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**RAT AND SQUIRREL MANAGEMENT USING WIRE MESH TRAP IN COCOA AREA AT CRDC TAWAU AND MADAI SABAH MALAYSIA**

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**Abstract**

More than 60 species of vertebrate reported as pest of cocoa worldwide. Some of them become a serious pest and give an impact on cocoa yield. Among them, mammalian pest in a rodent group such as rats and squirrels, are responsible for severe attack. The losses on cocoa yield are varied and differ from one country to another. It was estimated about up to 90 % due to the mammalian pest if left under control. This study was carried out at two Cocoa Research and Development Centre (CRDC) Tawau and Madai. This study was carried out using caught marked and release (CMR) technique by conventional method using wire mesh trap. From this study it was found that in the cocoa area size about only 1 ha, there were estimated about 40 rats and 33 squirrels when the first caught is only 9 rats and 22 squirrel respectively. Only less than 10 % of the total traps set up manage to caught the animals. In cocoa germplasm area at CRDC Tawau, trap set up using jackfruit bait is preferred by the rats and squirrel. Meanwhile, at CRDC Madai trap set up using palm oil as bait is preferred by the rat and squirrel. Generally, most of the rat caught in the trap set up on the ground and the squirrel trapped in the trap set up on the cocoa branch.

**Introduction**

There were estimated that more than 60 species of vertebrates become pest of cocoa globally (Thorold, 1975). Some of the mammalian pest give inflict massive losses and can be a serious problem on cocoa yield worldwide (John and Debbie, 1993; Lee, 1982). The losses are differed greatly within countries and estimated from a few per cent (0.7 – 7.0 %) in Ghana (Wharton, 1962; Glendinnings, 1962), 3 – 5 % in Sabah, Malaysia (Conway, 1971), 20 – 50 % in Sierra Leone (Urquhart, 1955), 30 % in Trinidad, (Montserin, 1937), 70 – 75 % in India (Anon, 1987; Ranjan, 1987), 72 – 82 % in areas without any control measures (Mainstone, 1978) and up to 90 % in Peninsular Malaysia (Juan and Rose, 1979). Generally, global annual loss due to vertebrate damage was estimated about 5 to 10 % (Entwistle, 1985). Among them, mammalian pest in a rodent group such as rats and squirrels, are responsible for severe attack (Bhat et. al., 1981; Cruz, 1983) on cocoa and can cause pod damage (Han and Bose, 1980). Therefore, this study was conducted to control the rat and squirrel problem at cocoa field in Cocoa Research and Development Centre (CRDC) Tawau and Madai.

**Material and Method**

From January to April 2016, study on rats and squirrels was carried out at cocoa germplasm Tawau using caught marked and release technique (Southwood, 1978). The size of the area is about 4.0 acre and the cocoa tree stand is about 1455. Total number of wire mesh traps set up per round is about 40. Equal numbers of traps were placed on the ground within the tree base and on the jorquette or within the tree canopy on a branch. Traps were left undisturbed, until inspected daily in the early morning. The wire mesh traps were set up twice a week on alternate day. All the rats and squirrel trapped was marked using the ring and release. The trap was set up again after 24 hours release. After 24 hours, the traps were checked again for the caught. Different fresh bait used to attract the rats and squirrel to the traps. In October 2016, the same method of caught applied to the cocoa field 6B at CRDC Madai. Total number of wire mesh trap set up is about 160 trap per round in the cocoa field area is about 4 ha. The cocoa trees in this two study sites were mature and bearing fruits and was monoculture. The number of animal caught, the type of baits, and the location and position of the trapped animals were recorded.

Plate 1: Rats and squirrels trapping at cocoa germplasm area CRDC Tawau.

	
<p>Marking technique of the rat and squirrel using the ring</p>	<p>Trap set up on the branch</p>
	
<p>Trap set up on the ground</p>	<p>Trap set up between trunk and branch</p>



### Result and Discussion.

Table 1: Total number of rat and squirrels catches using wire mesh trap at cocoa germplasm CRDC Tawau.

Month	Rat		Squirrel	
	First time catches	Second time catches	First time catches	Second time catches
January	-	-	-	-
February	8	1	17	3
March	0	0	3	0
April	1	0	2	0
<b>Total</b>	<b>9</b>	<b>1</b>	<b>22</b>	<b>3</b>

From table 1 and using the formula of actual sum of squares;

$$\sum (x - \bar{x})^2 = \sum x^2 f(x) - [\sum xf(x)]^2 / N,$$

and the expected (=theoretical) variance;

$$\sigma^2 = \sum ni / N - \sum (ni^2) / N^2,$$

by Southwood, 1978, there was another 31 more estimated rat population and 11 more estimated squirrel population left uncatch at cocoa germplasm CRDC Tawau. There were estimated about 40 rats and 33 squirrels in cocoa germplasm area CRDC Tawau which is the size is about 4.0 acres.

