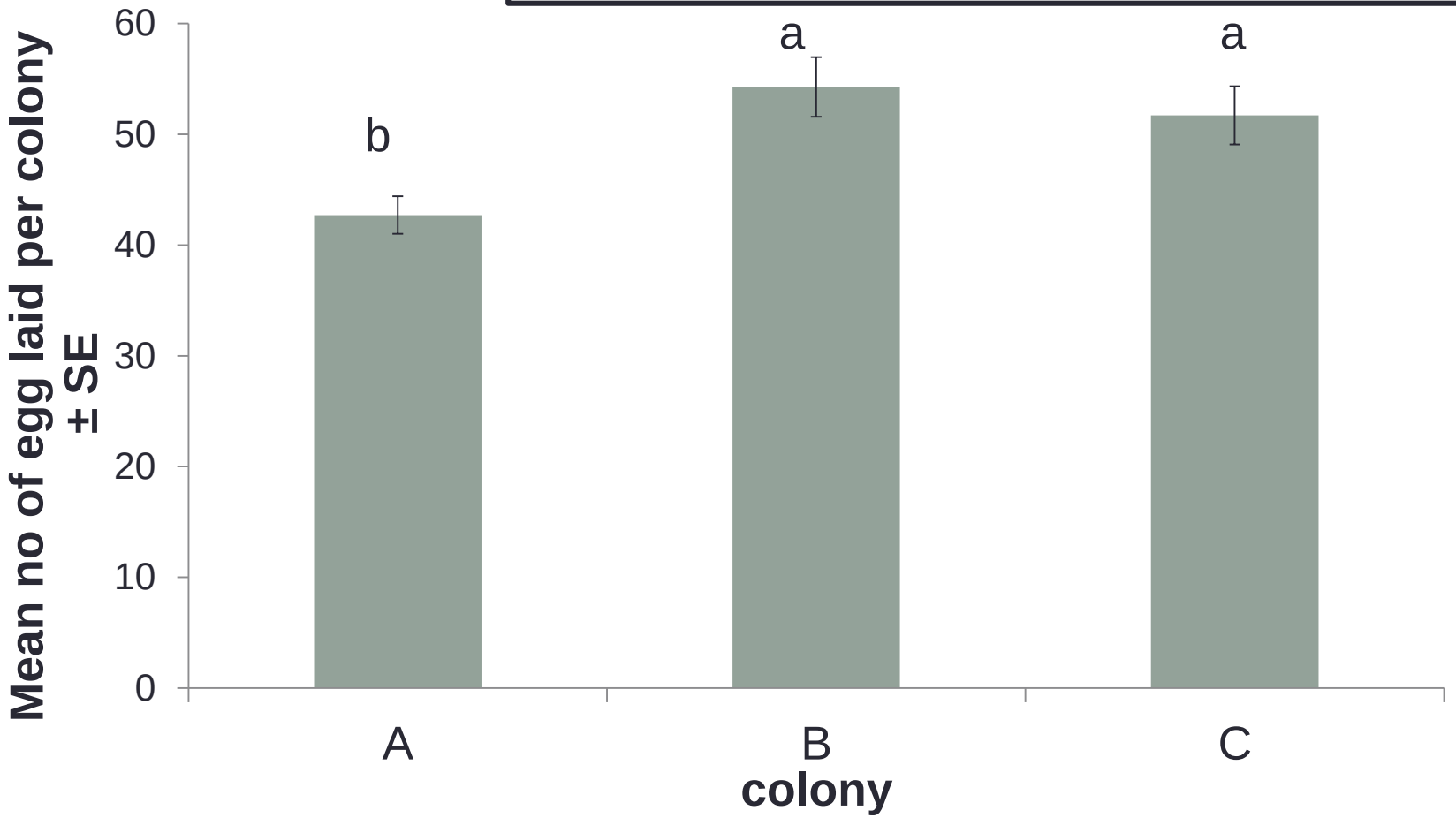
Methods and Results

Objective 1: To determine the oviposition behaviour of stingless bees

- Queen Behavior
  - Three colonies (A, B & C) of ***H. itama*** with 8 layers of brood were set up
  - A digital single-lens reflex (DSLR) camera with a macro lens attached was used to record every movement of *H. itama* **queen** in its colonies for 20 min per h between 0800h and 2000h per 7 days.
  - The top part of the nest which covering the brood cell with wax or involucrum was temporarily removed first for comprehensive viewing

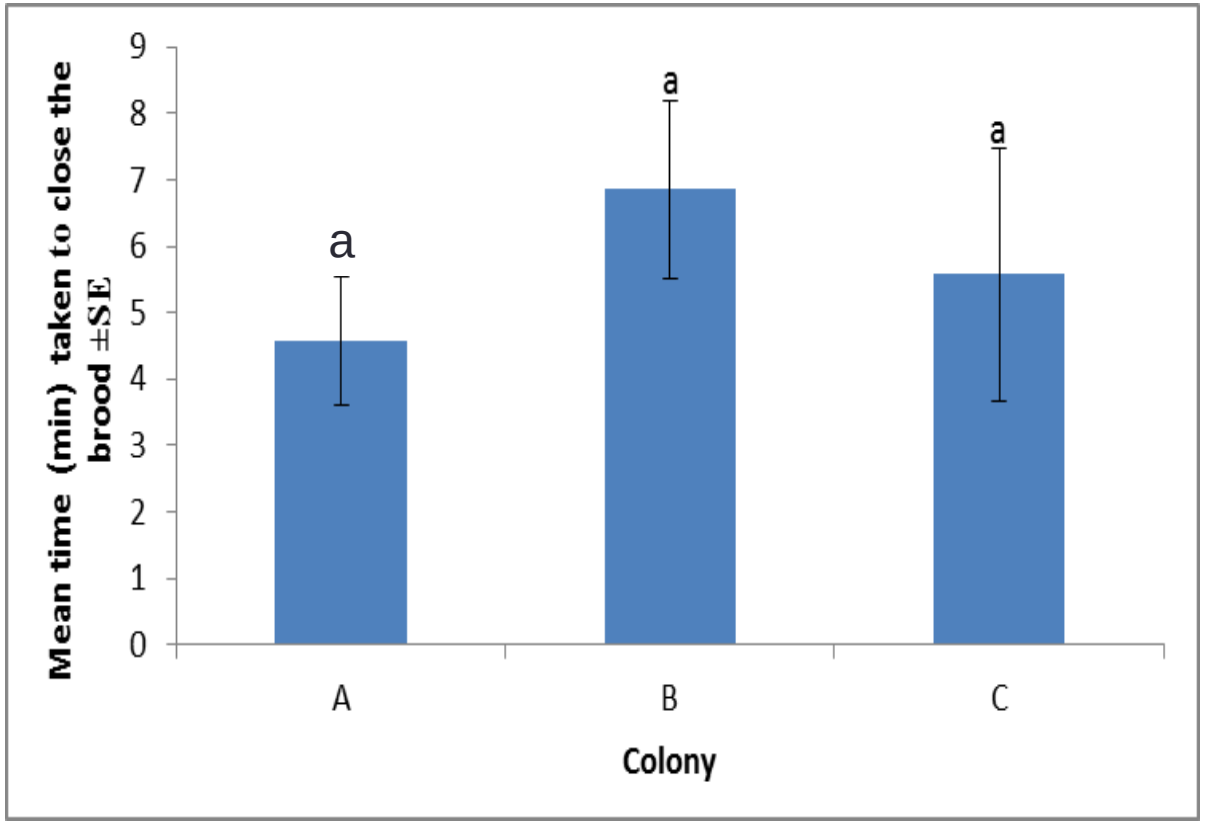
Result – Queen → Mean number of eggs per colony per day laid by a queen of *H. itama*

