AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C 20523

BIBLIOGRAPHIC INPUT SHEET

FOR AID USE ONLY
BATCH 40

1. SUBJECT CLASSIFICATION

A. PRIMARY
Food production and nutrition

AH10-0000-G732

B. SECONDARY
Pests of plants--Philippines

2. TITLE AND SUBTITLE
Growth of Rattus rattus mindanensis

3. AUTHOR(S)
Ferrer,L.S.

4. DOCUMENT DATE
1975

5. NUMBER OF PAGES
6p.

6. ARC NUMBER
ARC

7. REFERENCE ORGANIZATION NAME AND ADDRESS
Interior

8. SUPPLEMENTARY NOTES *(Sponsoring Organization, Publishers, Availability)*
(In Philippine agriculturist,v.59,nos.1-2,p.37-42)

9. ABSTRACT

10. CONTROL NUMBER
PN-AAC-734

11. PRICE OF DOCUMENT

12. DESCRIPTORS
Animal physiology
Growth
Rats
Tests

13. PROJECT NUMBER

14. CONTRACT NUMBER
PASA RA(ID)1-67 Res.

15. TYPE OF DOCUMENT

AID 590-1 (4-74)

PASA RA(ID)1-67 Res.
PN-AAC-734

GROWTH OF RATTUS RATTUS MINDANENSIS MEARNS

LORENZA S. FERRER

Reprinted from *"The Philippine Agriculturist"* Vol. 59 Nos. 1 & 2 (June-July, 1975)

Phil. Agr. 59: 37-42
June-July, 1975

GROWTH OF RATTUS RATTUS MINDANENSIS

LORENZA S. FERRER

Senior Plant Pest Control Officer, Bureau of Plant Industry, Tacurong, Sultan Kudarat, Philippines.

GCN 1061. UPCA Journal Paper No. 75–122
Accepted for publication 19 August 1975.

Common rice field rats, *Rattus rattus mindanensis* Mearns, held in the laboratory bore 87 young in 14 litters (average = 6.21/litter). Young averaged 3.71 and 59.33 mm in length initially, but increased in linear dimensions, mostly in the first 7 weeks, and gained weight rapidly from the sixth to the eleventh week. Young females reached sexual maturity in about 6 weeks; males required about 8. The young rats ate about 6 g daily from weaning to 12.5 g at maturity. Weights reached the maximum rate of increase more rapidly among litters from laboratory-bred than in field-bred females 56vs 70 days). Other morphological and behavioral changes associated with development were recorded.

INTRODUCTION

The roof rat *(Rattus rattus* Linneaus), the Norway or brown rat (*Rattus norvegicus* Berkenhaut) and the Polynesian rat *(Rattus exulans* Peale) have been studied extensively in other parts of the world (Leslie et al, 1952; Calhoun, 1962; Jackson and Barbehenn, 1962; Bentley and Taylor, 1965; Spillet, 1966; Egoscue, 1970; and Wirtz, 1973), but the details on the growth patterns of the common ricefield rat *(Rattus rattus mindanensis* Mearns) in the Philippines have remained largely unknown. In a preliminary study, Sanchez, et al (1971)[1] reported that litter size for this species varied from 2 to 11 and averaged 7.4, while average weight varied greatly from litter to litter. My data were obtained from 43 females and 44 males born in captivity to selected females that were pregnant when captured or to females that were mated successfully in the laboratory.

MATERIALS AND METHODS

All rats were collected in the vicinity of Siniloan, Laguna using drives as described by Townes and Morales (1953). The collection area was located about two kilometers from Laguna de Bay shoreline and was dominated by succulent grasses.

Ten pregnant and 30 non-pregnant, mature females and 30 mature males were collected. Pregnant animals were maintained in individual wire cages, while non-pregnant females were caged in pairs with males. All individuals were provided commercial multipurpose mash (creep pellets) with a weekly supplement of rough rice (palay) and water. Mothers with young were provided fresh green grasses for both food and nesting material. Food consumption was recorded for both the gravid rats and for the subsequent litters that were weaned.