Table 2: Estimated rat and squirrel and damage on cocoa pod.

No. of rat	No. of squirrel	Estimated no. of rat	Estimated no. of squirrel	$\bar{x}$ cocoa pod damage by rat	$\bar{x}$ cocoa pod damage by squirrel	Estimated pod damage by rat	Estimated cocoa pod damage by squirrel
9	22	40	33	0.1 – 0.5	2.1 – 4.0	4 - 20	69 - 132

Table 2 showed that a single rat can damage at least one cocoa pod per day. Meanwhile, squirrel damaged at least four cocoa pods per day (Lee, 2007). In cocoa area size of about 4.0 acres with the cocoa stand is about 1455 trees, there was estimated about 40 rats and 33 squirrels (Southwood, 1978). The mean cocoa pod damaged by rat and squirrel is about 0.1 – 0.5 and 2.1 – 4.0 respectively, there was estimated about 4 – 20 and 69 to 132 cocoa pod damage by rat and squirrel respectively per day in this area.

Table 3: Number of rat and squirrel trapped at cocoa germplasm area CRDC Tawau using different type of bait.

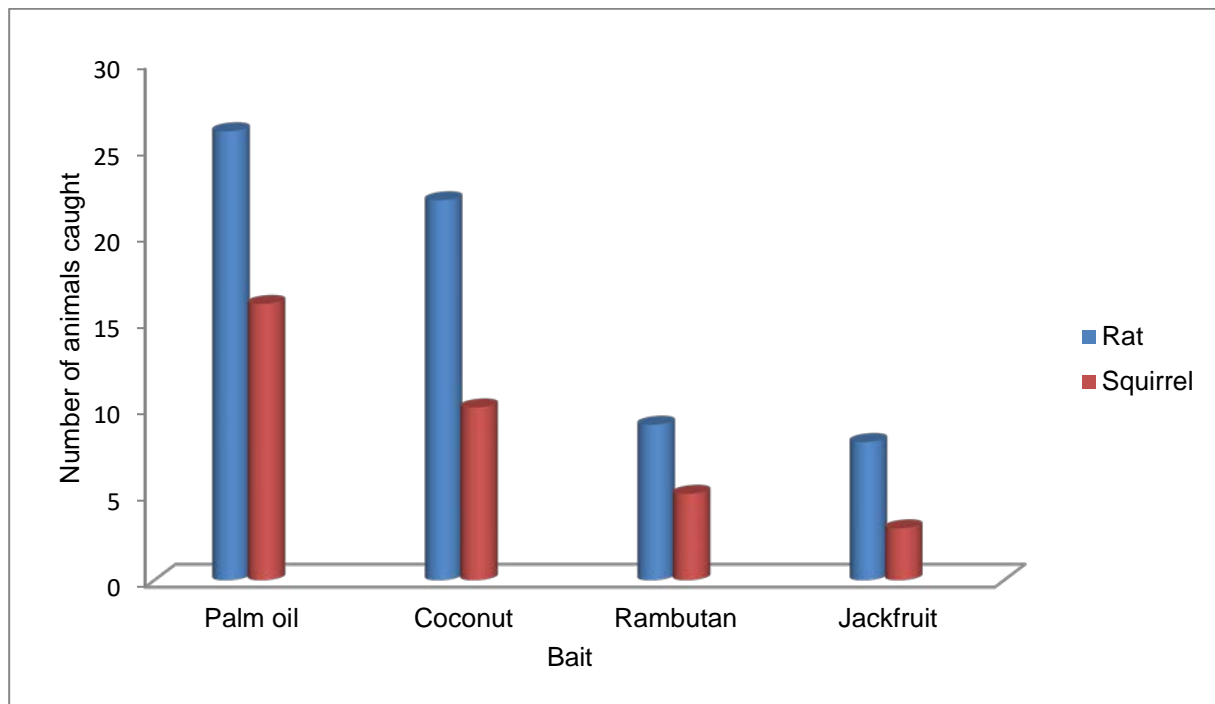
Date	Trap	No. of caught		Location of trap		Bait
		Rat	Squirrel	Branch	On the ground	
1/2/2016	1		1	/		Jackfruit
	2		1	/		Jackfruit
	3		1	/		Jackfruit
	4		1	/		Jackfruit
	5	1			/	Jackfruit
	6	1		/		Jackfruit
	7	1			/	Jackfruit
	8	1			/	Jackfruit
	9		1	/		Jackfruit
	10		1	/		Jackfruit
<b>Total</b>	<b>10/43</b>	<b>4</b>	<b>6</b>	<b>7</b>	<b>3</b>	
	1	0	1	/	-	Jackfruit
	2	0	1	/	-	Jackfruit

