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SEASONAL DEMOGRAPHIC VARIATION IN BANDICOOT RATS, *BANDICOTA BENGALENSIS* (GRAY) IN IRRIGATED CROPS

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The growth seasonality of the bandicoot rats (*Bandicota bengalensis*) was investigated in irrigated crops in district Faisalabad, for one year at regular intervals. A seasonal pattern of body growth in ♂ & ♀ was observed with increase in body weight and length with peaks in spring. Seasonal variations were investigated throughout the study period. Hundred and sixty seven rats were trapped with the help of snap traps from 150 acres of the vast study area which consists of wheat, sugarcane and fodder crop fields. Both trapped sexes were weighed and measured separately. The sex ratio skewed in favour of males. The mean body weight gained in four seasons (fall, winter, spring and summer) was 116.06 ± 13.632, 182.08 ± 17.833, 208.08 ± 8.087 and 129.56 ± 14.880g in males and 135.70 ± 18.932, 114.20 ± 10.411, 181.88 ± 15.830 and 154.11 ± 14.240g in females. Likewise the mean body length gains during fall, winter, spring and summer were 15.84 ± 0.592, 18.03 ± 0.602, 18.52 ± 0.276 and 16.36 ± 0.585cm in males, and 16.07 ± 0.769, 14.67 ± 0.726, 17.59 ± 0.536 and 16.18 ± 0.891cm in females, respectively. Observed variations in body growth and sex ratio in four seasons were suspected as due to photoperiod, ambient temperature, availability of food and differential contributory risks to the sexes.
Key words: *Bandicota bengalensis*, body growth (weight and length), sex ratio, irrigated crops

INTRODUCTION

Wheat and rice are the important cereals and major source of food for the South Asians. Rice-wheat cropping provides food and livelihood for millions of rural and urban populations including poor and landless alike across some 13.5 millions hectors in South Asia. Wheat and rice contribute 80% of total cereal production and are critical to food security for tremendously increasing population, and have vital role in our economy and country trade (GoP, 2005 and Khan *et al.*, 2003). But unfortunately, our food crops are in unremitting menace due to a boost in populations of insect pests and rodents; that is very stern in case of rodents. Khan and Razvi (2000) reported that of the rodent's fauna of Pakistan, *Bandicota bengalensis* is the most important species. Widespread in distribution, it causes serious economic losses to growing crops such as rice, wheat, sugarcane and groundnuts. Other seriously noting thing is the effect of these rodents on human health which will be an emerging issue in the next 5-10 years if unnoticed. There are more than 60 rodent born zoonoses (diseases that effect human), within the crop growing agricultural zones i.e., leptospirosis, the arena- and hantaviruses that cause haemorrhagic diseases; the plague (*Yersinia pestis*), rat typhus (*Rickettsia* sp.), and neuro-angiastrongliasis etc. (Mills, 1999; Gratz, 1996; Prociv *et al.*, 2000; Singleton *et al.*, 2003).

It is interesting to know that these bandicoot rats were not present in Central Punjab till 1963 but now they are well established here and affect agricultural produce seriously (Taber *et al.*, 1967; Beg and Khan, 1984; Ali, 1986). Beg *et al.* (1977) reported that wheat worth about Rs. 520 million was destroyed annually by the bandicoot rats and other rat species in the Punjab before its harvesting. In Pakistan, very little work has been done about their biology and ecology, especially with respect to their body growth. Khan and Beg (1984) described the growth structure of *Bandicota bengalensis* and recorded that mature males weighed on average as 100g with 14.7cm body length whereas the smallest female weighed 120.1g with 16.2cm body length. Senguttuvan *et al.* (2003) recorded body length of *Bandicota bengalensis* 15 to 23 cm and reported the 2 kg hoarded grains in a burrow of a rat. To save the crops and to secure our health, it is necessary to know their biology and ecology, so that a satisfactory and scientific plan for their management in the fields can be made and thus help cleaning down out intimidation which can surprise us in near future.

MATERIALS AND METHODS

A preliminary survey was made to select the wheat, sugarcane and fodder crop fields along banks of canal in district Faisalabad that lies from 30°-40 to 31°-47 north latitudes and 72°-42 to 73°-40 east longitudes for the trapping of rats. The crop fields were selected from an area of 150 acres of cropland. The rats *(B. bengalensis)* were snap-trapped from canal irrigated cropland. The trapping was done each month for one year. Each trapping period lasted for five consecutive nights, using 15 traps baited with roti (local bread)

each night. The two sexes of trapped rats were weighed to1.0 g and measured to 1.0 cm separately and results of different seasons were calculated to document their demographic information and growth seasonality.

