Mr. Rosman Sulaiman

Research Officer, Entomology and Integrated Pest Management Unit, Biology and Sustainability Research Division, Malaysian Palm Oil Board (MPOB)

- Academic Qualifications
  - BSc (Hons.) Plantation Technology & Management, Universiti Teknologi MARA
  - Master in Land Resource Management, UPM
- Work Experiences/ Area of Expertise/Interest
  - Research Officer, Entomology and Integrated Pest Management (2014-Present)
  - Areas of expertise: Applied entomology/pest management and control
  - Research experiences and current research project
    - Research related to termite and bunch moth control in oil palm
    - Assisting in research of population monitoring of oil palm pollinating weevil, fruit set formation in oil palm, and rats control.

MPOB soppoa

Seminar on R&D Progress 2023

15 Nov 2023, Bintulu, Sarawak

MPOB-SOPPOA Seminar on R&D Progress
15 November 2023
Green Hotel & Suites, Bintulu

Controlling Major Pests of Oil Palm on Peat- Termite and Bunch moth

Mohamad Rosman, Saharul Abillah, Muhammad Nurul Yaqin, Siti Nurulhidayah Ahmad, Mohamed Mazmira Mohd Masri

Biology and Sustainability Research Division

Malaysian Palm Oil Board

BUNCH MOTH, *Tirathaba sp.*

- Two species found in Malaysia & Indonesia; *T. mundella* & *T. rufivena.* It can be found in areas with low fruit set and late harvesting problems. Outbreaks were reported throughout Mukah, Sibu and Miri (Sarawak, Malaysia)
- Most infestations occur in coastal areas, with an estimated 46,992.6 ha involved
- Consisted of 5 larval stages, each differentiated by size and body length.
- Larvae damaging both male and female inflorescence and developing bunches. Severe infestation reduces the quality and weight of bunches and also causes malformed and premature bunch abortion

MPOB

DEVELOPMENTAL STAGES

- Egg: 4.56 days
- Instar 1: 2.22 days
- Instar 2: 2.30 days
- Instar 3: 2.54 days
- Instar 4: 3.14 days
- Instar 5: 4.08 days
- Pupa: 12.24 days
- Total from egg to adult: 34.36 days

Developmental stages of Tirathaba sp adapted from (Gan et al, 2011)

MPOB

BUNCH MOTH, *Tirathaba sp.*

- *Tirathaba* population increment was further helped by the following factors [(1)]:
  - Abundance of food sources [i.e. unharvested ripe bunches]
  - Presence of breeding sites
  - Scarcity of natural enemies
  - Inefficient pollination, causing the increasing case of abortive bunches
- Infestation can be detected by the presence of orange/light-brown fresh faeces/frass

MPOB

Pattern of infestation

Pattern of infestation on the mesocarp of a fruit (L-R): Newly infested, 5-6 days after infestation, 10 days after infestation

Late stage of Tirathaba larva on developing oil palm bunch

MPOB

Pattern of infestation

a

b

c

*Figure showing the pattern of infestation of bunch moth [**a**]: faeces and silk covering bunches [**b**]: damage to the surface of ripening fruits [**c**]: stunted growth of fruit*

MPOB

Pattern of infestation

Tirathaba frass on infested oil palm bunch (i). Fresh (Top) (ii). Drying (Bottom)

Hole made by Tirathaba larvae on the non-ripening fruit mesocarp

Tirathaba larvae boring hole into fruitlet's mesocarp

MPOB

BUNCH MOTH, *Tirathaba sp* Managements

Field evaluation of biological agents and insecticides to control larval population of *Tirathaba* sp.

