

**RAT MANAGEMENT IN OIL PALM
AND A NEW
SERIOUS RODENT PEST -
SWAMP GIANT RAT,
Sundamys muelleri (Jentink)
MURIDAE, RODENTIA**



TOPICS

RAT MANAGEMENT IN OIL PALM

- *Rodent pests*
- *Rat species – pests*
- *Damage and crop losses*
- *Management approaches*



SWAMP GIANT RAT, *SUNDAMYS MUELLERI* (JENTINK)

- *Taxonomy*
- *Recognition*
- *Distribution*
- *Ecology and habitats*
- *Economic importance*
- *Oil palm – Klias, Sampadi, Belitung, Bangka, Miri*
- *Management approaches*

Rodent pests

- **Porcupines**
- **Squirrels**
- **Rats**



Common porcupine (*Hystrix brachyura*)



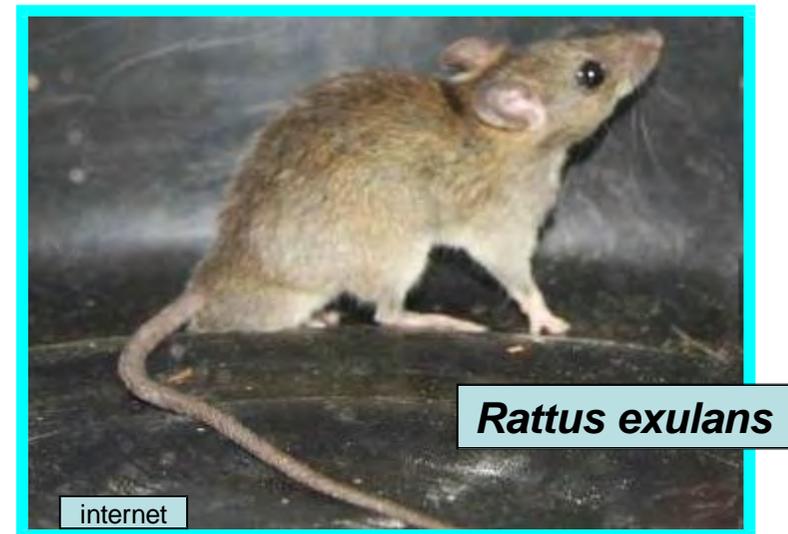
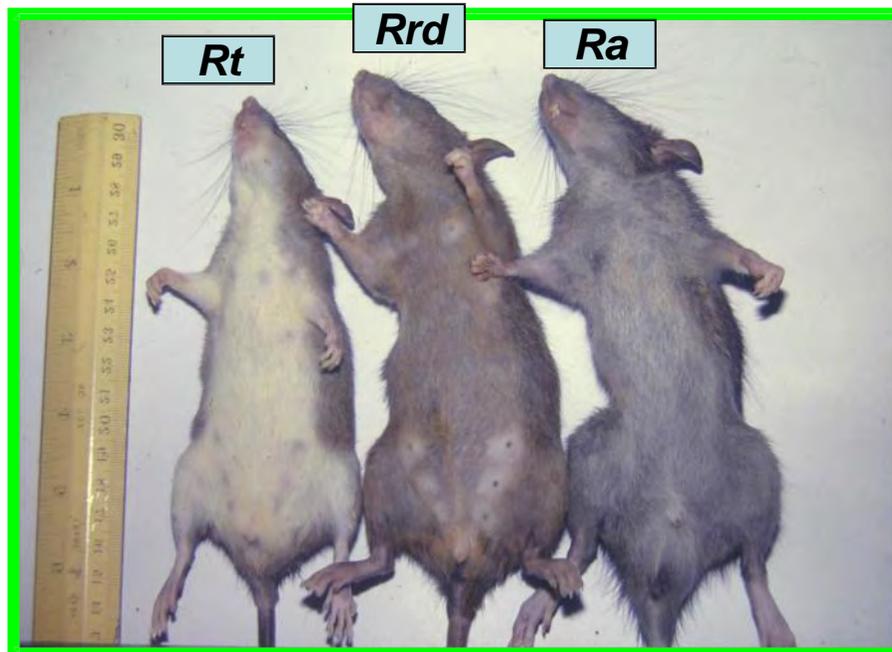
Wood rat (*Rattus tiomanicus*)



Red-bellied squirrel (*Callosciurus notatus*)

