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Status of Rat Infestation and Recent Control Strategies in Oil Palm Plantations in Peninsular Malaysia

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ABSTRAK

Satu soal selidik telah dijalankan untuk menentukan status serangan tikus dan kaedah kawalan tikus semasa di ladang-ladang kelapa sawit di Semenanjung Malaysia. Rattus tiomanicus (Miller), *merupakan spesies tikus yang utama (68%) diikuti oleh* Rattus argentiventer (Robinson and Kloss), *(46%) dan* Rattus rattus diardii (L.), *(28%). Walaupun 75% dari ladang tidak menganggap tikus sebagai masalah yang serius, kerugian yang diperolehi adalah dalam anggaran 0.01 hingga 0.1 t/ha. Burung pungguk jelapang* Tyto alba (Scopoli) *kini merupakan komponen kawalan tikus yang penting dalam ladang kelapa sawit iaitu sebanyak 82% daripada ladang yang mengambil bahagian. Ada ladang (21.4%) bergantung sepenuhnya kepada* T. *alba, tanpa menggunakan racun tikus. Sebahagian besar ladang (60.7%) menggabungkan mengumpan dan kawalan menggunakan* T. alba *yang dapat menjimatkan kos mengumpan di antara RM2.64 sehingga RM30/ ha/tahun.*

ABSTRACT

A survey was carried out to establish the status of rat infestation and recent rat control practices in oil palm plantations in Peninsular Malaysia. Rattus tiomanicus (Miller) *constitutes a major rat species (68%), followed by* Rattus argentiventer (Robinson and Kloss), *(46%) and* Rattus rattus diardii (L.), *(28%). Although 75% of estates did not consider rats as a serious problem, the damage estimated ranges from 0.01 to 0.1 t/ha. The barn owl* Tyto alba (Scopoli) *is now an important rat control component in oil palm i.e. 82% of estates that participated in the survey. In some estates (21.4%) control is achieved entirely with* T. alba, *without baiting. In most estates (60.7%) baiting was done in combination with* T. alba, *whereby the latter reduced baiting cost from RM2.64 to RM30/ha/year.*

INTRODUCTION

Rat species that can be found in oil palm plantation in Peninsular Malaysia are *Rattus tiomanicus* (Miller), *Rattus argentiventer* (Robinson and Kloss), and *Rattus rattus diardii* (L.) (Wood 1976). *R. tiomanicus* is the dominant species especially in matured palms (Wood 1968), whereas the rice field rat *R. argentiventer* is normally found in nurseries and young oil palms (Wood 1982). It is also a common species in oil palm formerly planted with rubber (Wood 1976). *R. rattus diardii* is normally associated with human dwellings, but has also become common in oil palm (Mohd 1985) especially in areas where *R. tiomanicus* has been controlled by baiting (Soh *et al.* 1982).

Apart from attacking matured palms, rat also causes damage to young plantings. At the nursery stage, rat feeds on the apical tissue causing death or affecting normal development of the young shoots. On young oil palms, the most favourite part is the petiole that forms the fronds. Damage to this suppresses the formation of fronds. In matured palm, attack is concentrated on the inflorescence and the fruit bunch. Damage to inflorescence affects flowering while damage to fruits can reduce yield (Wood 1982).

Baiting, with anticoagulant rodenticides is the mainstay of rat control practices in oil palm estates in Malaysia. However, beginning mid-eighties, the barn owl *Tyto alba* (Scopoli) has been identified as an effective predator of rats and had since been relied upon to control rats with encouraging results. Following successful trials in estates in Selangor and Negeri Sembilan (Smal 1988), the biological control programme using barn owl has been implemented in many estates throughout the country, by providing nest boxes to wild populations of barn owl. As a result there has been a boost in the barn owl population in oil palm. The purpose of this study is to determine the current status of rat control by the barn owl in oil palm estates vis-‡-vis baiting in Peninsular Malaysia.