---

[1] F. F. Sanchez et al. (Unpublished Annual Report, Rodent Research Center, College, Laguna, 1971)

Mated females were examined twice weekly for pregnancy as indicated by either the placental sign (droplet of blood in the vaginal opening) or by a marked increase in weight (approximately 25 to 30 g) and enlargement of the abdomen that, according to Farris and Griffith (1963), is generally evident by the fourteenth day of gestation. If pregnancy was apparent or copulation had taken place, the male was removed.

Suckling and weaned litters were weighed regularly and measurements of total, body plus head, tail, hind foot, and ear lengths were recorded. The occurrence of certain morphological characteristics, such as, the appearance of vibrissae and hair, tooth eruption, opening of ears and eyes, skull ossification, perforation of the vaginal orifices of females and descent of testes of males were also noted.

Litter size was recorded at parturition, 2 weeks after parturition, weaning, and 2 weeks after weaning. Litters were separated from their parents on the twenty-first day after birth, during the usual weaning period of this species (Medina et al, 1972 and Sumangil, 1965)[2] Observations prior to separation were made to determine whether young rats accepted solid food, whether mothers prevented the young rats from nursing, and whether milk could be expressed from the mammae of anesthetized mothers.

RESULTS AND DISCUSSION

All 10 pregnant female rats collected from the field gave birth; however, data from two litters were excluded because one mother had devoured its entire litter a day after parturition and the other mother escaped from the cage. Only six of the 30 laboratory pairs produced litters.

Table 1. *Litters and young of pregnant females* (Rattus rattus mindanensis) *collected in the field and those bred in the laboratory.*

	Female-bred females	Lab-bred females	All females
Litter:			
size (mean ± std. error)	6.38 ± 0.32	6.00 ± 0.63	6.21 ± 0.32
sex ratio (M:F)	45.5 : 54.5	61.5 : 38.5	52.4 : 47.6
Newborn rats:			
percent mortality at birth (no. dead/ total no. born)	11.8 (6/51)	11.1 (4/36)	11.5 (10/87)
percent mortality at weaning (no. dead/ total no. weaned)	4.4 (2/45)	3.1 (1/32)	3.9 (3/77)
percent surviving to maturity (no. alive/ total no. born)	84.3 (43/51)	86.1 (31/36)	85.1 (74/87

[2] J. P. Sumangil, 1965. Handbook on the Ecology of Rice Field Rats and Their Control by Chemical Means. Pest Control Division, BPI (Mimeo).

Eighty-seven animals were all born alive (table 1). At parturition, eight animals died of unknown causes and two "runts" were eaten by the mother. At weaning, three more young died. Eighty-five percent of the young born survived to sexual maturity.

Mean litter size was 6.21 young per litter, with all litters but one ranging between 5 and 8. For field-bred and lab-bred groups combined, litters had nearly equal numbers of each sex – 44 males and 43 females. Although figures show more females in the litters of field-bred mothers and more males for mothers bred in the laboratory, binomial tests (Siegel, 1956) indicated that no litters differed significantly ($P \geq 0.05$) from a 50:50 sex ratio (table 1).

Young *R. r. mindanensis* closely resembled *R. norvegicus* as described by Farris (1965). They were born without hair, with closed eyes and ears, undeveloped limbs, short tails, vibrissae absent, and with pinkish skin. Locomotion was effected by wriggling and paddling; side to side searching movements of the head were observed, and rapid responses to olfactory and taste stimuli were evident. Changes in morphology and behavior of this species are summarized in table 2.