Rat species and reports

- *Rattus tiomanicus* – 55 to 150g (2+3) – 1960s
- *Rattus argentiventer* – 85 to 240g (3+3) – immature and young palms
- *Rattus rattus diardii* – 100 to 200g (2+3) – 1980s
- *Rattus exulans* – 25 to 60g (2+2) – rarely encountered
- *Rattus muelleri* – 200 to 470g (2+2) – 1990s, Sabah



OP Rats in Malaysia

PENINSULAR –

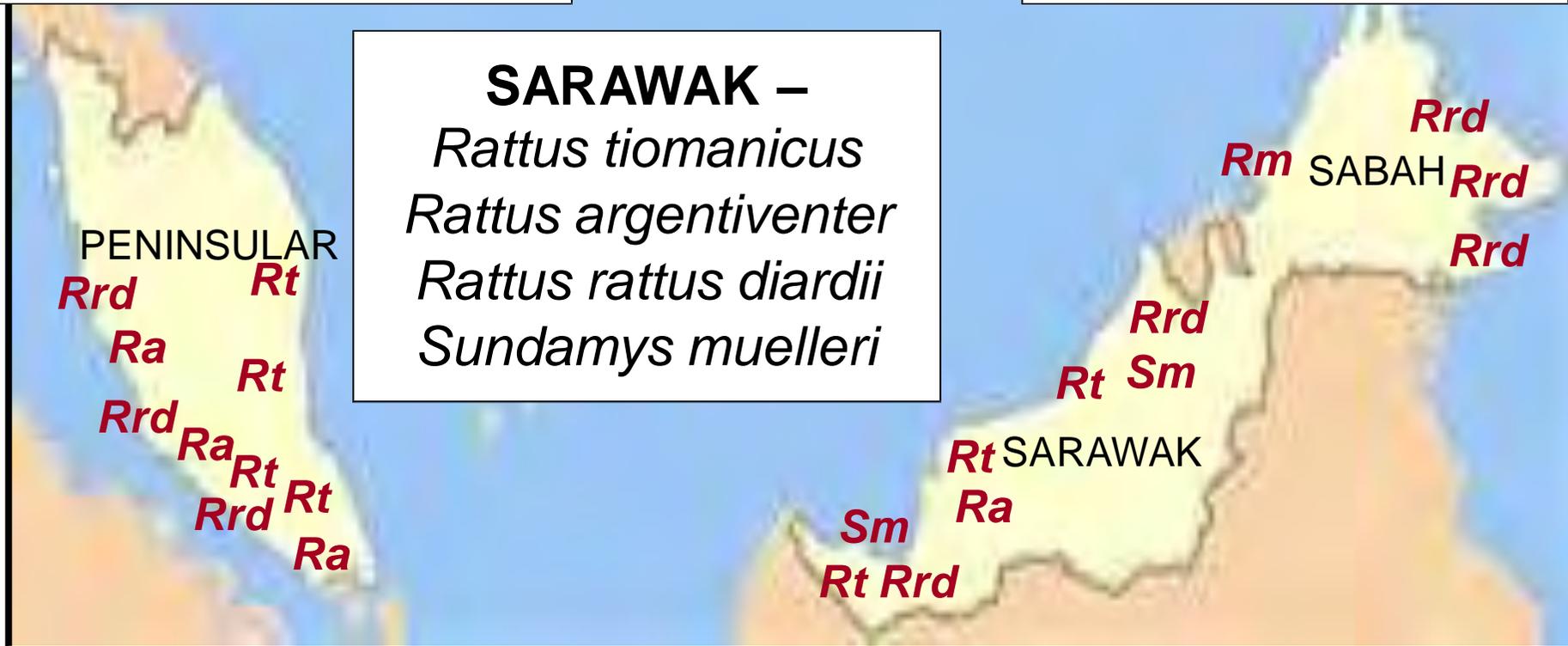
Rattus tiomanicus
Rattus exulans
Rattus argentiventer
Rattus rattus diardii

SABAH –

Rattus muelleri
Rattus exulans
Rattus argentiventer
Rattus rattus diardii

SARAWAK –

Rattus tiomanicus
Rattus argentiventer
Rattus rattus diardii
Sundamys muelleri



Damage and crop losses

- NEWLY PLANTED GERMINATED SEEDS
- SEEDLINGS fronds & bud
- FROND BASES OF IMMATURE PALMS
- FRUITS (MESOCARP + KERNEL)
- PAMI
- LOOSE FRUITS (removal)
- UNOPENED FLOWERS