(F = 45.48; df = 2, 20; P <0.05).



Result - Post ovipostion behavior – by Worker bees (Prefixation = closing the brood cell)

- No significant difference (F = 0.17; df = 2, 20 ; P>0.05) for time taken by worker bees to close the brood cell among the colonies.
- Workers took 4 min to close the brood after the queen laid an egg.



Objective 2: Preference of food from forest and agricultural areas

Methods

- Study was conducted at Taman Tropika Kenyir since 2015 and at MARDI Serdang

  - Foraging time
    - The behavior of each colony was observed and recorded for 5 min per hour between 0800 and 1700 h for 1 day per month per 6 months using a digital single-lens reflex (DSLR) camera with macro lens attached and action camera (SJCAM). All cameras were installed in front of hive entrance at the observation hive.

- **Food preference (Conducted at TTK and Serdang)**

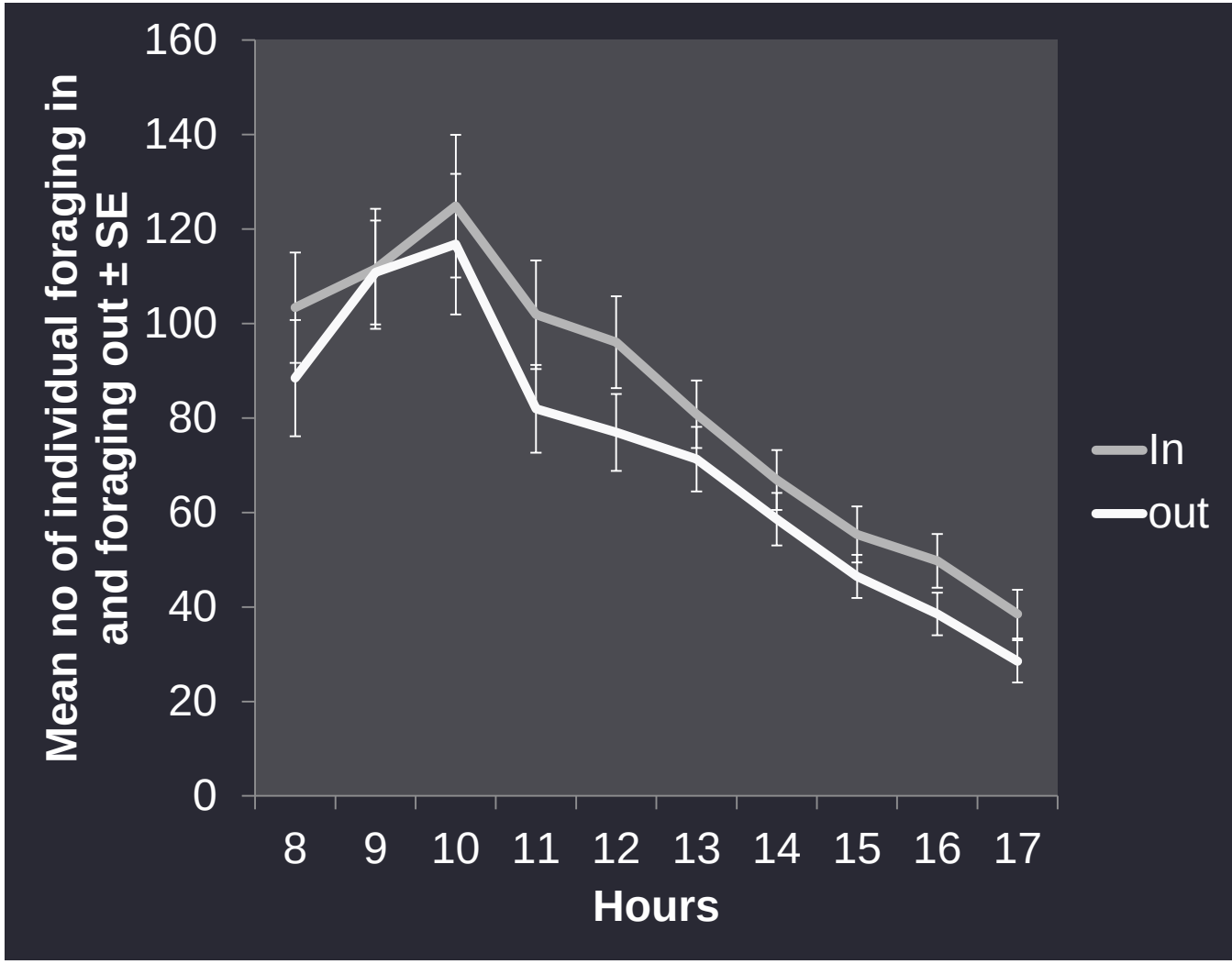
  - Before the food preference study started pollen from the tree was taken from flower buds (fresh material) which provided the key for pollen identification.