- Three trials conducted
  - Kuala Igan,Bakong, Sibu
  - Objective: To evaluate the effectiveness of microbial agents and chemical insecticides in controlling the larval population of *Tirathaba* sp.
- Treatments:
  - Cypermethrin, chlorantraniliprole, permethrin, chlorpyrifos
  - *Bacillus thuringiensis*, *Metarhizium anisopliae*
- 4 reps each treatment (1 rep = 70 palms)

Spraying gang at Kuala Igan

MPOB

List of Treatments Evaluated

	Kuala Igan Trial			Bakong Trial			Sibu Trial		
No	**A.I**	**Conc.**	**Rate/ 16 L Water**	**A.I**	**Conc.**	**Rate/ 16 L Water**	**A.I**	**Conc.**	**Rate/ 16 L Water**
1	**Control**			**Control**			**Control**		
2	**Cypermethrin**	5.5%	*30ml*	**Cypermethrin**	5.5%	*15ml*	**Permethrin**	20%	*5ml*
3	**Chlorantraniliprole**	5.0 % SC	*8ml*	**Chlorantraniliprole**	5.0% SC	*8ml*	**Chlorantraniliprole**	35% WG	*4.55g*
4	**Commercial *Bt***	17600 IU mg-1	*24ml*	**Commercial Bt**	17600 IU mg-1	*24ml*	**Chlorpyrifos**	38.7%	*10ml*
5	**MPOB-*Bt***	16000 IU mg-1	*640ml*	***M. anisopliae***	1.1 x 1011 spores kg-1	*150ml*			

Preliminary study on the efficiency of a different time and light source in light traps for capturing a population of adult oil palm bunch moth, *Tirathaba mundella* (Lepidoptera: Pyralidae)

Experimental Site

The study was conducted in two oil palm estates, namely Location A, Daro, and Location B, Sri Aman, both in Sarawak, Malaysia. The light traps deployed at both sites were different (*Tables 1* and *2*; *Figures 3*, *4*, *5*, *6*, and *7*).

Sampling Method and Design

The light traps were installed and deployed along the main road of every trial site. The trap location was selected as its placement in an open area can optimize the illumination from the light traps.

Data Collection

The number of individuals captured in each trap was recorded every two hours and the plastic sheets were cleaned before the start of the recording. This data collection represents the efficiency of the different light sources in the light trap. The interval for each trapping session in Location A and B were divided into three sessions with Interval 1 (1925 to 2125); Interval 2 (2130 to 2330); and Interval 3 (2335 to 0135).

TABLE 1. LIGHT TRAPPING DESIGN USED IN LOCATION A, DARO, SARAWAK

Traps No.	*Traps Type*	*Watt*	*Description*
1	Birdhouse Design	25W	A portable trap design with one meter long stainless-steel rod as stand equipped with 0.5ft normal fluorescent light.
2.	Tripod Angel Bulb with Water Basin	8W	A joint of three stainless steel rods, slanted at 45°; equipped with normal standard bulb light, hanging 50 cm from the ground, and powered by diesel generator. Three plastic sheets (74 x 90 cm) was applied with aerosol glue sprayed (Anti Pest Sticky Spray; Chemi-Bond), and placed adjacently in triangular form to facilitate the moth trapping.
3.	Spotlight with Water-filled Oil Drum (9.5ft)	400W	A spotlight hanging 9.5ft from the ground with a semi-rectangular wooden structure as the pillar; equipped with 50 litre oil drums, and powered by diesel generator.
4.	Spotlight with Water-filled Oil Drum (5.0ft)	400W	A spotlight hanging 5.0 ft from the ground with a semi-rectangular wooden structure as the pillar; equipped with 50 litre oil drums, and powered by diesel generator.
5.	Fabricate Plastic Container with Funnel	25W	Fabricated-household plastic container and funnel; equipped with normal bulb light hanging 50 cm facing the funnel and powered by diesel generator. Three plastic sheets (74 x 90 cm) was applied with aerosol glue (Anti Pest Sticky Spray; Chemi-Bond), and placed adjacently in triangular form to facilitate the moth trapping.
6.	Fluorescent Tube Light	8W	Standard fluorescent white light tied (4 ft) tied vertically, 2 meters from the ground with a wooden pole stand; equipped with tarpaulin PE Sheet (2.74 m × 3.65 m), and powered by diesel generator.

TABLE 2. LIGHT TRAPPING DESIGN USED IN LOCATION B, SRI AMAN, SARAWAK

Traps No	*Traps Type*	*Watt*	*Description*
1.	Fluorescent Tube Light	8W	Standard fluorescent white light tied horizontally, 50 cm from the ground, on stainless steel rod slanted at 45°, with water basin for catching moth.
2.	LED Light	50W	LED light with housing, vertically hanging 50 cm from the ground and powered by 220V car battery.
3.	Spotlight with Water Basin	150W	A spotlight vertically hanging 1 meter from the ground, tied with 45° modified stand, and powered by diesel generator.