Table 2. *Times of occurrence of morphological and behavioral changes in developing* Rattus rattus mindanensis

Morphological and behavioral changes	Times of occurrence (days) Range	Mean
Suckling rats		
Vibrissae appear	2	2
Hairs appear	5 - 7	6
Incisors erupt	8 - 10	9
Ears open	8 - 11	9
Young find way to mother	9 - 11	10
Eyes open	14 - 16	15
Hair obscures genitalia	14 - 17	15
Hair obscures nipples in female	14 - 17	15
First molar erupts	19 - 20	19
Second molar erupts	21 - 23	22
Weaned rats		
Third molar erupts	35 - 40	36
Skull ossification	38 - 40	39
Vaginal orifice perforates	40 - 56	51
Testes in scrotal position	60 - 70	64

Weaned rats consumed about 5 g/day of laboratory chow during the first 2 to 3 days; consumption increased to 8.5 g/day during the first and second weeks and to 12.5 g/day at maturity (table 3).

The average weight of the newborn young was 3.71 (range, 3.0 to 5.2; (figure 1). The members of smaller, laboratory-bred litters were generally heavier and longer in linear dimensions than those from larger, field-bred litters. Analysis of variance indicated a

Table 3. *Average daily food consumption (laboratory chow) of the growing* R. r. mindanensis *from weaning to sexual maturity.*

Time from Weaning (weeks)	Average Food Consumed (g)
1	5.
2	8.5
3	8.5
4	10
5	10.5
6	11
7	11
8	12.5
9	12.5
10	12.5

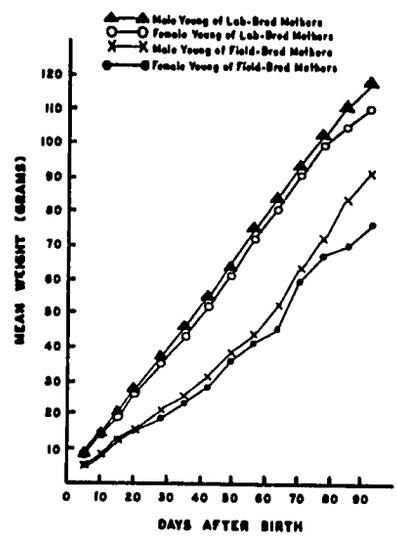

Fig. 1. Mean weights (g) of young male and female *Rattus rattus mindanensis* from birth to 91 days.

highly significant difference in weight between litters of field-bred and lab-bred mothers and between males and females of the two groups taken together (figure 1). There was also a significant interaction between groups and sexes, because the young males and females from laboratory-bred mothers gained weight faster than their counterparts.

The only measurement taken at birth averaged about 60 mm, ranging from 54 to 65 mm; young born to field-bred mothers were slightly shorter than those born to lab-bred females (figure 2). At weaning, average weight was 22.81 g, ranging from 15.5 to 37.1 g. Male rats weighed about 1.0 g more than the females at this time; by the ninety-first day after weaning, this difference had increased to about 12.1 g. The average lenghts (total, body plus head, tail, hind foot, and ear to notch) at 91 days post-weaning were 177, 94, 83, 26, and 14 mm respectively. At sexual maturity (as determined by descent of testes for males and vaginal perforation for females) individual weights

averaged 63.2 g, ranging from 33.3 to 89.2 g. Average lengths at maturity were: total, 248 mm; body plus head, 120 mm; tail, 128 mm; hind foot, 30 mm; and ear, 19 mm.

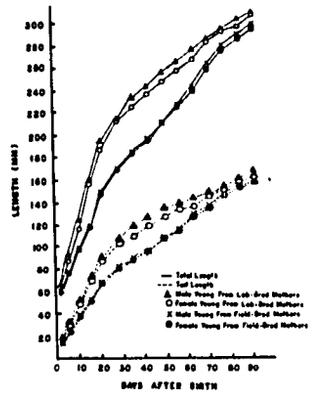

Fig. 2. Total and tail lenghts (mm) of young male and female *Rattus rattus mindanensis* from birth to 91 days.

The sizes at which 50% of the rats showed various maturational characters with reference to weight and body plus head length were summarized in table 4. The use of 50% points to express maturational indices were used to reduce possible biasing by a few slowly maturing individuals (Jackson and Barbehenn, 1962).