  - 5 returning pollen foragers from each colony were captured at the nest entrances using a sweep net at 10 am.

  - Pollen identification using standard acetolysis method.

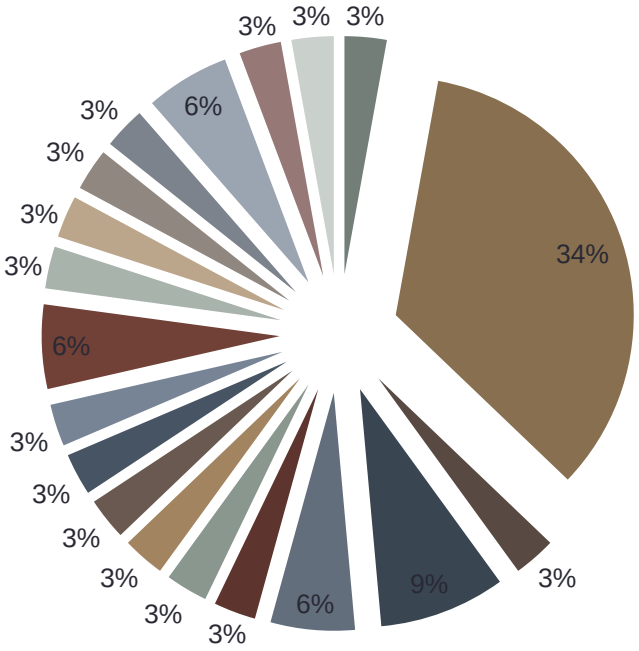
Results – foraging time

- Low in early morning
- High around 10 am. Depend on sunrise
- Very low late in evening



Result - Food Preference at natural ecosystems before the tropical fruits tree planted at TTK

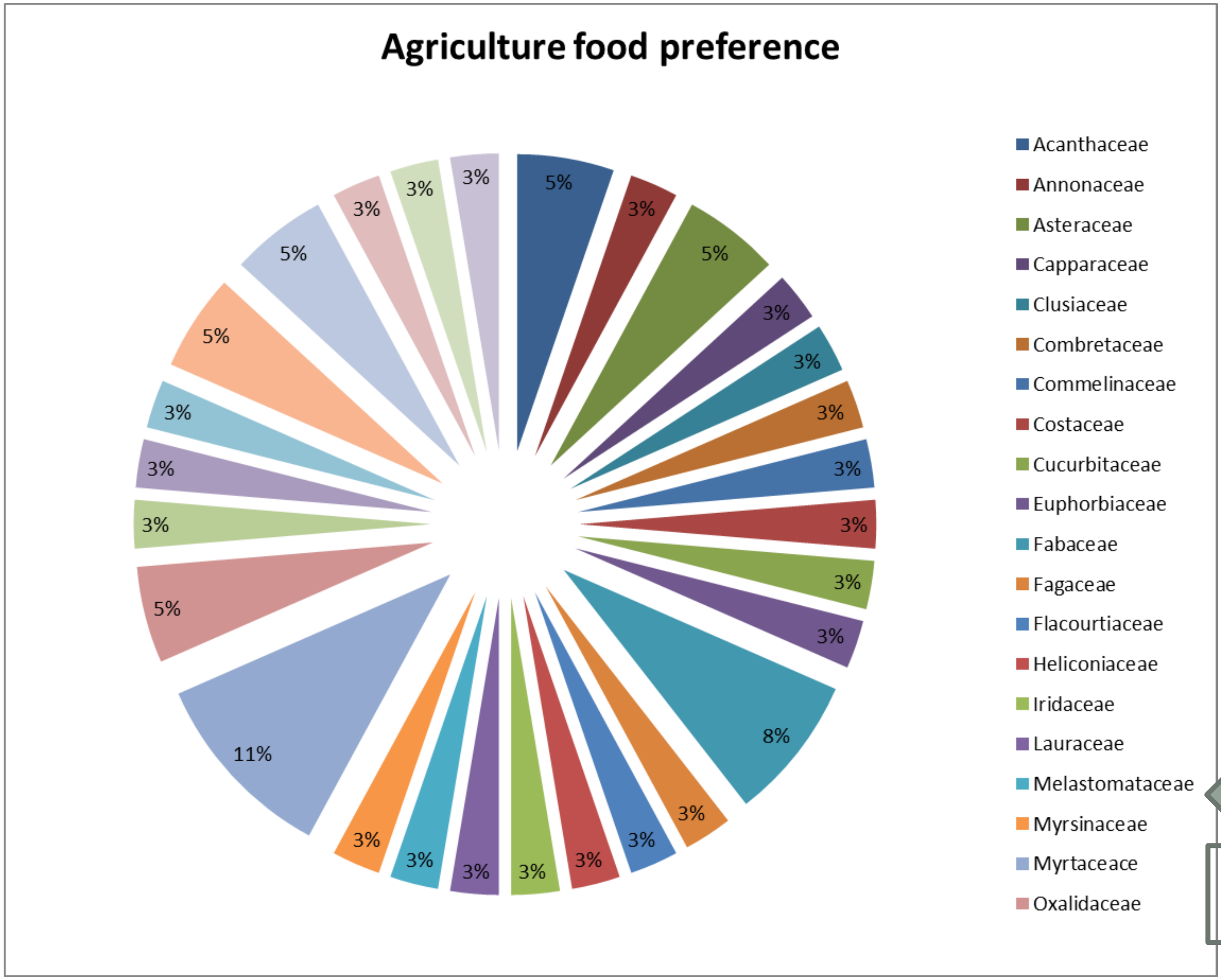
- From bee baskets of forager bees - we successfully identified 33 plant species of 19 families pollen
- Dipterocarpaceae were the most pollen found/collected by *H. itama* (34%)



- Anacardiaceae
- Dipterocarpaceae
- Ebenaceae
- Euphorbiaceae
- Fagaceae
- Guttiferae
- Hypericaceae
- Lauraceae
- Lecythidaceae
- Legiuminosae
- Melastomaceae
- Myristicaceae
- Myrtaceae
- Polygalaceae
- Sapotaceae
- Sterculiaceae
- Thymeleaceae

Forest area

Results - Food preference after the tropical fruits tree planted at TTK



melastomaceae

We also found that the most visited tree by Stingless bees was:

1. Ceri Terengganu (*Lepisanthes fruiticosa*).
2. Kerkup (*Flacourtica jangomas*)
3. Berangan (*Castanopsis sp*.) - existing
4. Cerapu (*Garcinia sp*)

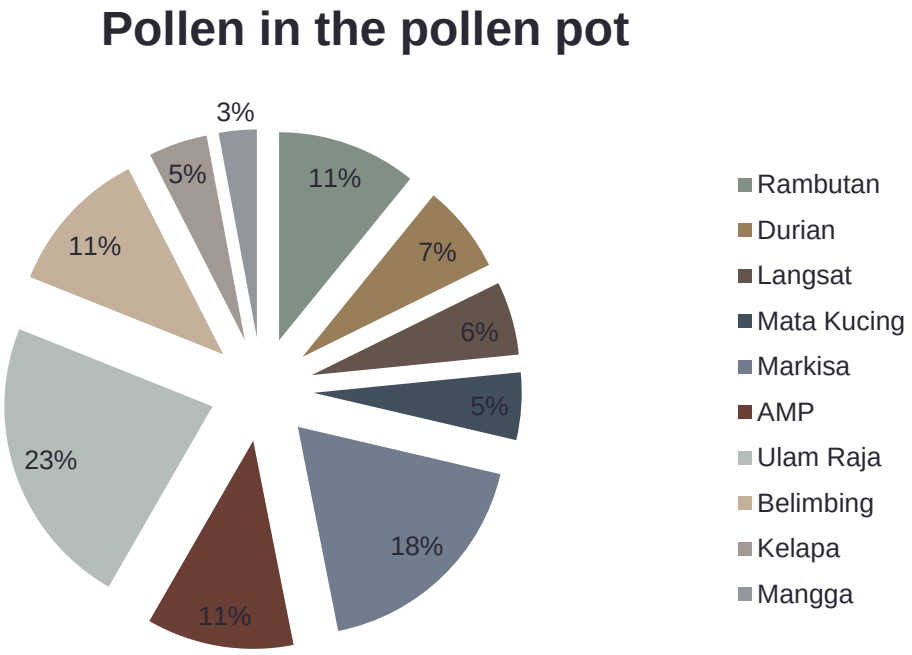
Since , the forest tree flowering once in two years, it foraging behaviour got to change.

As a generalist pollinator, stingless bees was seen to able to adapt with the changes of the area.

Pollen in Agricultural area (Serdang)

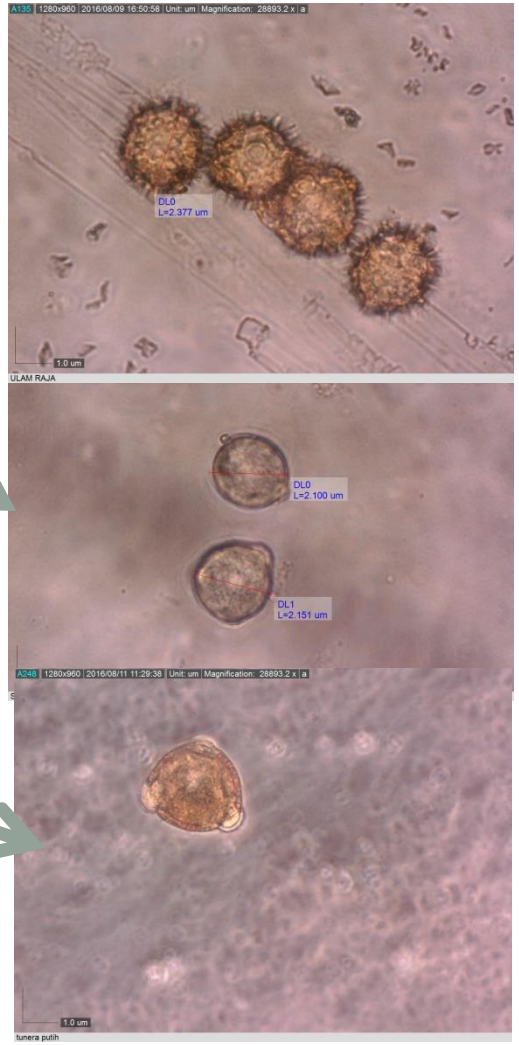
- In the agricultural area - limited of food - lack of plant diversity
- Study was conducted in May - the most flowering period by fruit tree.
- Bees visited more to Ulam raja (23%), followed by markisa, AMP and Belimbing, Rambutan, Durian, Langsat, Mata Kucing and Mangga

Ulam raja/markisa/amp – flowering through out the year



These are most visited trees in agricultural areas

- Ulam raja (*Cosmos sp*)
- Senduduk (*Melastoma sp*.)
- Lantana (*Lantana sp*.)
- Coconut
- Belimbing
- Turnera
- Jambu (Guava)



We observed that when the flowering seasons end bee will →

- changes of food preference.
- forage the tree which flowering through out the year.
- However different meliponiculture site different results.

Result suggested that in the meliponiculture areas, these plant should be considered by the beekeepers as their bees major food source

1. Ceri Terengganu (*Lepisanthes fruiticosa*).
2. Kerkup (*Flacourtica jangomas*)
3. Berangan (*Castanopsis sp*.)
4. Cerapu (*Garcinia sp*)

1. Ulam raja (*Cosmos sp*)
2. Senduduk (*Melastoma sp*.)
3. Lantana (*Lantana sp*.)
4. Coconut
5. Belimbing
6. Turnera
7. Jambu (Guava)

