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GROWTH AND REPRODUCTION OF LABORATORY — BRED MALAYSIAN WOOD RAT (*RATTUS TIOMANICUS* MILLER)

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RINGKASAN

Kajian di makmal mengenai tumbesaran dan pembiakan tikus belukar (*Rattus tiomanicus* Miller) menunjukkan hubungan yang linear di antara berat badan dengan umur sehingga 20 minggu. Semasa dilahirkan, berat badan tikus jantan adalah 4.0 g dan betina 3.8 g. Semasa penceraian susu 28 hari kemudiannya, berat badan tikus-tikus ini adalah 34.0 g dan 30.0 g masing-masing. Lima puloh peratus daripada tikus-tikus jantan dan betina itu telah baligh (jantan: testes scrotal, betina: perforated vagina) pada minggu ketujoh dengan purata berat badan 59.2 dan 56.2 g, masing-masing. Setengah daripada bilangan tikus betina telah bunting untuk pertama kalinya pada minggu 24 dengan purata berat badan 88.6 g. Lima puloh peratus kematian berlaku pada umur 34 minggu bagi tikus jantan dan 40 minggu bagi tikus betina, apabila purata berat badan mereka 114.0 dan 106.4 g, masing-masing. Jangkamasa anak pertama dilahirkan ialah 121 ke 265 hari (purata 202.6 hari atau 29 minggu selepas dilahirkan). Jangka banyak bilangan anak adalah 3.6 kemaksima 5.8 ekor. Tikus betina mengandung sebanyak dua hingga sembilan kali semasa hayatnya. Jangkamasa di antara satu-satu kandungan adalah di antara 22 hingga 155 hari.

INTRODUCTION

Accurate age estimation is vital in population studies. Eyelens weights have been considered accurate to estimate age for some immature mammals but not for smaller vertebrates because of the relative magnitude of measuring errors (DAPSON and IRLAND, 1972). Age and body-weight relationships have been frequently used because of their ease and convenience. Although bias is inherent in comparisons of this sort, HARRISON, (1956) thought that variation would be negligible in areas where climate is uniform and breeding is continuous throughout the year. He postulated that Malaysian rat populations were stable, having a constant age structure and with members having similar growth rates.

The age-weight relationship of *R. tiomanicus* had been studied earlier by HARRISON (1956) but in forest and oil palm habitats. Although the same rat species was found in cocoa, it was thought that due to differences in food types, habitat, and cover their growth rates probably would differ. A study was made to examine the age-weight relationship for a cocoa inhabiting *R. tiomanicus* population. In addition, the rat's rate of reproduction was investigated.

MATERIALS AND METHODS

Twelve pregnant *R. tiomanicus* females were live-trapped from cocoa fields 10 and 36B Kuala Bernam Estate near Teluk Anson, West Malaysia, and placed singly in laboratory cages measuring 45 x 45 x 30 cm. Rats were fed with laboratory chow, coconut meat, cocoa, bones and water *ad libitum*. Birth dates and numbers of young were recorded.

The young were weighed at birth and weekly thereafter. At weaning, they were separated from their mothers. Female rats were then paired to males of slightly heavier weights. Males that died during the pairing process were replaced by males of equivalent weights. Care was taken to prevent mating brothers and sisters. The times of first and subsequent births were noted. Young from these births were subjected to treatments similar to their mothers.

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Body weights were recorded up to death or 60 weeks whichever came first. Weights of pregnant females were excluded beginning three weeks prior to birth. This was done to avoid false reporting of weight to age. The relationship of age and weight were compared statistically using the Statistical Package for Social Sciences (SPSS) computer programs (NIE *et. al.*, 1975).

RESULTS

1. Age-weight relationship

Growth curves for males and females were plotted on scattergrams *(Figures 1* and *2)*. Both sexes exhibited steady growth rates up to 20 weeks, and tended to level off thereafter. Weight gains declined as the animals proceeded towards old age. Males weighed more than females in each age-class.

Because of the curvilinear nature of the growth pattern, a linear relationship to 20 weeks. There were strong correlations between weights to ages in both males and females ($r = 0.8952$ and $r = 0.8974$, respectively). A linear regression equation for both sexes was fitted up to 20 weeks *(Figures 1* and *2)*.

2. Reproduction

The mean number of young born to 12 adult females was 4.4 and their sex-ratio was 0.75 males per female. The mean birth weights for 21 males and 26 females were 4.0 and 3.8 g, respectively. Average weights were 34.0 g for males and 30.0 g for females when weaned 28 days after birth. Fifty percent of the males were scrotal and half the females had perforated vaginal membranes by the seventh week after birth. Their mean weights then were 59.2 and 56.2 g, respectively *(Table 1)*.