Amount eaten



Rat species	consumption (g/rat/day)
<i>Rattus tiomanicus</i>	4.29 (ripe fruits)
<i>Rattus argentiventer</i>	3.80 (ripe fruits)
	8.60 (unripe + ripe fruits)
<i>Rattus rattus diardii</i>	9.90 (ripe fruits)
<i>Rattus muelleri</i> <i>(Sundamys muelleri)</i>	10.80 (oil palm fruits)

Loss of oil crop

FEEDING ON FRUITS (mesocarp) (Wood, 1976 b, 1977; Wood and Liao, 1978, 1984)	5%
FEEDING ON FRUITS (mesocarp) + removal of loose fruits (Liao 1990)	7–10%

4 to 6 detached fruits
per day per palm



Values of crop losses by rats in RM

Crop loss (oil production)	10 %
Oil production /ha (year 2009)	3.93 ton *
10% loss in oil production	0.39 ton
Value in oil loss /ha (RM2584** x 0.39ton)	RM 1007.76

* Malaysian Oil Palm Statistics 2010

** Prices in December 2013 (Kok *pers. comm.* 2014)



internet

Management approaches

- *Ecological control*
- *Cultural control*
- *Physical control*
- *Biological control*
- *Chemical control*





Jude de Souza

Biological control – using barn owls

- **INSTALL NEST BOXES AT 1 UNIT PER 10 HA**
- **REQUIRE ABOUT 2 YEARS TO BUILD UP ADEQUATE POPULATION**
- **DAMAGE USUALLY VERY SERIOUS**
- **RESULTS VARIABLE**
- **SOME AREAS – NO BARN OWL COLONIZATION**
- **CAPTIVE BREEDING & RELEASE**





Biological control – using barn owls

To date, mixed results are reported:

- 1. some estates have good colonization and breeding of barn owls which result in effective rat control;**
- 2. the colonization and breeding of barn owls are not satisfactory in other estates due to unknown reasons, which result in ineffective rat control;**
- 3. thirdly, barn owls fail to occupy the nest boxes in estates and rat control has to depend on anticoagulant poison baiting.**

Chemical control

is the use of chemical agents (rodenticides) to reduce rat populations. Ideally, chemicals are selective for the target pest and do not harm other non-target species, viz. predators, livestock, pets, etc .



Zinc phosphide



Warfarin 1% powder



Warfarin 0.05%



Brodi Broma Flocou Brodi Broma



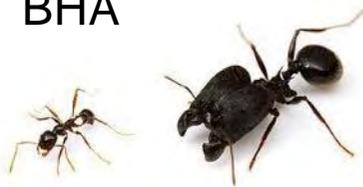
Rat Baiting

- *Rodenticides*
- *Types of rat baits*
- *Baiting practices*



Chlorophacinone
0.29% w/w

BHA



internet



Snail

Standard baiting

- 1 bait per station (palm or every 9 m apart)
- Check and replenish bait points at every 4 days interval until **20%** replacement

20% replacement indicates
1) Rat trapped = 0 or few
2) Fresh Damage = 0 – 1%



Dead rat

Diagram illustrating “Baiting in response to population dynamics” - *no census*

baiting every 6 months interval and stop baiting at 20% replacement

number of baiting rounds



Diagram illustrating "Census & block baiting"