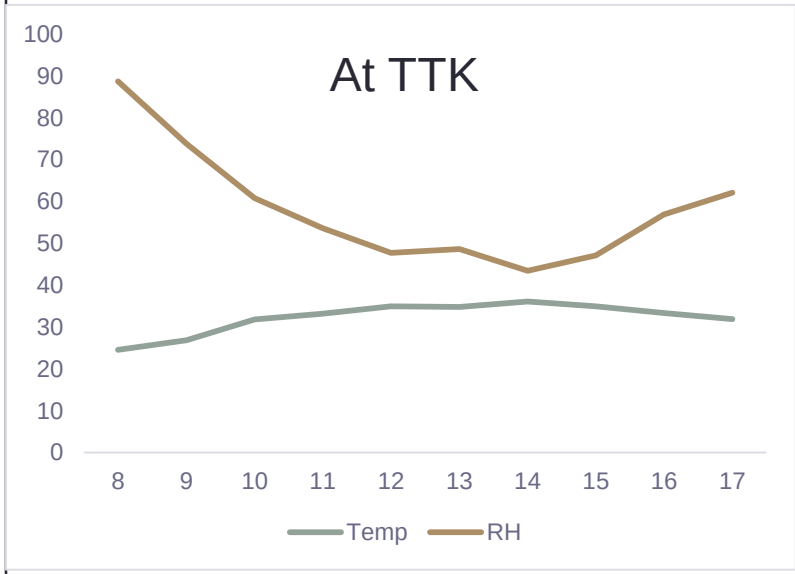
Objective 3 → Relationship to Climate

- Camera was installed in front of the nest entrance for foraging in an out (FIFO) behaviour.
- Button Data logger Watchdog (B100 2K) was also installed inside the nest.
- Our assumption is that the change in temperature will affect the frequency of FIFO of the bees

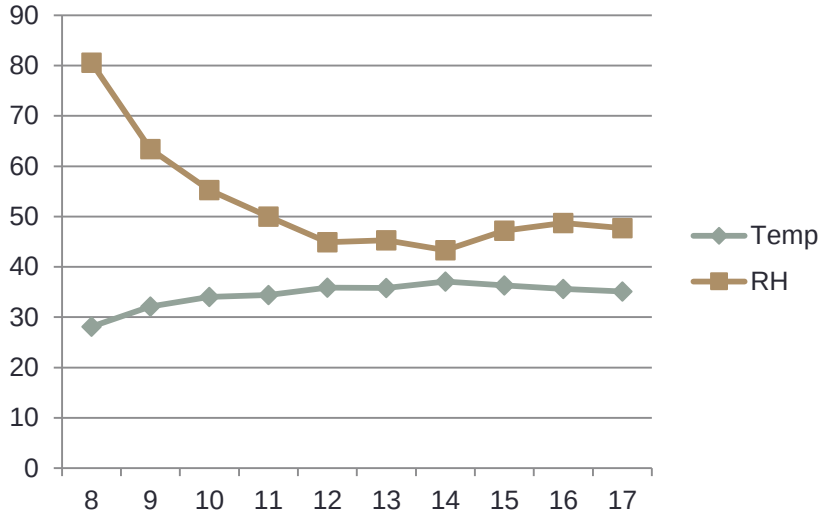
Climate factor

Inside the nest

- Normally will lower 1°C



Outside the nest

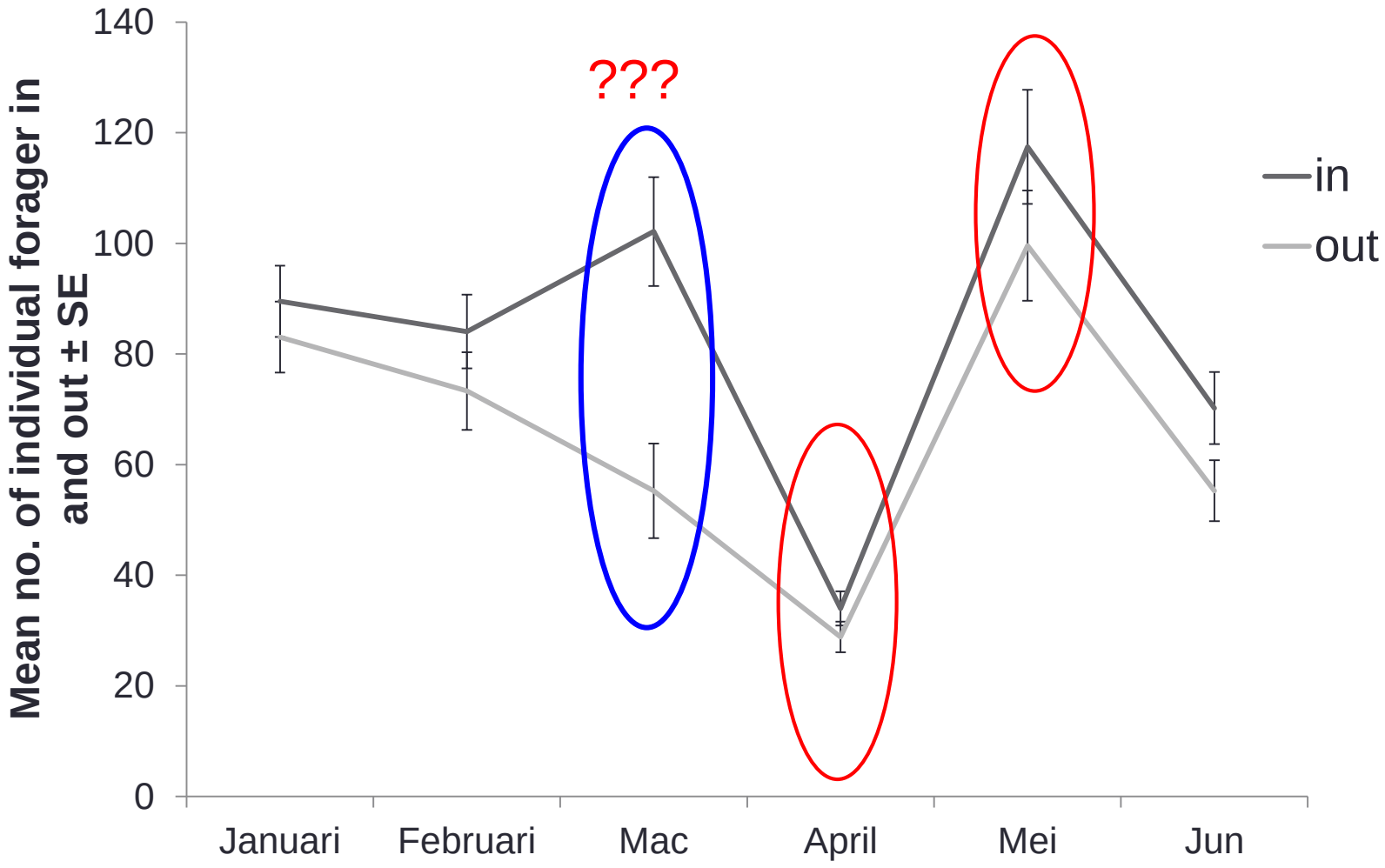


Our observation showed

- changes of the surrounding temperature will affect the inside colony temperature.