Figure 3. Light trapping was deployed in Location A. a) Trap 1 was placed on the harvesting path, approximately 20 meters from the main collection road. b) Trap 2 in the middle of the collection road.

Figure 4. Light trapping was deployed in Location A. c) Trap 3 and d) Trap 4 both were placed on the collection road.

Figure 5. Light trapping was installed in Location A. e) Trap 5 and f) Trap 6 both were placed on the collection road.

Figure 6. Light trapping installed in Location B. g) Trap 1 is located in the middle of the collection road. h) Trap 2 is located on the harvesting path approximately 20 meters from the main collection road.

Figure 7. Light trapping was installed in Location B. i) Trap 3 was also located in the middle of the collection road.

Light trap 6 (FTL) (mean=38.6667,p<0.05), location A

Light trap 2 (LED) (mean=18.0000, p>0.05), location B

Interval 3, female moth (mean=16.0000, p<0.05), Location A

Interval 1 & 2, female moth (mean=8 and 9.6667, p<0.05) Location B

Recommendations

- Chlorantraniliprole: most effective in controlling larval population of *Tirathaba*
  - Has the longest sustained effects on the population
  - Able to reduce spraying frequency
  - Allow the population of beneficial insects to build up
- *Bacillus thuringiensis* var *kurstaki* effectiveness in controlling the larval population of *Tirathaba* sp was comparable against chemical
  - Will not negatively affect the population of beneficial insects i.e. pollinating weevil
- Removal of rotten bunches, unharvested ripe bunches should be practiced to reduce breeding sites of *Tirathaba*.
- Patterns of night flight behaviour of the pest were also observed. The study also managed to record the night flight behaviour with sexes of the bunch moth itself as indirect information on the bunch moth diversity

Termite, *Coptotermes sp*.

- Termite become economic pests when their appetite for wood and wood products extends to human homes, building materials, forests, crops and other commercial products.

Genera	species	Source
42	175	P. Malaysia, Tho, 1992
33	103	Sabah, Thapa, 1977
17	45	Oil Palm, Zulkefli, 2012