start baiting at Fresh Damage = 5% or more
and stop baiting at 20% replacement

%
Fresh
damage

March

June

5	3	1	2
3	2	2	5
3	7	4	4
1	4	9	8

1	4	3	4
3	5	3	1
4	2	5	6
3	10	3	4

3	5	4	9
4	2	4	3
8	4	2	4
4	1	5	11

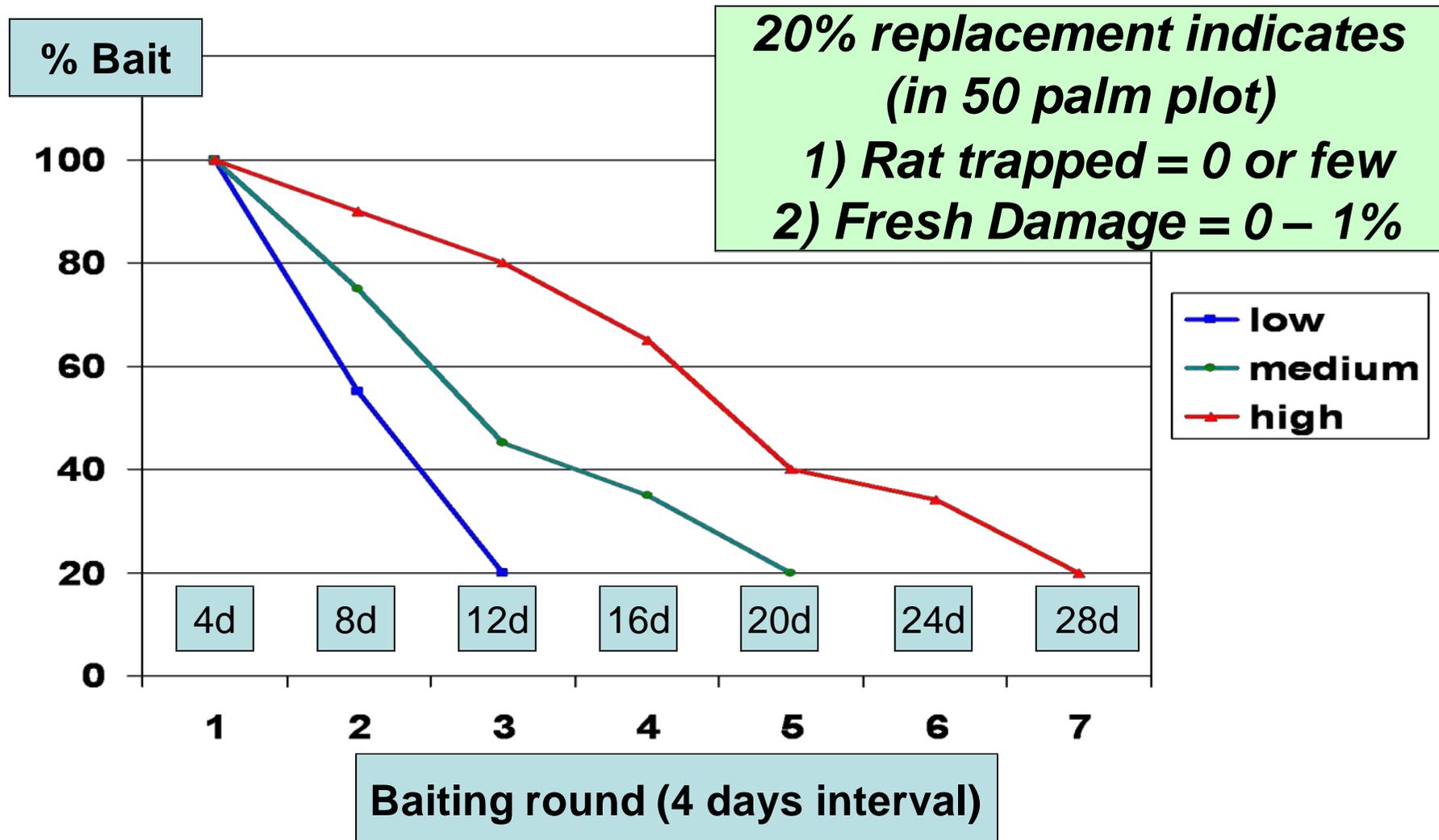
5	2	8	2
7	9	8	5
2	7	6	11
8	2	1	3

September

December

	baiting
	no baiting

Number of baiting rounds depends on the rat population



SWAMP GIANT RAT, *Sundamys muelleri* (Jentink) MURIDAE, RODENTIA



- ***Recognition***
- ***Distribution***
- ***Ecology and habitats***
- ***Economic importance***
- ***Oil palm – Klias, Sampadi, Belitung, Bangka, Miri***
- ***Management approaches***

Common names	Swamp Giant Rat, Muller's Rat, Muller's Sundamys, Muller's Giant Sunda Rat
Malay name	Tikus Ayer
Chinese name	巨沼鼠