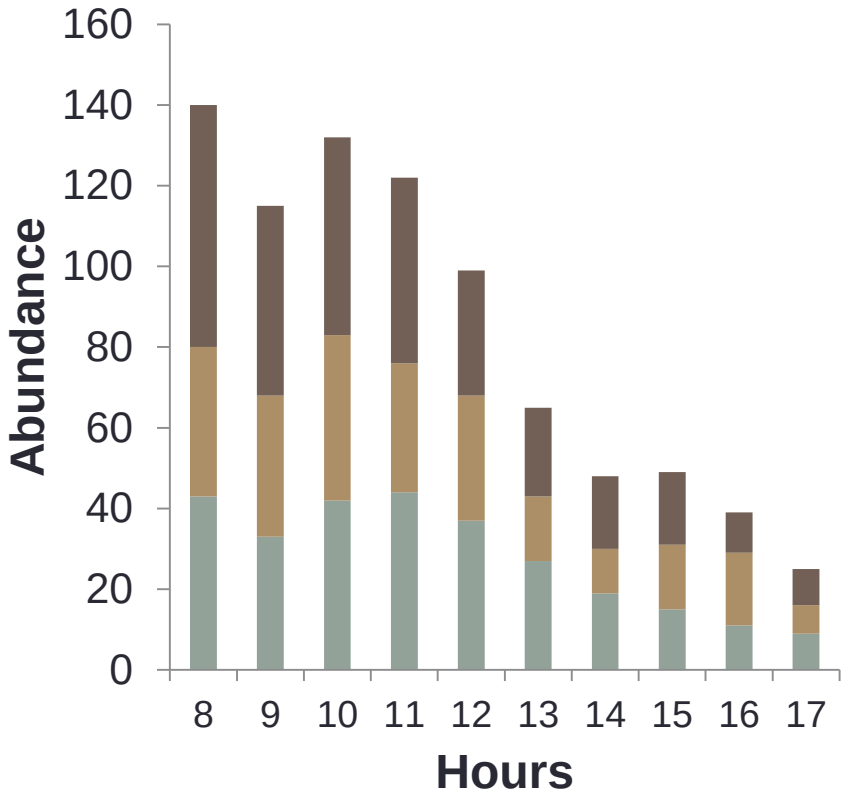
- On the hot temperature period, normally from 1 - 2pm, workers will like to stayed and cooling their nest with buzzing their wings.

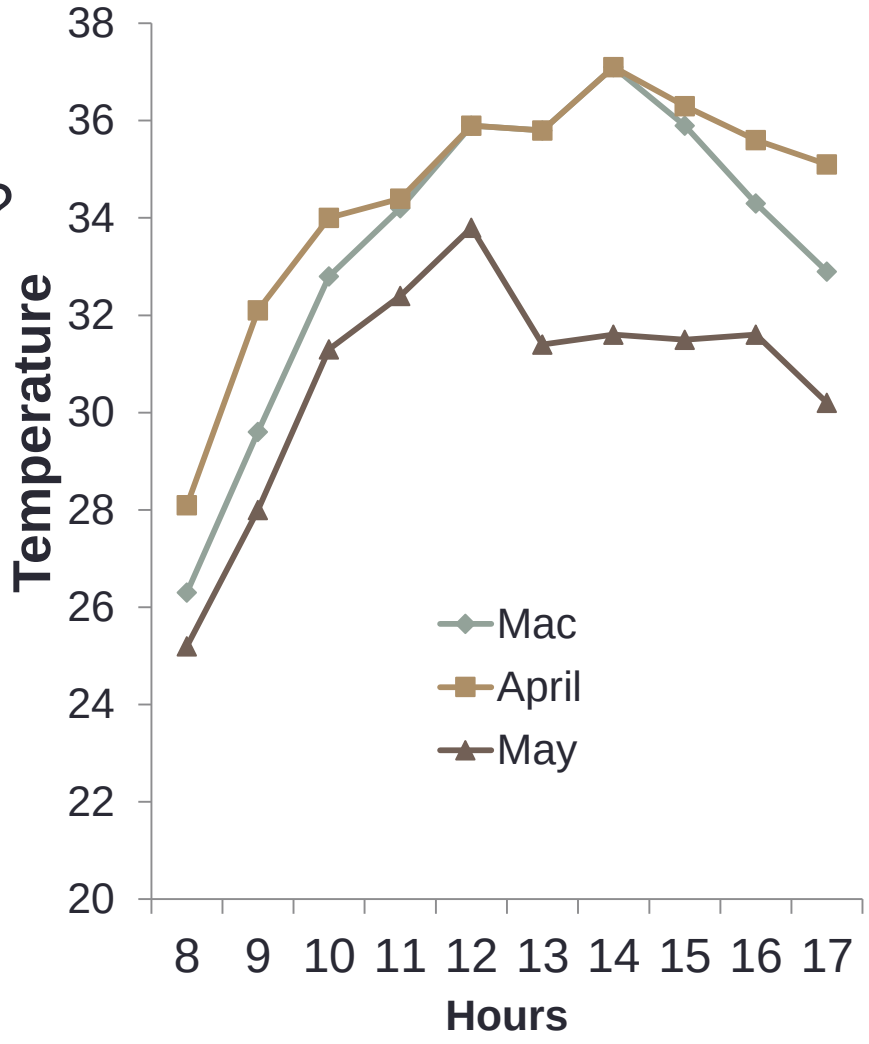
Mean number of forager in and out of the nest



Why April

- El-Nino effect during sampling ??





That’s means

- Foraging behaviour always related to surrounding climate.
- The ideal temperature to stingless bees was 27°C to 34°C.
- during the rainy day the forage workers will pause their activity
- So this temperature should be considered in the meliponiculture areas.