On the average, 50 percent of the females were visibly pregnant for the first time 24 weeks after birth when they weighed 88.6 g. Half of adult mortality occurred by the mean ages of 34 weeks for males at mean weight 114.0 g, and by 40 weeks at mean weight of 106.4 g for females. The mean number of placental scars was 6.6 (range 4–10).

Mean days to first birth was estimated to be 202.6 days (about 29 weeks), ranging from 121 to 265 days. The mean number of young varied from 3.6 at first birth to a maximum of 5.8 young at litter number four. The days between litter varied from 22 to 155 days. Mean litter size was 5.7 and ranged from 2 – 9 litters throughout a female's lifespan *(Table 2)*.

DISCUSSION

The existence of a linear relationship between body weights and growth in rats and mice (HARRISON, 1951; KREBS, *et al.*, 1969; HIRATA and NASS, 1975) enabled a regression of age and body weight to be used frequently for estimating the animal's age. HARRION, (1956) pointed out that the growth of rat appears to occur at a fairly regular rate up to a certain size and then fluctuating about that size. Up to a certain weight then, body weight could be an acceptable indicator of age. HIRATA and NASS (1975) utilized age-weight curves up to 20 weeks for Norway, black and Polynesian rats. Similarly, with *R. tiomanicus* body weight was also approximately linear up to 20 weeks and then tended to level off.

Reproductive data for laboratory-bred *R. tiomanicus* from cocoa areas were within the ranges of those obtained by HARRISON, (1951, 1956) for wood rats from oil palm and forest habitats. Slight differences were detected, however, in the mean number of young and in fertility age and pregnancy rate. Differences between rats of the same species but in different habitats have been attributed by JACKSON and BARBEHENN (1962) to nutritional or environmental factors rather than to genetic variation. This study yielded no evidence to the contrary.