METHOD

A survey was carried out on 68 oil palm estates, all greater than 1000 ha, selected at random from nine states in Peninsular Malaysia; the breakdown were as follows; Kedah (6), Kelantan (6), Malacca (6), Negeri Sembilan (9), Pahang (9), Perak (8), Selangor (8), Terengganu (8), and Johore (8). The survey questions were designed to meet three major objectives. Firstly, to establish the common rat species recently found in both mature and young oil palms in Peninsular Malaysia. Secondly, to gauge the severity of rat damage, subjectively assessed in terms of yield loss, and finally, the method of control currently employed with particular reference to baiting and natural predation by barn owl.

RESULTS AND DISCUSSION

A total of 28 estates (41%) returned the survey forms. Twenty of these or 71% came from five states namely Negeri Sembilan, Pahang, Selangor, Malacca and Kedah.

Rat Species Composition in Oil Palm

Seven estates (25%) reported the presence of *Rattus tiomanicus* only, three estates (11%) reported *R. argentiventer* only and two estates reported *R. rattus diardii* only while seven estates (25%) reported the presence of both *R. tiomanicus* and *R. argentiventer,* three estates (11%) reported *R. tiomanicus* and *R. rattus diardii* and only one estate reported *R. argentiventer* and *R. rattus diardii.* Only one estate reported the presence of all three species. Three remaining estates were not sure of the identity of the rat species. The species composition is summarized in Fig. 1. Based on individual species, *R. tiomanicus* was reported in 68% of the estates, followed by *R. argentiventer* 46% and *R. rattus diardii* 28%.

The survey results show that *R. tiomanicus* is still the dominant species in oil palm, as initially reported by Wood (1971), then Wood and Liau (1978) and the latest by Basri and Halim (1985). *R. tiomanicus* is well adapted to live in oil palm due to its agility and arboreal habits as compared to *R. argentiventer* and *R. rattus diardii,* which live on the ground. *R. argentiventer* is more common in young palms (Wood 1982). Survey results indicate that 13 out of 33 (39%) rat damage reported by the estates occurred in young plantings. Seven out of the 13 (54%) damage on young plantings was attributed to *R. argentiventer.* The survey also confirms the status of *R. rattus diardii* reported by Basri and Halim (1985) as becoming more common in oil palm. There are several factors to explain the higher occurrence of *R. rattus diardii* in oil palm. Firstly, successful control on *R. tiomanicus* has opened the way for infestation by *R. rattus diardii* (Soh *et al.* 1982). Secondly, bait formulation and baiting techniques has been designed primarily for *R. tiomanicus,* leading to *R. rattus diardii* developing resistance due to insufficient (sub-lethal dose) bait consumption (Lam *et al.* 1982). Finally, the propagation of the pollinating weevil *Elaeidobius kamerunicus* in oil palm has become an attractive source of food (protein) to *R. rattus diardii.* Rat is more difficult to control after the introduction of the pollinating weevil (Mohd 1985). The inclusion of the pollinating weevil in the rat diet has lead to juveniles growing faster and heavier adults (Liau 1985).

The particularly high percentage of estates using barn owl points to a greater reliance on biological means to control rats in oil palm. Besides proven efficient and generally tolerant to baits, the high cost of rodenticides and the operational cost of baiting have lead many estates to start their own barn owl programme. The result of the survey indicates a departure from the control strategies normally employed in oil palm in the 80's whereby control is primarily achieved through baiting alone (Wood 1982; Basri and Halim 1985).