Sundamys muelleri Recognition

- **Body size - large to very large**
- **Body weight for males (210–412 g) and for females (206–441 g)**
- **The colour of the BACK is dark tawny brown**
- **In Malaysia, the colour of the BELLY is white, cream, grey or buffy-grey.**
- **Clear line of demarcation between the dorsal and ventral pelage along the flanks.**
- **Tail is longer than the head and body and unicoloured, dark brown above and below. Tail scales are large with 9–12 rows of scales/cm.**
- **Ears are small, round, and dark brown.**
- **Females have eight mammae: one pair pectoral, one postaxillary and two inguinal. (mammary formula : 2+2=8)**



Uraiporn Pimsai *et al.* 2014



Clear demarcation



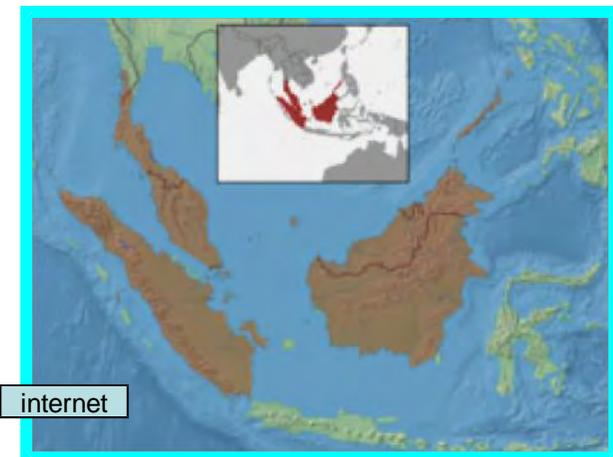
Luhut Gultom 2015

***Sundamys muelleri* Distribution**

This species is known from south western peninsular Myanmar, peninsular Thailand, Malay Peninsula, Sumatra, Borneo, and Palawan, as well as on the smaller islands of Siantan (Anamba Island), many of the Riau Islands, Tuangku and Bangkuru (Banjak Islands), Mansalar (western Sumatra), Pinie, Tanahmasa and Tanahbala (Batu Islands), Banka, Bunguan and Serasan (Natuna Islands), Karimata Island (south western Borneo), Sebuku (south eastern Borneo), Balembangan and Banggi (northern Borneo), and Balabac, Culion, and Busuanga (Palawan Faunal Region) (Musser and Carleton 2005).

It does not occur on Java.

**Brunei Darussalam,
Indonesia, Malaysia, Myanmar,
Philippines and Thailand**



Sundamys muelleri - Ecology and Habitats

- Normally caught near **rivers** (Francis 2008). It is often found near **streams** and prefers **moist habitats** (Lim 1970). It is primarily **terrestrial**, though it is found on branches of trees (Lim 1970). According to Lim (1970), it is rarely found in lowland primary forest but is abundant in **lowland disturbed primary and secondary forests and mangrove forests**.
- In oil palm plantation, **arboreal** activity has been observed (feeding on oil palm fruit bunches and PAMI; running along lower fronds to escape shooting at night).
- **Dig burrows**. It normally spends the day in one or more regularly used dens, under logs, in holes in the ground or under the roots of trees. The diet consists of **insects, fruit, leaves and shoots, other vegetable matter, crabs, and land snails** (Medway 1969; Lim 1966, 1970).
- *S. muelleri* were trapped from **secondary forest, mixed dipterocarp forest, limestone forest and lowland dipterocarp forest** in Peninsular Malaysia and Sarawak in studies conducted from 2008 to 2010 (Madinah *et al.* 2014)



Good summary given in Uraiporn P. *et al.* 2014

Sundamys muelleri

Economic importance

- 1st report in 1992 – at **25%** fresh damage, crop losses = **1.25 tonnes of oil per ha**
- More reports from 2013, 2014, 2015,
- Serious pest in oil palm
- Poison baiting ineffective in 3 locations
- Stop-gap control measure – shooting, in 2 locations

Mean litter size was 3.8, with a range of 1 to 9 (Medway, 1969).