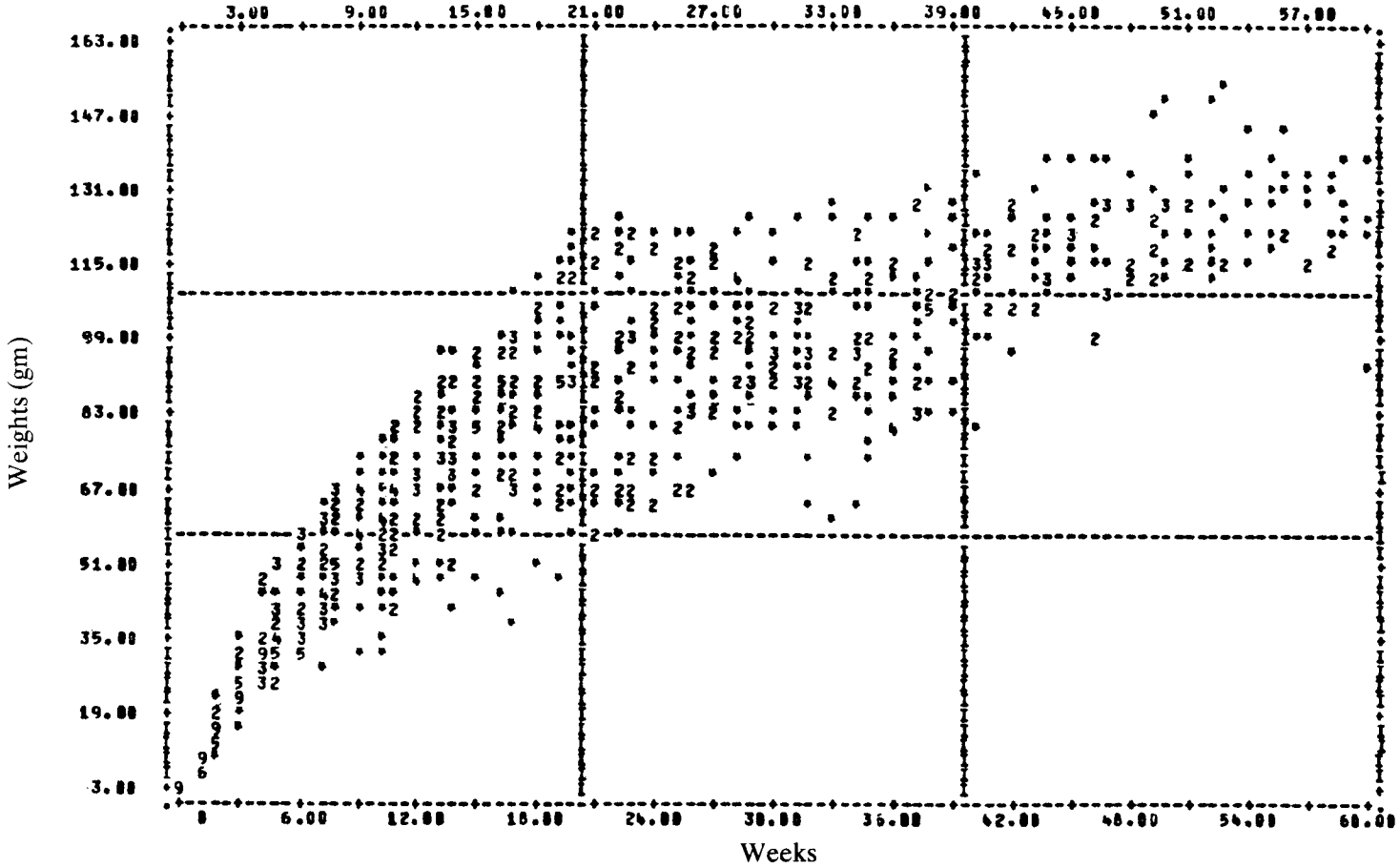

Figure 1. A scattergram of the age-weight relationship for male ***Rattus tiomanicus*** *(Miller) from Kuala Bernam Estate, Telok Anson, West Malaysia bred in the laboratory, 1980–1981. Linear regression relationship from birth up to the 20th week was computed as:*

$$Y_{wt} = 14.3119 + 4.2082\, X_{wks}$$

Note: Numbers in the plot indicate the number of animals with the same age-weight values.

