PART 2

Rats

Rat incidence in oil palm

Recognition of rat species

Damage symptoms caused by rats

Signs of rat activity

Rat population estimation by catch marked release (CMR) techniques

Effect of rat damage on crop losses

Natural control of rats

Management approaches to control oil palm rats

RAT INCIDENCE IN OIL PALM

Rats are important pest of many types of cultivated crops such as rice and plantation crops. A few species of rats have become the key pest causing serious damage and economic losses in oil palm plantings in Indonesia and Malaysia. Malaysia has more than 5 million hectares of oil palm. Rat species attacking oil palms in Malaysia have been reported and reviewed by several researchers. These rat species include *Rattus tiomanicus* (Wood Rat), *Rattus argentiventer* (Rice Field Rat), *Rattus rattus diardii* (House Rat), *Rattus exulans* (Polynesian Rat or Little House Rat) and *Sundamys muelleri* (Swamp Giant Rat; old name *Rattus muelleri*).

Peninsular Malaysia (2.5 million ha)

Rattus tiomanicus was the only rat species of fully mature oil palms in the early days (1960s) of oil palm cultivation in Peninsular Malaysia. *Rattus argentiventer*, was found in immature palms and young mature palms in some localities. Thereafter, *Rattus argentiventer* and *Rattus rattus diardii* become the dominant rats surpassing *Rattus tiomanicus* in many plantations. In the 1980s, *Rattus rattus diardii* was recorded in an oil palm estate near Kapar, Selangor. Although all three species were present but their composition and distribution varied with location and time. Results from trapping experiments in 3 states from 1983 to 1993 showed that the rat species found in Selangor were *Rattus rattus diardii* and *Rattus tiomanicus*; in Melaka *Rattus rattus diardii*, *Rattus tiomanicus* and *Rattus argentiventer*; and in Johore *Rattus tiomanicus* and *Rattus argentiventer* (with low incidence of *Rattus rattus diardii, Rattus rajah* (Rajah Spiny Rat), *Rattus surifer* (Spiny Rat)). However, other trapping studies from 1994 to 1997 recorded (i) 3 estates in Lower Perak caught almost equal number of *Rattus rattus diardii* and *Rattus tiomanicus*, (ii) only *Rattus rattus diardii* was trapped (large number) in 1 estate in North Selangor, (iii) only *Rattus tiomanicus* was trapped (large number) in 1 estate in Negri Sembilan, (iv) more *Rattus rattus diardii* than *Rattus tiomanicus* were trapped in 4 estates in Melaka, (v) only *Rattus tiomanicus* was trapped in 2 estates each in Trengganu and Pahang, and (vi) *Rattus tiomanicus* was the main species found in 5 estates in Johore (with few *Rattus rattus diardii* in 1 estate). In another survey, the main rat species was *Rattus tiomanicus*, followed by *Rattus argentiventer* and *Rattus rattus diardii*. In 2010s, through examining the bones in the barn owl pellets, *Rattus rattus diardii* (67.4%) was found to be the main rat species in Labu, Negeri Sembilan, and followed by *Rattus*

argentiventer (24.4%) and the rest *Rattus tiomanicus* (3%). In a study carried out in 2013, the composition of rat species in oil palm areas in Carey islands (Selangor) was 45.7% *Rattus tiomanicus*, 25.9% *Rattus rattus diardii*, and 16% *Rattus argentiventer*. Thus it is fair to assume that rat species and composition may vary from estate to estate and variation may occur at different time period too.

Sabah (1.4 million ha)

In the 1990s, the common species of rats in oil palm plantations of Sabah were *Rattus muelleri, Rattus exulans, Rattus rattus diardii* and *Rattus argentiventer*. In early 2000s, the rat species causing serious damage to oil palm in Sandakan areas was *Rattus rattus diardii* (from observation/identification of trapped rats). *Rattus rattus diardii* was also reported as pest of oil palm in Lahad Datu and Tawau areas in 2010s.

Rat species damaging oil palm in Malaysia		
Location	Species (common name)	Source
Peninsular	*Rattus tiomanicus* (Wood Rat)	1, 13
	Rattus tiomanicus (Wood Rat) *Rattus rattus diardii* (House Rat)	10, 12
	Rattus tiomanicus, (Wood Rat) *Rattus rattus diardii* (House Rat) *Rattus argentiventer* (Rice Field Rat)	3, 5, 11, 14, 15
	Rattus tiomanicus (Wood Rat) *Rattus exulans* (Polynesian Rat or Little House Rat) *Rattus argentiventer* (Rice Field Rat) *Rattus rattus diardii* (House Rat)	2, 4, 9
Sarawak (Mukah)	*Rattus tiomanicus* (Wood Rat)	6
Sarawak (Pusa)	*Rattus tiomanicus* (Wood Rat) *Rattus argentiventer* (Rice Field Rat)	16
Sarawak (Kuching)	*Rattus tiomanicus* (Wood Rat) *Rattus rattus diardii* (House Rat)	20
Sarawak (Sampadi)	*Sundamys muelleri* (Swamp Giant Rat)	19

RECOGNITION OF RAT SPECIES - OIL PALM PESTS

Identification of a rodent species is basic to any attempt to investigate pest incidence and its population dynamics. Rodent species can be distinguished based on the external appearance and body measurements. In practice, distinguishing some rodent species is a difficult task.