RESULTS

Of a total of 167 specimens, 102 were males predominating females in number in the whole sample of the bandicoots. In all of the seasonal samples the sex ratio skewed in favor of males except that of winter when females were slightly greater in number (Table1). The abundance of *B. bengalensis* seemed to be effected by breeding and unaffected by agricultural operations. The mean body weight gained by males was greater than females in winter and spring samples but it was reverse between sexes during summer and fall seasons when most of the females were pregnant increasing their mean body weight (Beg et al., 1981).

The trapped bandicoot rats were of different ages. To reduce heterogeneity due to age, different age groups were segregated and compared for seasonal changes in body weight (Table2). The juvenile sex ratio was almost 1: 1 in all seasonal samples whereas it deviated in favor of males in sub-adults samples. In adults only spring sample showed considerable male abundance while during summer females increased in number to some extent indicating their restricted activity during this stage of their life or increased mortality due to some specific predation related to specific female behavior or any other unknown factor.

The seasonal variations in body weight also proved true in adult males and females. The males outweighed females in all seasonal samples except fall when females showed an increase in body weight. The males gained highest weight in spring probably due to abundant food availability during spring or males' reproductive activity round the year.

Table. 1. Seasonal changes in the body weight (g) in *Bandicota bengalensis*.

Season	Sample	Mean ± S. E.	95% C.I.	Observed Range Minimum – Maximum
FALL				
Male	22	116.06 ± 13.632	87.705 – 144.414	35.3 – 231.1
Female	14	135.70 ± 18.932	94.826 – 176.573	34.0 – 248.1
WINTER				
Male	9	182.08 ± 17.833	140.957 – 223.202	101.8 – 256.5
Female	12	114.20 ± 10.411	91.285 – 137.115	56.8 – 163.5
SPRING				
Male	52	208.08 ± 8.087	191.821 – 224.330	52.9 – 292.2
Female	25	181.88 ± 15.830	149.230 – 214.578	25.2 – 304.4
SUMMER				
Male	19	129.56 ± 14.880	98.297 – 160.822	34.5 – 289.7
Female	14	154.11 ± 14.240	123.351 – 184.868	58.1 – 233.4

Table 2. Average body weight (g) of juveniles, sub-adults and adults of *Bandicota bengalensis* in seasonal samples.

Season	AVERAGE BODY WEIGHT (g) ± S. D.		
	Juvenile	Sub- Adult	Adult
FALL			
Male	56.87 ± 21.77(9)	119. 52± 21.83 (4)	173.73 ± 48.89 (9)
Female	51.94 ± 17.05(9)	-	182.24 ± 34.39 (8)
WINTER			
Male	101.80(1)	-	192.12 ± 47.28 (8)
Female	64.50(1)	108.82 ± 20.198 (5)	126.97 ± 42.62 (6)
SPRING			
Male	108.20 ± 78..20(2)	139.30 ± 76.58 (6)	222.00 ± 43.39 (44)
Female	43.27 ± 18.62(3)	115.4 (1)	204.88 ± 61.89 (21)
SUMMER			
Male	-	83.49 ± 33.10 (9)	171.04 ± 58.36 (10)
Female	-	92.8 (1)	158.78 ± 52.68 (13)

The females become lighter during winter probably due to their reproductive quiescence during this period (Beg et al., 1981). A considerable reduction in weight was evidenced in adult females (Table2) suggesting the same possibility.

Results presented in Table 3, are showing the variations in mean body length in four seasons of *B. bengalensis* in males and females. Similarly results regarding to mean body length in four seasons; in body length tended to be stable in *Bandicota bengalensis.*

DISCUSSION

Critical investigations were made regarding seasonal increase in body weight of *Bandicota bengalensis* in irrigated crops to portray some of it's demographic features and some aspects of ecology. A seasonal

Table 3. Seasonal changes in the body length (cm) in *Bandicota bengalensis.*

Season	Sample	Mean ± S. E.	95% C.I.	Observed Range Minimum – Maximum
FALL				
Male	22	15.84 ± 0.592	14.60 – 17.07	10.6 – 21.9
Female	14	16.07 ± 0.769	14.39 – 17.75	10.5 – 18.8
WINTER				
Male	9	18.03 ± 0.602	16.64 – 19.41	14.0 – 20.5
Female	12	14.67 ± 0.726	13.07 – 16.26	12.6 – 18.3
SPRING				
Male	52	18.52 ± 0.276	17.96 – 19.07	12.6 – 21.3
Female	25	17.59 ± 0.536	16.48 – 18.70	10.4 – 22.3
SUMMER				
Male	19	16.36 ± 0.585	15.13 – 17.59	11.5 – 20.8
Female	14	16.18 ± 0.891	14.25 – 18.10	08.4 – 19.3

Table 4. Average body length of juveniles, sub-adults and adults of *Bandicota bengalensis* in seasonal samples.