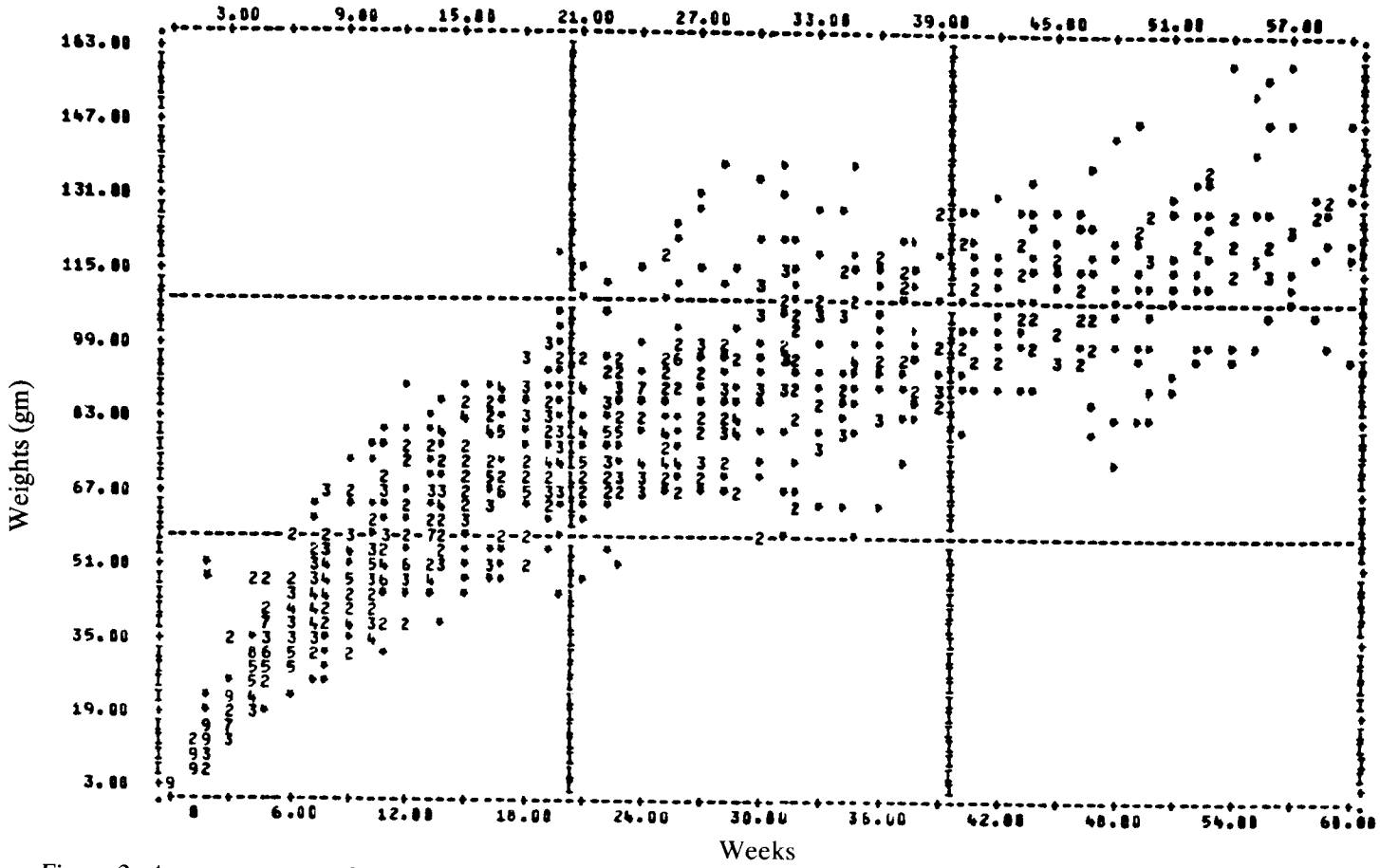

Figure 2. A scattergram on the age-weight relationship for female ***Rattus tiomanicus*** *(Miller) from Kuala Bernam Estate, Telok Anson, West Malaysia bred in the laboratory, 1980–1981. Weights three weeks prior to giving birth were excluded. Linear regression relationship from birth up to the 20th week was computed as:*

$$Y_{wt} = 13.0219 + 3.7275\ X_{wks}$$

Note: Numbers in the plot indicate the number of animals with the same age-weight values.

TABLE 1: A SUMMARY OF REPRODUCTIVE DATA FOR MALES AND FEMALES *RATTUS TIOMANICUS* (MILLER) FROM KUALA BERNAM ESTATE, TELOK ANSON, WEST MALAYSIA, 1980–1981 BRED IN THE LABORATORY

	Mean values (± SE or ranges)	
	Males (N=21)	Females (N=26)
Birth weight (g)	4.0 ± 0.2	3.8 ± 0.1
Weight at weaning (days)	34.0 ± 1.4	30.0 ± 1.3
Age at weaning (days)	28 (26–35)	28 (26–35)
Weight when 50% testes scrotal/vaginas perforated (g)	59.2 ± 2.4	52.6 ± 3.5
Age when 50% testes scrotal/vaginas perforated (weeks)	7 (5–9)	7 (5–9)
Weight when 50% pregnant (g)	–	88.6 ± 4.5
Age when 50% pregnant (weeks)	–	24 (17–29)
Placental scars[1]	–	6.6 ± 1.2
Weight when 50% adult mortality (g)	114.0 ± 5.7	106.0 ± 7.4
Age when 50% adult mortality (weeks)	34 (19–43)	40 (24–54)

[1]May represent more than 1 litter

TABLE 2: REPRODUCTIVE DATA ON LITTER SIZE AND INTERVAL BETWEEN LITTERING FOR FEMALE LABORATORY–BRED *RATTUS TIOMANICUS* (MILLER) FROM KUALA BERNAM ESTATE, TELOK ANSON, WEST MALAYSIA, 1980–1981 WITH VARYING NUMBER OF LITTERS

Litter size	Number of females sampled	Mean number of young (range)	Mean interval between litters in days (range)
1	11	3.6 (3 – 5)	62.6 (26 – 155)
2	11	3.9 (3 – 6)	42.4 (25 – 68)
3	9	3.8 (3 – 5)	33.0 (22 – 54)
4	7	5.8 (4 – 7)	72.4 (24 – 127)
5	6	4.3 (3 – 6)	33.6 (24 – 87)
6	6	3.8 (3 – 5)	56.2 (54 – 57)
7	4	4.0 (3 – 5)	32.4 (24 – 64)
8	2	2.0 (1 – 3)	32.0 (30 – 34)
9	2	4.0 (3 – 5)	

The gestation period of *R. tiomanicus* is unknown, although HARRISON, (1951) estimated it to be 21 days from data for related species. It was found in these laboratory studies that females of this species were capable of producing another litter after 22 days. Harrison's estimate, therefore, was not excessive.

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SUMMARY

Laboratory studies on *Rattus tiomanicus* (Miller) indicated that linear relationship between weights and ages up to the 20th week existed. At birth, males weighed 4.0 g and females weighed 3.8 g and were weaned about 28 days later at 34.0 and 30.0 g, respectively. Fifty percent of males were scrotal and half of the females had perforated vaginas by the seventh week after birth at mean weights 59.2 and 56.2 g, respectively. Fifty percent of the females became pregnant for the first time by the 24th week and weighed 88.6 g. Fifty percent adult mortality occurred at mean ages of 34 weeks for males, and 40 weeks for females with mean weights of 114.0 and 106.4 g, respectively. Mean days to first birth ranged from 121 to 265 days (mean 202.6 days about the 29th week after birth). Their mean number of young varied from 3.6 to maximum 5.8, and litter sizes ranged from 2 to 9 throughout the lifespan of the females. The days between litters varied between 22 and 155 days.

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