Oil palm areas

- *Klias, Sampadi, Belitung, Bangka, Miri*



Klias, Sabah - 1992

- Work carried out in **Klias Settlement Scheme, Sabah** indicated ***Rattus muelleri*** can consume an average of 10.8 g of oil palm fruits per day under captivity.
- Losses as high as **1.25 tonnes of oil per ha** was estimated for an area with 25 per cent fresh damage.



internet



Payne *et al.* (1985)

Source: Hoong and Hoh. 1992.
Planter 1992 Vol. 68 No. 793 pp. 193-210

Sampadi, Sarawak 2013

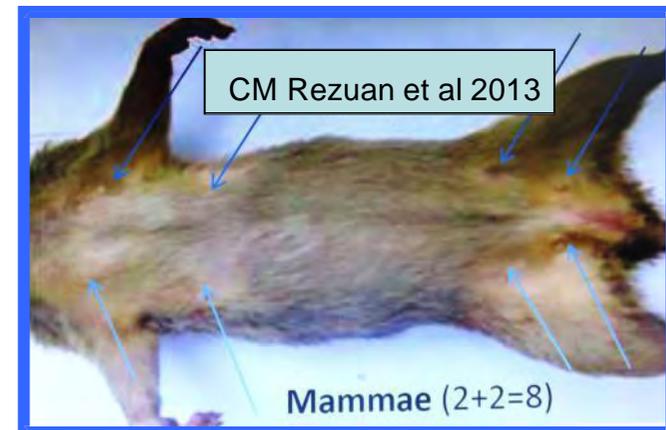


% Rat trapped (Cik Mohd. Rizuan, Z.A., Sukri Taib, I. and Noor Hisham, H. 2013)

- ***Sundamys muelleri*** – 71%
- *Rattus tiomanicus* – 18%
- *Rattus rattus diardii* – 11%



Sundamys muelleri

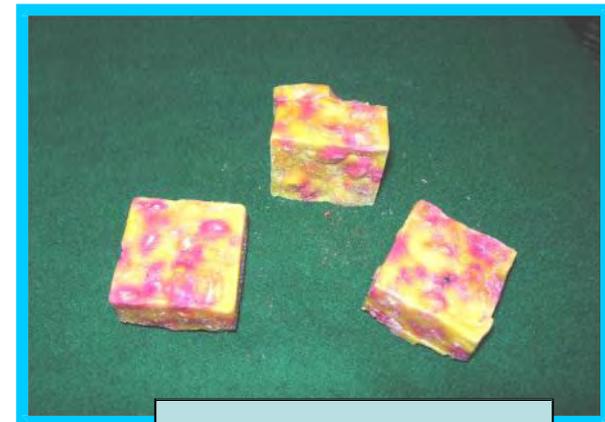


Sampadi - Oil Palm

- **Control by Rat baiting** (Cik Mohd. Rizuan, Z.A., Sukri Taib, I. and Noor Hisham, H. 2013)
- Bromadiolone 0.005% baits:
R1-94.7%, R2-83.7%,
R3-61.0%
- Chlorophacinone 0.005% baits:
R1-98.3%, R2-93.3%,
R3-89.0%
- 60-70% of dead rats seen in palm circles



**Bromadiolone
0.005%**



**Chlorophacinone
0.005%**

Belitung, Indonesia - 2014



- *Rattus argentiventer*
- *Rattus rattus diardii* (*Rattus tanezumi* ?)
- *Rattus norvegicus*

RAT BAITS USED ONLY KILLED SOME OF THE RATS



  **K (Brodifacum)**
 **R (Comathretalil)**
 **RG (Brodifacum)**
 **KR (Brodifacum)**
 **X (Brodifacum)**
 **S (Flocumafen)** 



SHOOTING RATS

Jun 2014 – Mar 2015	Male	Female	Total
	251,052	392,672	643,724
%	39	61	100

Bangka, Indonesia

- 2015



- Total areas = 7000 hectares.
- Planting = 2006 (9 years old) - 2014 (1 year old)
- oil palm areas fringing forest fragments, secondary forests, riparian belts near stream - several species of large rats (*Sundamys* spp), medium sized rats (*Rattus* spp.) and small sized rats (*Maxomys* spp.)
- ***S. muelleri*** is the main rat species in mature oil palm areas causing severe damage to fruit bunches and PAMI.
- In 3 blocks, the % palm with fresh damage was high (28%; 56%; 43%).

Sundamys muelleri

- have dark brown dorsum (upper part or back of body) with long black guard hairs
- white belly
- and mammae formula 2 + 2
- Difficult to trap (<5% success)



Brown back



White belly



long black guard hairs

DAMAGE



RAT CONTROL

- **POISONING WITH WAX BAIT**

- Ineffective
- Not attractive to *muelleri*
- Poor acceptance from 2011 onwards

- R (Comathretalil)
- RG (Brodifacum)
- X (Brodifacum)

2013 – 1 nest box per 30 ha,
2014 – 1 nest box per 15 ha,
Todate (2015 Mar) occupancy rate = 25%

S.