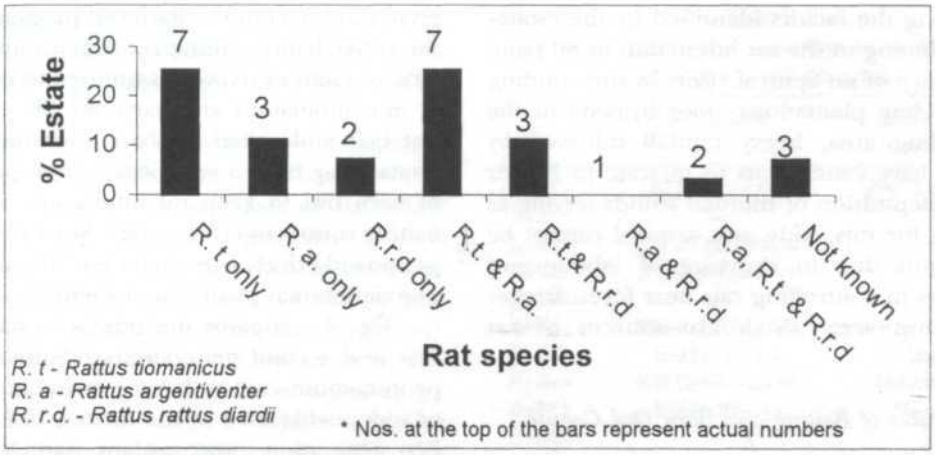

Fig. 1. Composition of rat species present in the estates surveyed

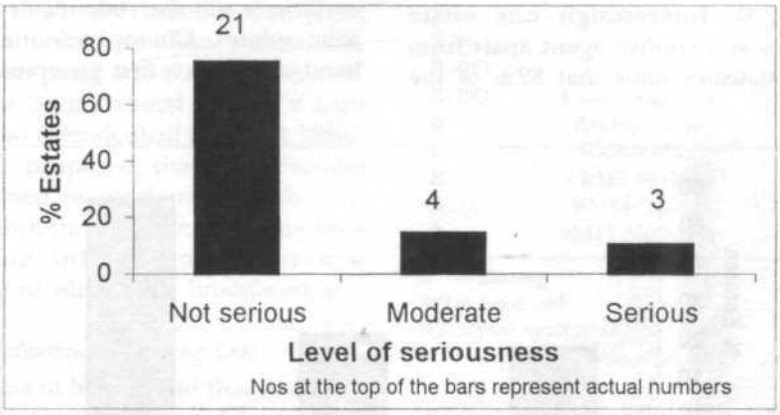

Fig. 2. Percentage of estates based on level of seriousness of rat damage

Rate of Losses due to Rat Damage

Estates were asked to subjectively assess the level of rat damage as not serious, moderate or serious. Fig. 2 shows the percentage breakdown of estates based on these categories. Results of the survey show that 75% of estates assigned their rat damage as not serious. Only 14.3% assigned rat damage as moderate and 10.1% as serious. Table 1 shows the estimated damage and loss incurred by some of the estates. The estimated damage in yield varies from 0.01 t/ha to 3 t/ha/yr. This translates into losses ranging from RM 4/ha to RM1200/ha/yr. These figures were either estimated on a per hectare or per hectare on a yearly basis. Therefore it may not be comparable. However it can be deduced that damage to oil palm lies in the range of 0.01 t/ha to 0.1 t/ha. When infestation is serious, the annual loss can exceed RM 1000 /ha. In terms of crude palm oil, Wood *et al.* (1973) estimated a loss of between 134 to 240 Kg/ha i.e. approximately 5% of total oil production.

TABLE 1
Estimated damage and loss due to rat damage on oil palm

Estates	Estimated damage	Estimated loss
1	0.4 t/ha	RM 180 /ha
2	0.7 t/ha	RM 200-300 /ha
3	0.32 – 0.93t/ha	RM 496 /ha
4	3t/ha/yr	RM 1000 /ha/yr
5	0.01t/ha	RM 4 /ha
6	1 – 2 t/ha	RM 400 /ha
7	5 – 10Kg/ha	RM 5 – 10 /ha
8	0.25t/ha	RM 115 /ha
9	3t/ha/yr	RM 1200 /ha/yr
10	2.2t/ha/yr	RM 594 /ha
11	0.02 t/ha	RM 8/ha
12	0.1 t/ha	RM 43 /ha

Among the factors identified by the estates as contributing to the rat infestation in oil palm are; absence of rat control effort by surrounding small holding plantations, poor hygiene in the surrounding area, heavy rainfall followed by flooding have caused rats to migrate to higher ground, deposition of thinned fronds serving as nest sites for rats, wide area control cannot be carried out due to shortage of labour and difficulties in controlling rats near forest fringes and swamp area which are sources of rat infestation.