MPOB

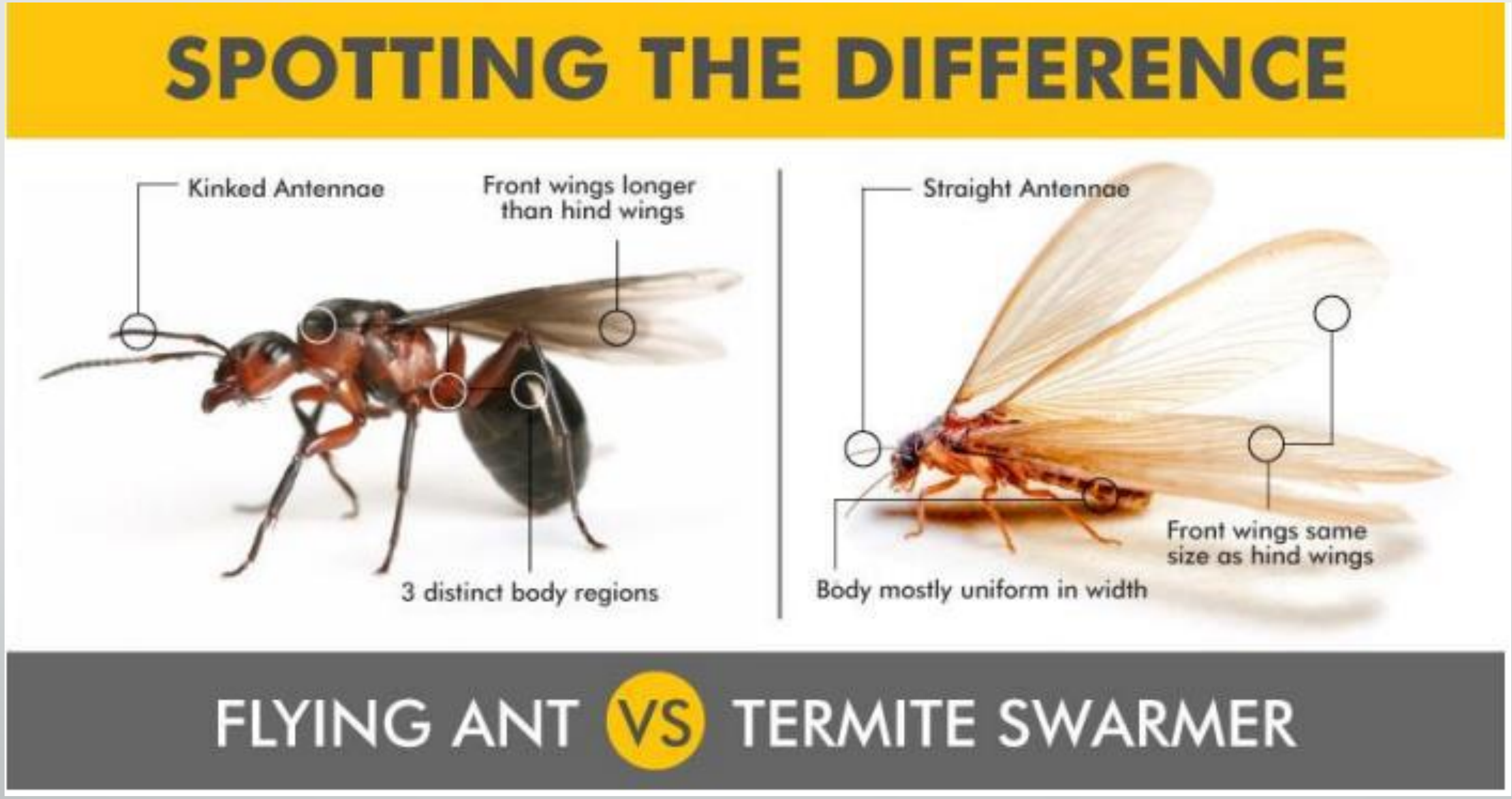
Termite, *Coptotermes sp*.

Termite swarmers look a lot like flying ants. In fact, homeowners and planters often mistake flying ants for termite swarmers and become alarmed.