Season	AVERAGE BODY LENGTH (cm) ± S. D.		
	Juvenile	Sub- Adult	Adult
FALL			
Male	13.20 ± 1.31(8)	16.90 ± 0.66 (4)	17.72 ± 2.28 (9)
Female	12.52 ± 1.66 (4)	-	17.68 ± 1.05 (9)
WINTER			
Male	17.60(1)	-	18.09 ± 1.92 (8)
Female	13.80(1)	15.86 ± 0.42 (5)	16.35 ± 2.29 (6)
SPRING			
Male	15.30 ± 3.82(2)	16.33 ± 1.81 (6)	19.06 ± 1.44 (44)
Female	12.27 ± 1.64(3)	16.00 (1)	18.43 ± 1.80 (21)
SUMMER			
Male	-	14.58 ± 1.67 (9)	17.97 ± 2.11 (10)
Female	-	15.2 (1)	16.21 ± 3.43 (13)

juvenile, sub adults and adult rats have been given in Table 4. The mean body length varied seasonally as those observed for body weight because the data relating to rapport between body weight and body length (Table 5 & Fig.1,2) clearly indicated that body length of both males and females generally increased with the increase in the body weight. Data creating keen interest that increase in the body length from lowest body weight to the heaviest class was gradual but in the last two or three classes body weight and pattern of fluctuation in body weight of trapped rats was noted during the entire study period with peaks in spring as earlier described by the Khan and Beg (1984), and Senguttivan *et al.* (2003) which ranged from 34.50-292.20g in males, 25.2-304.04g in females. The juvenile males ranged from 56.87–108.20g, whereas those of females varied from 43.27–64.50g. In sub-adults, it was noted that females were comparatively heavier than males. Body length boost in all trapped rats during the whole year was noted, which ranged from 10.6-21.9 and 8.4-22.3cm in

females and males, respectively. Whereas body length in juveniles, sub-adults and adult rats ranged from 13.20-17.60 (♂) : 12.27-13.80cm (♀), 14.58-16.90 (♂) : 15.2-16.00cm (♀) and 17.72-19.06 (♂) : 16.21-18.43cm (♀), respectively. These results fully agreed with those of Bindra & Sagar (1968), Fulk *et al.* (1981) and Beg *et al.* (1977).

Table 5. Relationship of body weight and body length in the *Bandicota bengalensis*.

Body Weight (g)	♂		♀	
	Frequency	Average body Length (mm)	Frequency	Average body Length (mm)
≤ 59	7	126.50	6	115.10
60 - - 89	9	142.40	6	138.60
90 - - 119	13	156.50	5	158.40
120 - - 149	12	169.20	12	164.10
150 - - 179	12	173.60	16	175.40
180 - - 209	11	187.60	6	172.30
210 - - 239	19	194.10	6	190.10
240 - - 269	13	199.00	1	182.00
≥ 270	7	200.50	6	202.10

A great deviation in sex ratio in favor of males provided a clue for the active participation of males in all their explorations and depredation on the food crops whereas females were trap shy or lived more concealed and were retracted especially during spring prior to breeding in summer and fall seasons. Moreover size-specific predation could not be ruled out. Investigations concerning rapport between body weight and body length clearly indicated that body length of both male and female *Bandicota bengalensis* generally increased with the increase in the body weight. Results creating keen interest that boost in the body length from lowest body weight to the heaviest class was gradual in *B. bengalensis* but in the last two or three classes body weight and length tended to be stable. These results show full agreement with Hussain *et al.* (2003). The recorded variation in body weight and length might be due to photoperiod, ambient temperature, rain fall, humidity, starvation, malnutrition, pregnancy, some untailored risk to life and time of maturity because early maturing females get higher weight as reported by Fulk *et al.* (1981), Smiet *et al.*(1980), Beg *et al.*(1981), Khan and Beg (1984), Chakraborty (1977).