Objective 4 --The distance forager go out and back

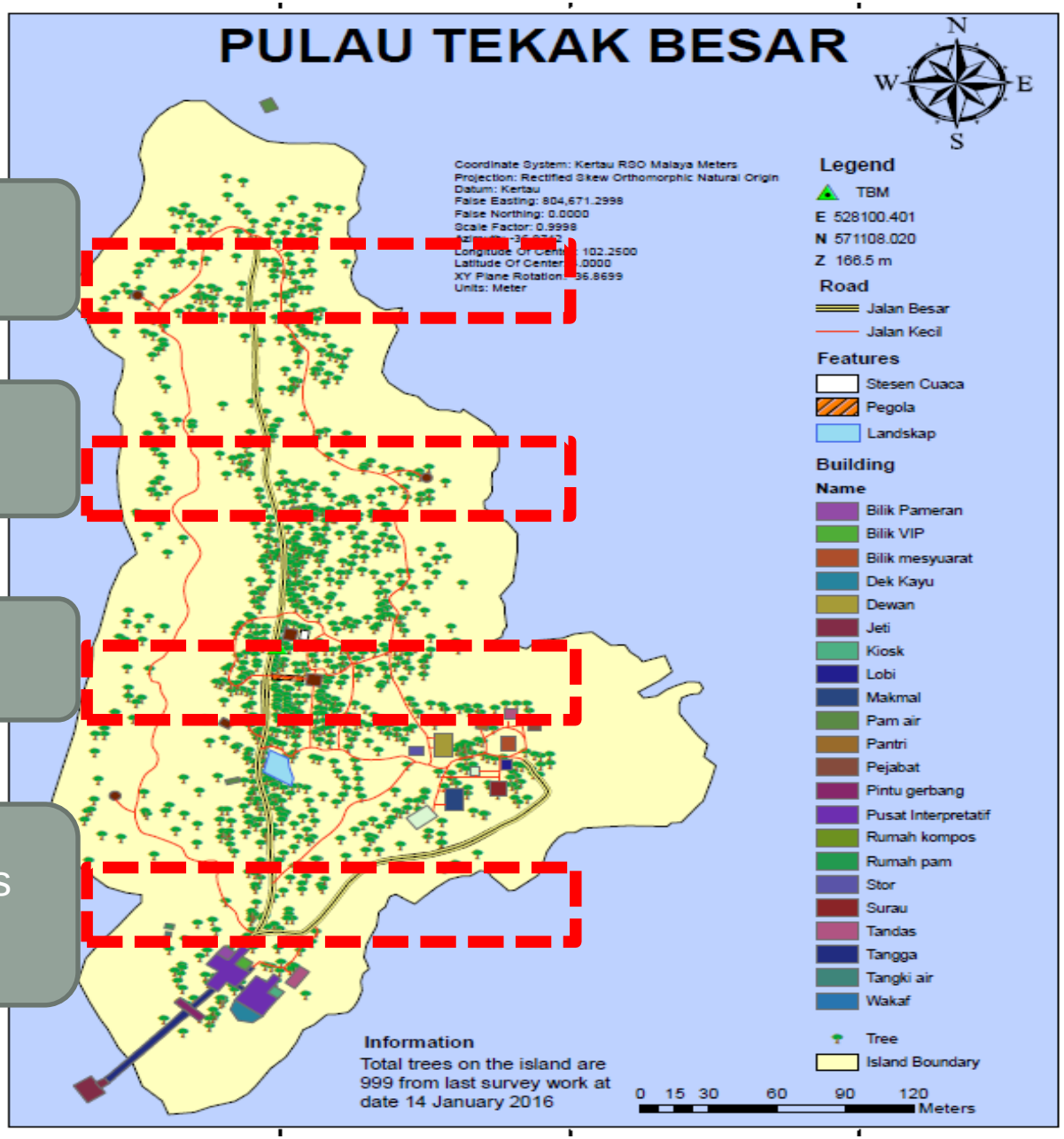
- Conducted at Taman Tropika Kenyir.
- Island with 2000 plants of 200 species (2.5% of all plant species in Malaysia)
- 10 Forager workers were tagged.
- three shrub species (Cosmos sp), were planted at 50m,100m, 150m, 200m, 250m and 300m from the nest.
- At the planted area, action camera (SJCAM) were installed (setting for 5 min per 30 min from 9.00am to 5.00pm) to capture a video for coming forager.