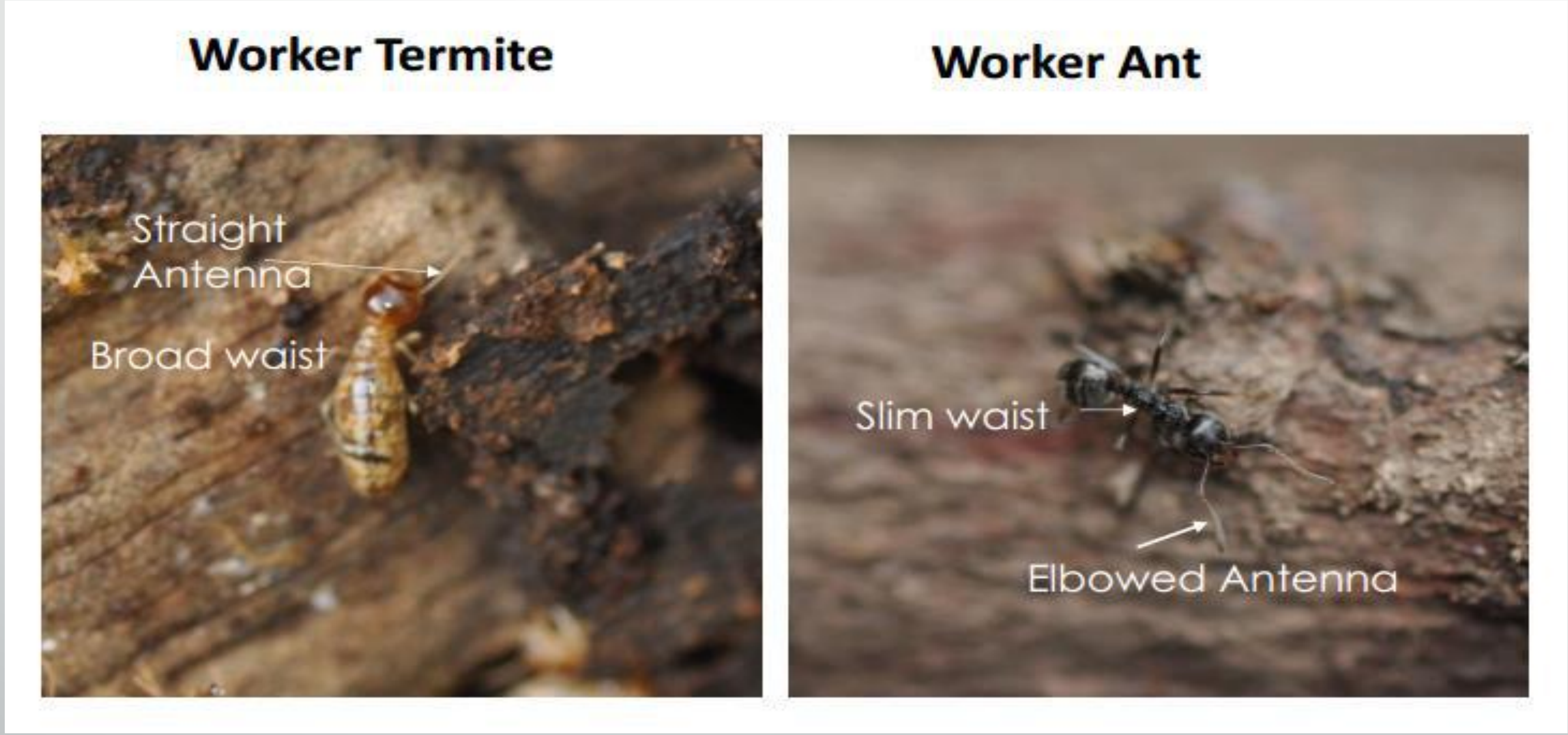
TERMITE	FLYING ANTS
Straight antennae	Elbowed antennae
Two pairs od wings- same size and shape	Two pairs of wings, rear wings smaller than front wings
Broad waist	Narrow of pinched waist
Short legs	Long legs