3/2/2016	3	1	0	-	/	Jackfruit
	4	0	1	/	-	Jackfruit
	5	0	1	/	-	Jackfruit
	6	0	1	/	-	Jackfruit
<b>Total</b>	<b>6/43</b>	<b>1</b>	<b>5</b>	<b>5</b>	<b>1</b>	
15/2/2016	1/43	-	1	/	-	Jackfruit
	2/43	1	0	-	/	Jackfruit
	3/43	1		-	/	Jackfruit
<b>Total</b>	<b>3/43</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>	
17/2/2016	1/43	0	1	-	/	Banana
	2/43	0	1	/	-	Banana
	3/43	0	1		/	
<b>Total</b>	<b>3/43</b>	<b>0</b>	<b>3</b>	<b>1</b>	<b>2</b>	
8/3/2016	1/43	1	0	-	/	Banana
<b>Total</b>	<b>1/43</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	
10/3/2016	1/43	1	0	-	/	Banana
	2/43	0	1	-	/	Banana
	3/43	0	1	-	/	Banana
	4/43	0	1	-	/	Banana
<b>Total</b>	<b>4/43</b>	<b>1</b>	<b>3</b>	<b>0</b>	<b>4</b>	
22/3/2016	43	0	0	-	-	Tapioca
<b>Total</b>	<b>43</b>	<b>0</b>	<b>0</b>	<b>-</b>	<b>-</b>	
24/3/2016	1/43	0	1	/	-	Tapioca
	2/43	0	1	/	-	Tapioca
	3/43	0	1	/	-	Tapioca
	4/43	0	1	/	-	Tapioca

<b>Total</b>	<b>4/43</b>	<b>0</b>	<b>4</b>	<b>4</b>	<b>0</b>	
<b>Grand total</b>	<b>31</b>	<b>9</b>	<b>22</b>	<b>18</b>	<b>13</b>	

Result from Table 3 showed that the number of squirrel caught is higher compared to the rat. Total number of squirrel caught is about 22 and the number of rat caught is about 9. This table also showed that only 9.0 % of the traps set up manage to trap the rat and squirrel at cocoa germplasm area CRDC Tawau. Among the trap set up using jackfruit as bait manage to catch 14.7 % rat and squirrel. Followed by the trap using banana caught 6.2 % rat and squirrel and tapioca caught 4.6 % of rat and squirrel respectively. Most of the rat caught in the trap set up on the ground, but only one (11.1 %) rat trapped in the trap set up on the branch of the cocoa tree. It is about 18.2 % (4) of the squirrel caught in the trap set up on the ground. The rest of the squirrel trapped in the trap set up on the cocoa branch.

Figure 1: Number of rats and squirrels caught at CRDC Madai using different type of bait.



Result from Figure 1 showed that the wire mesh trap set up using palm oil as a bait manage to catch higher number of rat and squirrel followed by the coconut, rambutan and jackfruit. This result also showed that the number of rat caught in this trial also higher compared to the number of squirrel caught using the same bait.

## Conclusion

In the cocoa area size about 4.0 acre and with the cocoa stand is about 1455, there were estimated about 40 rats and 33 squirrels respectively in this area. The mean cocoa pod damaged by rat and squirrel is about 0.1 – 0.5 and 2.1 – 4.0 respectively, there was estimated about 4 – 20 and 69 to 132 cocoa pod damage by rat and squirrel respectively per day in this area.

Only less than 10 % of the total traps set up manage to catch the animals. In cocoa germplasm area at CRDC Tawau, trap set up using jackfruit bait is preferred by the rats and squirrel. Meanwhile, at CRDC Madai trap set up using palm oil as bait is preferred by the rat and squirrel. Generally, most of the rat caught in the trap set up on the ground and the squirrel trapped in the trap set up on the cocoa branch.

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