300m

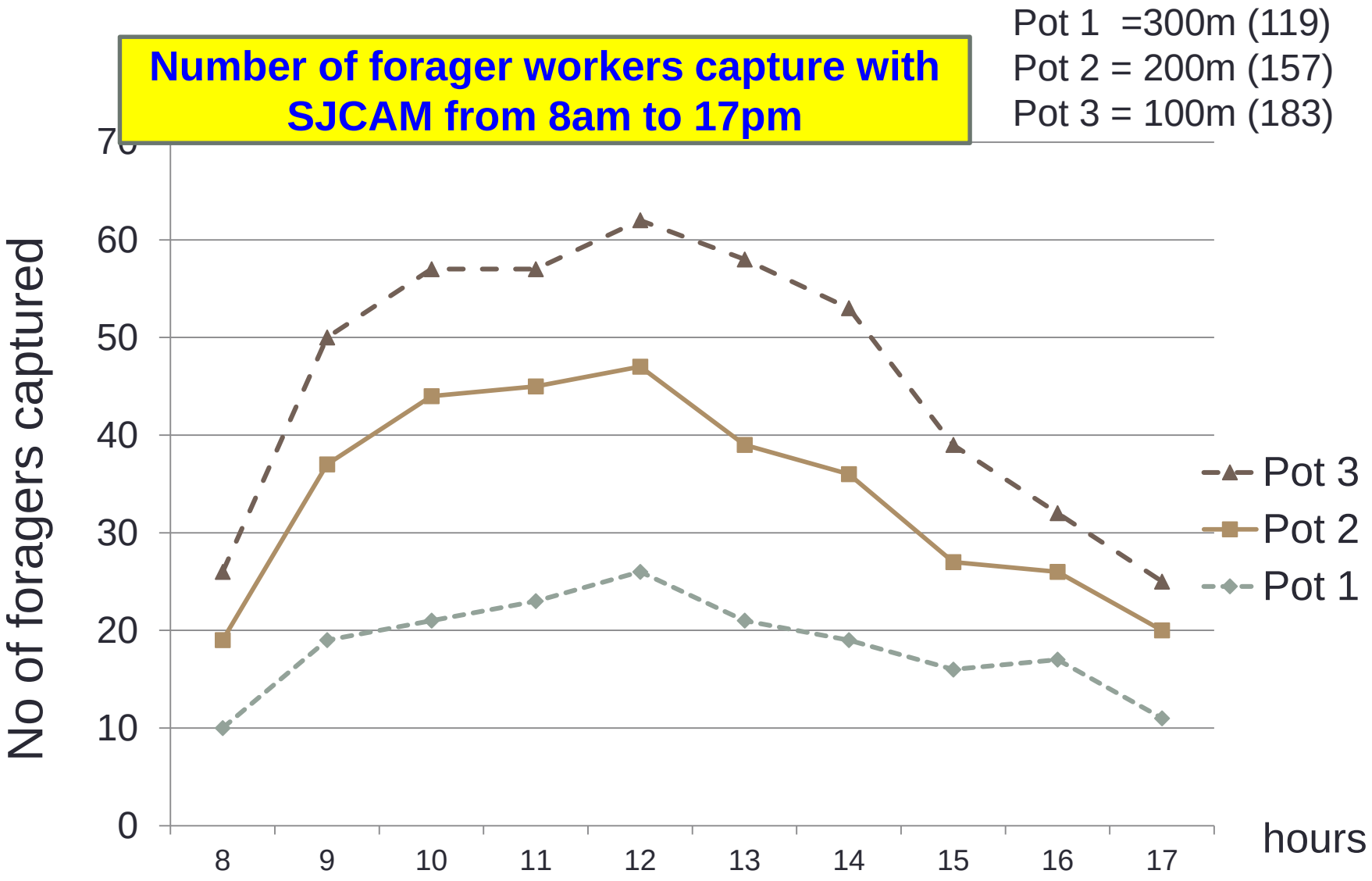
200 m

100 m

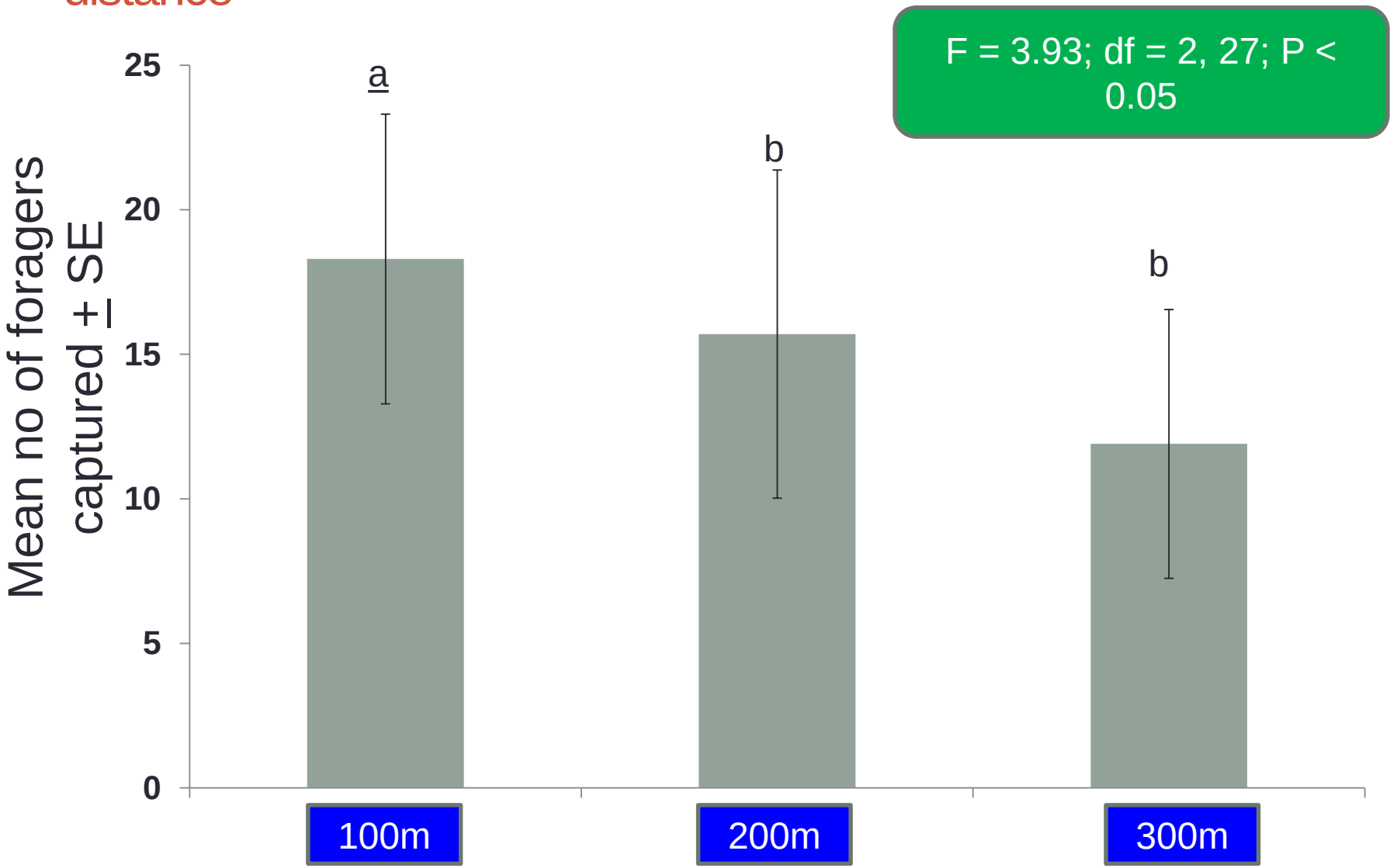
Where the colonies placed



Result – Distance of foraging



Mean number of forager workers forage the pot in the different distance



Meaning….

- Stingless bees could forage for food up to 300m or more
- But preferred foods closer to the nest
- Need to plan when one to plant the food tree for stingless bee farming.

Conclusions

- Rearing a stingless bees must be considered several factors such as;
  - Area temperature - if too hot, make sure planted the area with the shady tree.
  - Food source- diversity food sources are better than the single or few food due to the flowering seasons.
  - Distance of food source-better nearby the colonies.

- Food sources quality and accessibility to the forager also need to be investigated as this also affect honey quality and bees reproduction

Acknowledgment

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- Thanks to all team involved in the research.


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