MPOB

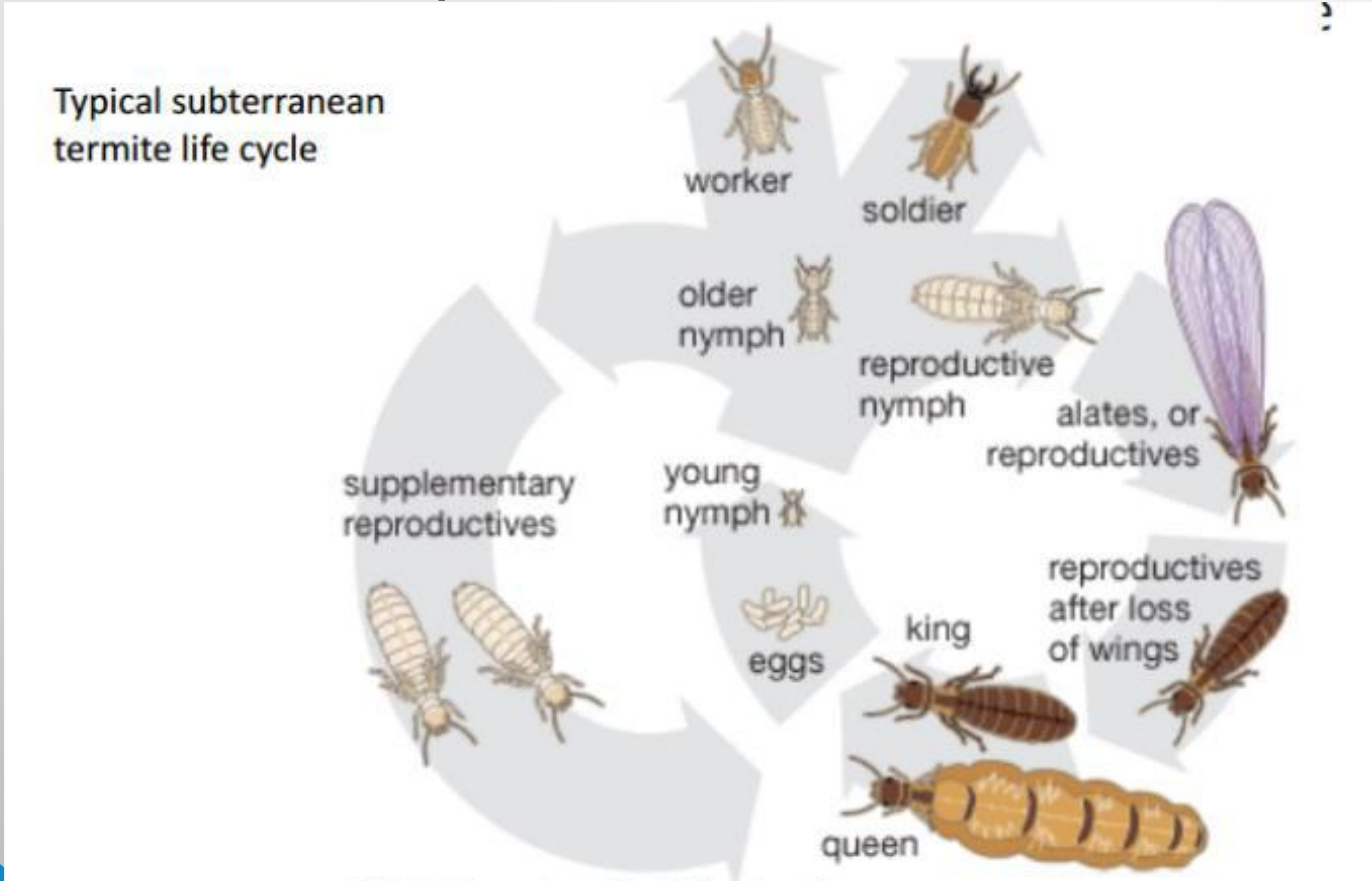
Termite vs Flying ants



Termite vs ants



Lifecycle of subterranean termite



MPOB

Termite nesting systems

- Wood nesters – main trunk/branches
- Hypogeal nesters – below ground/subterranean
- Epigeal mound – nest above ground
- Arboreal nesters – attached to tree
- Inquiline nesters - sharing