- **BIOCONTROL** – using barn owl, *Tyto alba*
- Captive breeding and release on going
- Nest boxes put up in field
- Occupation rates are low



SHOOTING

- Bait shyness
–commercial rat baits
- Trap shy - < 5% success
- Damage to FFB, PAMI, inflorescence – severe
- Pay IR 3600 = 1 Ringgit



**Estate records: 2012-374000 rats; 2013-6000 rats;
2014-350000 rats; and in Jan 2015-45000 rats.**

LARGE NUMBER OF RATS RECOVERED FROM 50 PALMS PLOT BY HUNTING IN MARCH 2015



HUNTING



68 RATS FROM 50 PALM
= **185 RATS / HA** at 136 palms/ha

Estimate Rat No. in 7000 ha
= **1.295 millions**

Miri, Sarawak - 2015

- Total areas = 2400 hectares, peat soil.
- Planting = 2001 (14 year old)
- Hunting = mostly *S. muelleri*
- Trapping = all *S. muelleri*
- *S. muelleri* is the main rat species in mature oil palm areas causing severe damage to fruit bunches and PAMI.



Sundamys muelleri

- back of body- brown with long black guard hairs
- white belly
- mammae formula 2 + 2
- trapping success was 35%
- estate trapping - about 50% success



Back: brown



White belly



Long guard hairs

Miri - *Sundamys muelleri* identification and measurements

Head+Body mm	190
Tail mm	222
Hind foot mm	42
Skull mm	-
Weight g	300
Back colour	Dark brown
Belly colour	Creamy white
Tail colour	Entire black
No of mammae	2+2

Chai 2016



DAMAGE



RAT CONTROL POISONING WITH WAX BAITS

- **Ineffective**
- ***S. muelleri* not attracted to feed on wax baits**
- **Poor acceptance – Day 1, 10% and less (oil palm fruits 88%)**
- **In 3 blocks, the % palm with fresh damage was high (30%; 28%; 26%).**

FOLLOW UP ACTIONS

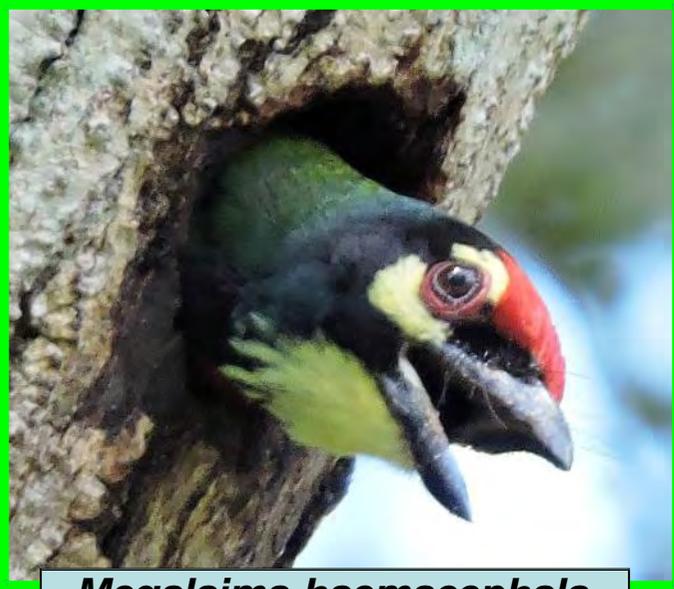
- Testing rat baits in original formulation
- Testing new formulation of rat baits
- Search for attractive material (AM)
- Test on acceptance of AM + R by caged rats
- Look into biocontrol using barn owls
- Look for physical control measures as stop gap measure (**shooting**, live trapping, snap-trapping, etc.)



CONCLUSION



- **RATS IMPORTANT PESTS OF OIL PALM**
- **BIOCONTROL USING BARN OWL – cheapest if effective**
- **RAT BAITING – effective and widely practiced**
- **PLANTATIONS encountered rat control problem: 1) id rat species, 2) find out which type of rat bait is attractive n accepted**
- ***SUNDAMYS MUELLERI* – if rat baits are ineffective; test new baits; stop gap measure – shooting, trapping (TT)**



Megalaima haemacephala



Rattus rattus diardii

TERIMA KASIH
THANK YOU
NANDRI
謝謝