The conditions of the reproductive organs after *R. r. mindanensis* reached sexual maturity in the laboratory were determined from observations of 20 females and 29 males which were sacrificed at various stages up to four weeks after descent of testes (males) or perforation of the vaginal orifice (females). Captive females became perforate as early as 40 days after birth; all females had perforate vaginas by 56 days of age. Uterine vascularity was observed in all specimens examined from 1-4 weeks after vaginal perforation. The cauda epididymis of males born to field-bred mothers contained no sperm until about 3 weeks after the testes descended, while sperm were visible in the epididymal tubules about 1 week earlier in males from lab-bred mothers. These times correspond closely with the observations of Jackson and Barbehenn (1962), who noted that the testes descended at about 7 weeks in *R. rattus* and *R. exulans,* but that tubular sperm were generally not visible until about 10 weeks.

Table 4. *Size of the rice field rat at various stages of maturity*

Characters	No. of rats	Weight (g) at 50 point	Body + head length (mm) at 50 point
Eruption of third molar	74	38	101
Ossification of skull	74	45	105
Vaginal orifice perforate	34	49	108
Testes scrotal in position	40	68	123
Sperm in cauda epididymis	12	99	142

ACKNOWLEDGMENT

The author is grateful to Prof. Pablo J. Alfonso, Dr. Leopoldo S. Castillo, and Dr. Benjamin L. Cariaso (University of the Philippines at Los Baños), for supervision of this work; Director Eliseo C. Carandang and Messrs. Jose L. Morales, Hipolito A. Custodio, and Jesus P. Sumangil (Bureau of Plant Industry) for support and advice.

LITERATURE CITED

BENTLEY, E. W. and E. J. TAYLOR. 1965. Growth of laboratory reared ship rats. (*Rattus rattus* L) Ann. Appl. Biol. 55:193-205.

CALHOUN, J. B. 1962. The ecology and sociology of the Norway rat. Washington DC. Publ. 1009. U.S. Public Health Service,

EGOSQUE, H. J. 1970. A laboratory colony of the Polynesian rat. *Rattus exultans* J. Mammal. 51:261-266.

FARRIS, E. J., 1965. The care and breeding of laboratory animals. New York: John Wiley and Sons, Inc. 515 p.

JACKSON, W. B. and K. R. BARBEHENN. 1962. Growth and development. In T. I. Stour, (ed.), 1962. Pacific Island Rat Ecology. Bull. 225. B. P. Bishop Museum, Honolulu, Hawaii.

LESLIE, P. H., V. M. VENABLES, and I. S. V. VENABLES. 1952. The fertility and population structure of the brown rat (*Rattus norvegicus*) in corn ricks and some other habitats. Proc. Zool. Soc. London. 122:187-238.

MEDINA, F. I. S. III, C. I. MADRIAGA, B. DELA CRUZ, V. PAGUIRIGAN, E. PADRELANAN, S. ESLIT and J. GREGORIO. 1972. A study on the adaptation and breeding of field rat. (*Rattus rattus* sp) in the laboratory. Phil. Agr. 56:274-279.

SIEGEL, S. 1956. Nonparametric statistics for the behavioral sciences. New York: McGraw Hill Book Co., Inc. 312 p.

SPILLET, J. J. 1966. Growth of three species of Calcutta rats. Indian Rodent Symposium. Center for Medical Research and Training, Calcutta, India. 312 p.

TOWNES, H. and J. L. MORALES. 1953. Control of field rats in the Philippine with special reference to Cotabato. Plant Ind. Digest. 16:3-12.

WIRTZ, W. C. II, 1973. Growth and development of *Rattus exultans*. J. Mammal 54:189-202.

U.S. GOVERNMENT FUNDS WERE PROVIDED TO THE U.S. FISH AND WILDLIFE SERVICE BY THE U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT UNDER THE PROJECT "CONTROL OF VERTEBRATE PESTS", PASA RA (ID) 1-67