MPOB

Termite mound and nest

Epigeal mound

Aboreal nester

Macrotermes gilvus

Dicuspideitermes sanstchii

Lacesstitermes sp

Hospitalitermes sp

Macrotermes gilvus on oil palm

Fungus garden of *M. gilvus* in their mound

Coptotermes curvignathus

Macrotermes gilvus

***Schedorhinotermes* sp.**

MPOB

TERMITE DAMAGE ON RUBBER WOOD STAKE

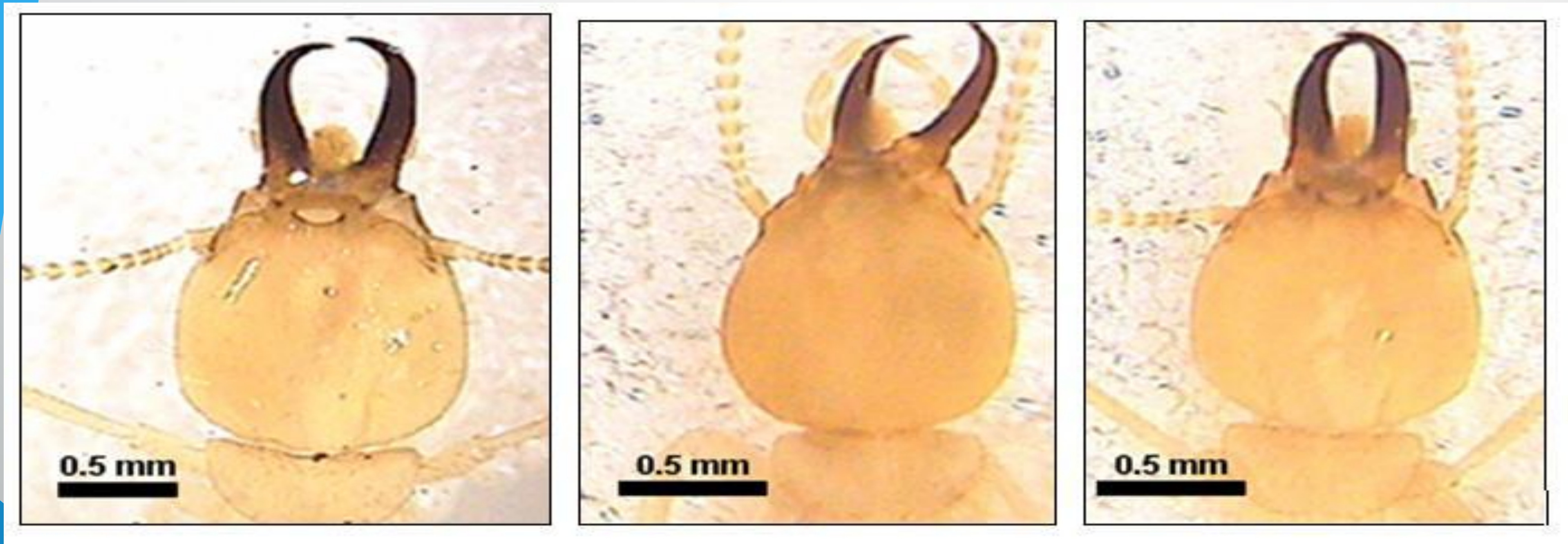
1. *C. curvignathus*
2. *C. sepangensis*
3. *C. kalshoveni*
4. *Schedorhinotermes* sp.
5. *Nasuttitermes* sp.

Termite species detected using rubber wood stake

Family	Subfamily	Genus species
Rhinotermitidae	Coptotermitinae	*Coptotermes curvignathus*
		Coptotermes sepangensis
		Coptotermes kalshoveni
	Rhinotermitinae	*Schedorhinotermes sarawakiensis*
Termitidae	Macrotermitinae	*Macrotermes gilvus*
	Nasutitermitinae	*Nasutitermes* sp.
	Termitinae	*Globitermes* sp.

MPOB

Head and mandible shape of *coptotermitinae* soldier detected with rubber wood stake



Coptotermes curvignathus

Coptotermes sepangensis

Coptotermes kalshoveni

Other species found on rubber wood stake

Macrotermes gilvus

Scherdorhinotermes

Nasutitermes

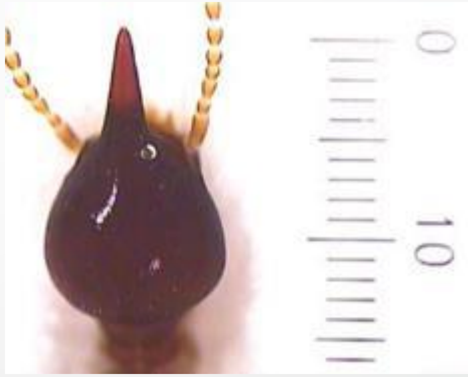
Globitermes

MPOB

other termite species detected using transect belt

Bulbitermes

Havilandtermes



Hospitalistermes

Odontotermes

Prohamitermes

Termes rostratus

Pericaprritermes

Termite infestation and damage on oil palm





MPOB

Detection based on visual observation

1. Initial stage
   - Presence of fresh mud work on the frond bases, inflorescences, developing bunches, and spear region. At this stage spear and upper fronds are still green
2. Intermediate stage
   - Discoloration of spear & the upper two- three young fronds turns to yellowish brown. At this stage, the recovery rate after treatment will be relatively slow
3. Advanced stage
   - Spear and the upper 3-4 fronds start to dry up, turning brownish. The spear becomes rotten and collapse/
   - The recovery rate after treatment at this stage will be very poor at this stage.