Present Status of Baiting and Barn Owl Control Program

Of the estates surveyed 17.9% relied on baiting only, 21.4% relied on barn owls only and 60.7% on both (Fig. 3). Interestingly one estate employed snakes as a control agent apart from baiting. These statistics show that 82% of the estates implement the barn owl programme. On the other hand, baiting remained important as 79% of estates surveyed continued to bait, singly or in combination with barn owl. Six estates did not bait and relied on barn owls only. These estates may have a sufficiently large population of barn owl to keep rat infestation down that baiting is no longer necessary. Smal *et al.* (1990) proposed that the increase in barn owl population may justify the suspension of baiting.

Fig. 4 compares the number estates using first and second generation rodenticide singly or in combination with barn owls. On the types of rodenticide used by the estates, 76% used the first generation anticoagulant, namely warfarin (68%) and chlorophacinone (8%). This suggests that as in the 80's (Basri and Halim 1985), warfarin is still the rodenticide of choice in oil palm estates. Chorophacinone, on the other hand, although a first generation anticoagulant

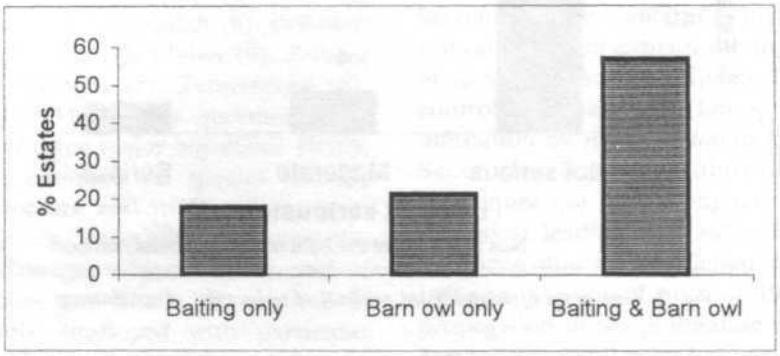

Fig. 3. Percentage of estates surveyed using baits and barn owl in controlling rats in oil palm

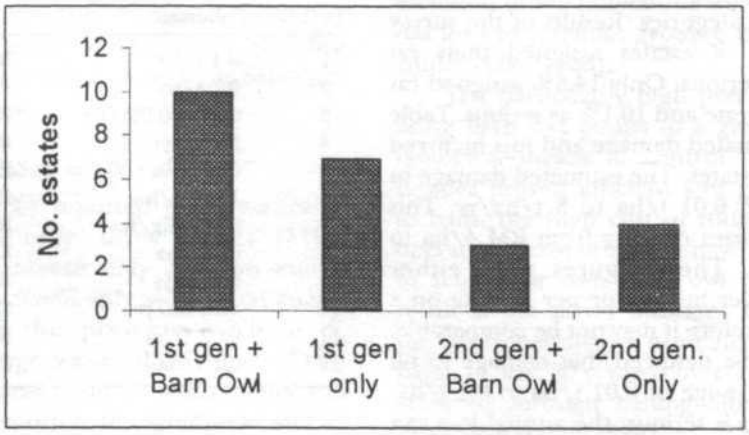

Fig. 4. Number of estates using first and second generation rodenticide singly and in combination with barn owls

having similar effects like warfarin (Wood and Liau 1978), is not widely used, as revealed by the survey. This is probably due to the latter being cheaper.