Six species of rats have been identified as pests of oil palms in Malaysia and Indonesia:

1) *Rattus tiomanicus*
2) *Rattus argentiventer*
3) *Rattus exulans*
4) *Rattus rattus diardii*
5) *Rattus tanezumi*
6) *Sundamys muelleri* (old name *Rattus muelleri*)

Among them, *Rattus tiomanicus, Rattus argentiventer* and *Rattus rattus diardii* are more common as they are more frequently reported in oil palm plantations. *Sundamys muelleri* has been reported as a serious pest in East Malaysia (Sabah and Sarawak), and in the large islands of Indonesia (Belitung and Bangka Islands).

Useful references for identification of rat species are listed below:

APLIN, K.P., BROWN, P.R., JACOB, J., KREBS, C.J. and SINGLETON, G.R. 2003. *Field methods for rodent studies in Asia and the Indo-Pacific.* Aciar Monograph Series. 223 pp.

FRANCIS, C. M. 2008. *A Field Guide to the Mammals of South-East Asia.* New Holland Publication. 392 pp.

HARRISON, J. 1973. *An Introduction to the Mammals of Sabah.* Reprinted 1973. The Sabah Society. Kota Kinabalu. 244 pp.

HARRISON, J. 1974. *An Introduction to the Mammals of Singapore and Malaya.* Malayan Nature Society, Singapore Branch. 340 pp.

LEKAGUL, B. and McNEELY, J. A. 1988. *Mammals of Thailand.* Second edition. 758 pp.

MEDWAY, L. 1978. *The Wild Mammals of Malaya and Singapore.* Second edition. Oxford University Press. 128 pp.

PAYNE, J., FRANCIS C. M. and PHILLIPPS, K. 1985. *A Field Guide to the Mammals of Borneo.* 332 pp.

Rattus tiomanicus (Miller)

Family	Muridae
Synonym	*Rattus rattus tiomanicus / Rattus jalorensis*
Common name	Wood Rat, Malaysian Wood Rat, Malayan Field Rat
Malay name	Tikus Belukar
Chinese name	林鼠

Rattus tiomanicus is a medium size rat among the 6 species of oil palm pests. The back of the body is greyish brown and the belly is clean white. Fur is smooth with short stiff spines and back guard hairs are short to moderate length and evenly distributed. Tail is entirely dark brown. It is a good climber and spends much time on trees. It only digs shallow burrows under frond piles. It is found in secondary forest, coastal forest, undergrowth, woodland and grassland. Diet includes a wide range of plant and animal matters. It is an important pest of oil palm and was the first reported key rodent pest of oil palm plantations in Malaysia. *Rattus tiomanicus* is well adapted to live in oil palm due to its agility and arboreal habits (and diets). *Rattus tiomanicus* can be identified based on features and measurements shown in the table below:

Rattus tiomanicus - mature male showing enlarged testes

Rattus tiomanicus - lateral view showing the grey brown upper part of the body and the clear white belly

Ventral view showing belly colour of 3 rat species - clear white of *Rattus tiomanicus* (left), brown of *Rattus rattus diardii* (middle), silver grey of *Rattus argentiventer* (right)

Features and measurements for identification of *Rattus tiomanicus* (Miller)			
Body measurements and features	*Reference*		
	Harrison 1974	*Payne et al. 1985*	*Francis 2008*
Head + Body length (mm)	100 - 180	140 - 188	140 -190
Tail length (mm / % of Head + Body)	80 - 110%	120 - 181 mm / 75 - 120%	150 - 200 mm / 95 - 120%
Hind foot length (mm)	26 - 34	28 - 35	28 - 35
Skull length (mm)	41	34.3 - 36.9	34 - 45
Weight (g)	110	78 - 125	55 - 150
Belly colour	Clean white	White	Pure white or slightly off-white
No of mammae - pectoral	2 pairs	Total of 10 mammae	2 pairs
No of mammae - inguinal	3 pairs		3 pairs

Measurements:

a) Head + Body length (HB) - from anus to the front of the nose (mm)

b) Tail (T) - from anus to tip of the tail excluding long fur or hairs which project beyond the end (mm)

c) Ear length (E) - from the external opening to the tip (mm)

d) Hind foot (HF) - from the heel to the tip of the longest toe, excluding the claws (mm)

e) Skull length - from the back of the skull to the front (mm)

f) Bodyweight - in grams