MPOB

Severity of termite infestation

Initial stage

Intermediate stage

Advanced stage

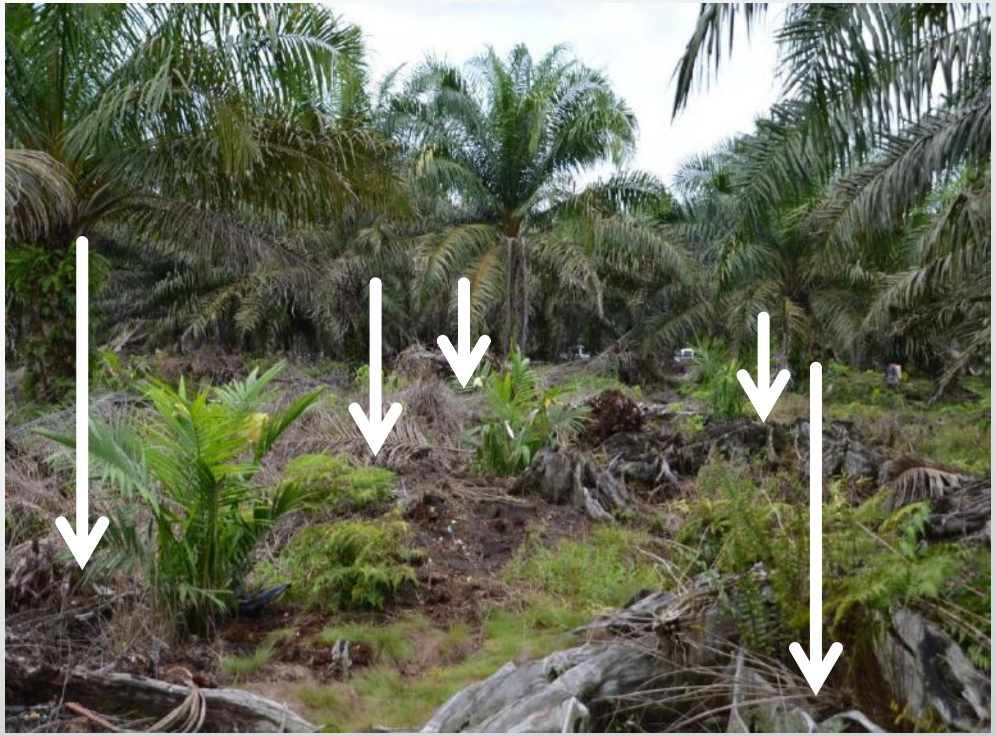
Advanced infestation

Symptom & damages

MPOB

Termite infestation starts from shoot and not from the base of palm

Absence of termite tunnel or damage
on oil palm base while serious infestation
on trunk, frond base and shoots



A row of dead oil palm attacked by *C. curvignathus*

Termite management

1. Early warning system – census
   - Visual observation on fresh mud-work
   - Baiting with rubber wood-stake @ corrugated cupboard in termite detector station
2. Mark infested & six adjacent palms
   - To avoid a new infestation at the nearest palms
3. Treat with chemicals and baiting
   - Scrape the mud-work to improve penetration

MPOB

Application of chemicals to control termite

MPOB

Insecticides	Rates	Frequency	Methods of application
Fipronil	**5ml/ 5 liters water**	**Every 5-6 months**	**Spraying& drenching Baiting**

scraping the mud-work

spraying mature palm with fipronil

Application of baiting Copton (a.i. Hexaflumuron) to control termite

The bait in early application showing no repellence behavior.

Rubber wood and acacia baiting placement on the infested palm not treated with Copton.

Result of rubber wood and acacia baiting placement on the infested palm treated with Copton. No sign of termite activity was observed.

Termite management using water table

Increasing water-table can force termites onto the surface and apply the control

BMP peat water-level 50-70cm

Adjustable weirs made from sand bags
to increase water-table to 15-30 cm

Other control methods




Destroying termite food sources

Metharizium anisopliae killed 100% of pest termite at 8 DAT in laboratory

A way forward..

- A continuous observation and management of the population
  - Ensuring the population is below the threshold levels
- There is a need for field testing of novel/alternate ingredients in controlling the pest populations (Per case basis)
  - Longer interval between applications
  - Reduce impact on non-target organisms
  - Reducing the possibility of pests developing resistance
- Further study to explore the potential of the light trap method to control the population of bunch moths in the field.
- The possibility of technology detection tools such as ground penetrating radar (GPR) in exploring the wood log (termite nesting & food source) as a new approach to reducing termite attacks

Thank You