This paper provides us a high-tech review concerning growth seasonality and some of the demographic features relating to differential abundance of the two sexes of bandicoot rats Accordingly, these rats heavily infesting our major crops (Singleton *et al.*, 2003, 1999; Singleton and Petch, 1994) gain optimal growth during the harvesting period and ripening stage of the crops under study. These rodents which give chronic losses to these crops, and also pollute their products, would be an un-imaginary peril to human health in near future in the form of zoonoses (unpublished data by Malik, 1998) if unnoticed for their management.

The success of organisms depends on the life strategies they adapt for their best of the safety tactics and food availing ways. Trap shyness or retraction of females in concealments could favor in providing protection to breeding and recruiting segment of the population of bandicoots and indicate that the species is going to flourish well in this area. The prevalence of their negative impacts concerning food security, poverty alleviation and health for rural and urban population is alike, severe and becoming more complex over time. There is a crying need to manage the rats (rodents) in food crops and to save our consumable products because it is a short gun and key stone to secure our food, health and to get by with poverty in future.

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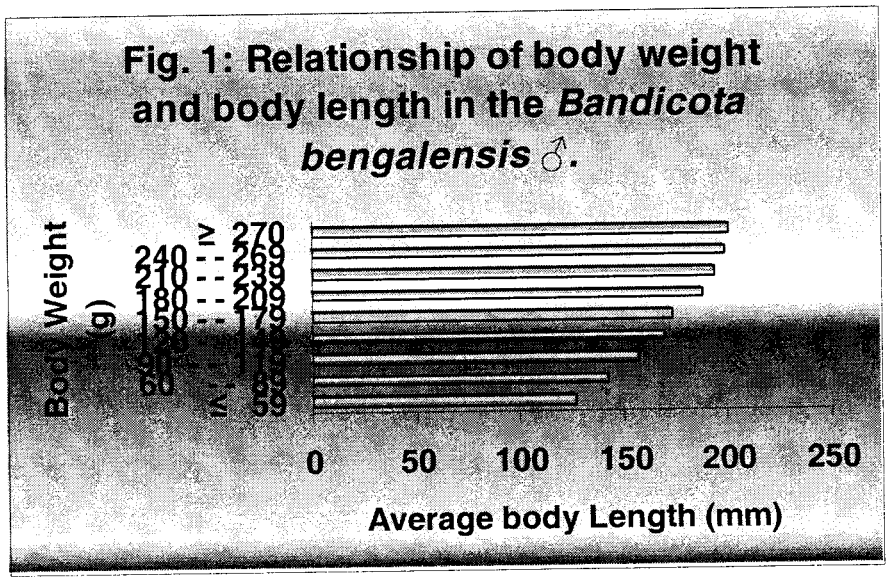

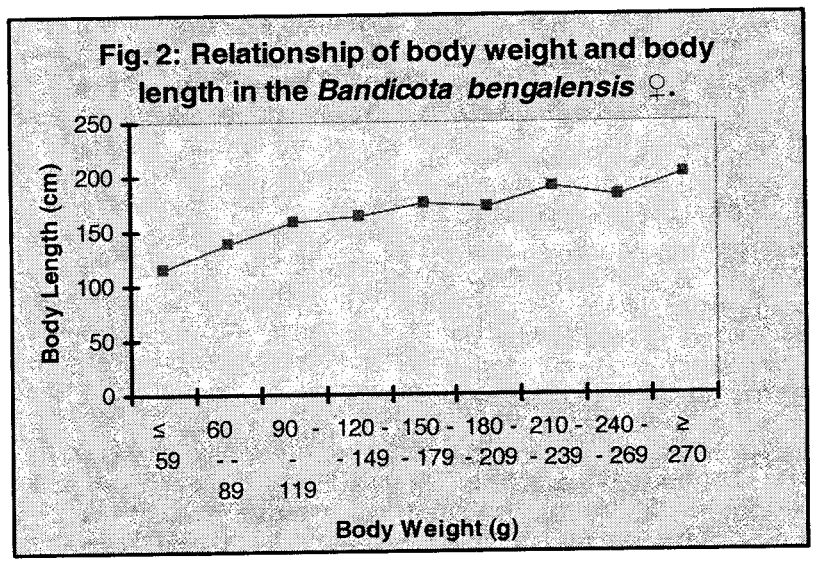

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