Warfarin is also a relatively safe rodenticide when used in combination with barn owl, as there have been no known cases of secondary poisoning to the latter (Duckett 1984). This is also reflected from the survey whereby 10 estates out of 16 (62.5%) that combines baiting and barn owl used warfarin in their baits. However with reports of rats developing resistance to first generation anticoagulant, as also revealed by the survey, some estates started to switch to second generation rodenticide. The results from the survey show that 24% of the estates indeed used second generation anticoagulant, namely bromadiolone (16%) and brodifacoum (8%). However, unlike first generation rodenticide, second generation poses a hazard to barn owls. Brodifacoum has been claimed to have a high toxicity to barn owl (Mendenhall and Pank 1980). Duckett (1984) proposed that brodifacoum should not be used in combination with barn owl. In spite of this, three estates combine barn owl and baiting with second generation rodenticide; one of which with brodifacoum.

Barn Owl and Reduction in Baiting Cost

The estimated cost of baiting and that to sustain the barn owl program, as indicated by some of the estates, are shown in Table 2. Not all estates have provided the information needed and no standard response was given. However, based on the survey returns it can be deduced that baiting cost can be substantially reduced by implementing the barn owl programmes. The cost of baiting varies from RM10/ha/yr to RM64/ha/yr with average cost of RM24.11/ha/yr. The average baiting cost was recorded by Basri and Halim (1985) as between RM10 – RM30/ha/yr. Duckett and Karuppiah (1989) indicated that in severe cases the cost may reach RM60/ha/yr. From the survey, the reduction in baiting cost from using barn owl ranges from RM2.64/ha/yr to RM20 – RM30/ha/yr. This also generally falls within the range quoted by Duckett and Karuppiah (1989) i.e. RM4.80 to RM20/ha/yr. Other estates gave less objective response which include 50% reduction in baiting requirements, reduction in baiting campaigns from twice to once a year, baiting campaigns continue at twice a year but with a reduced intensity up to 50%/ha or baiting rounds for each campaign reduced to 2 – 5 rounds from 7 – 10 rounds. There is one claim however, that barn owl did not lead to any reduction in cost.

TABLE 2
Cost of baiting and reduction in baiting cost from barn owl program

	Baiting Cost	Reduction in Baiting Cost
B+BO	RM 13/ha/yr	RM 3.20/ha/yr
B+BO	–	Yes
B+BO	RM 17.82/ha/yr	Yes
B+BO	RM40.82/ha/yr	Yes
B+BO	–	Yes
B+BO	RM40.60/ha/yr	RM20/ha/yr
B+BO	RM11.80/ha	< 10 ñ 20%
B+BO	RM12.60/ha/yr	RM2.64/ha/yr
B+BO	RM18.92/ha	Not much
B+BO	–	50%
B+BO	–	Yes
B+BO	–	RM20-30/ha/yr
B+BO	–	No of baiting rounds reduced
B+BO	–	Not sure
B+BO	–	RM26/ha/yr
B+BO	4 campaigns/yr	No reduction in cost
B	RM10/ha/yr	NA
B	RM8.40/ha	NA
B	RM5.80/ha	NA
B	RM64/ha/yr	NA
B	RM11.50/ha/yr	NA

B – Baiting
BO – Barn owl
NA – Not applicable

CONCLUSION

The results of the survey show that R. tiomanicus remained the dominant species in oil palm followed by *R. argentiventer.* The survey also indicates that *R. rattus diardii* is becoming important in oil palm probably as a result of baiting strategy and methods of oil palm propagation. Damage caused by rats is generally considered not serious but can be substantial and control can be difficult, often hindered by circumstances beyond the jurisdiction of the estates concerned.

The survey also shows that barn owl has become an important component in the rat control practices in oil palm estates in Peninsular Malaysia. First generation rodenticide namely warfarin remained widely used and by virtue of its low toxicity to barn owl would ensure the

survival of the latter. Earlier claims that barn owl programme can considerably reduce baiting cost has been substantiated by this study.

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