SURVEY OF MORPHOMETRIC FEATURES OF PALM SQUIRREL, *FUNAMBULUS PENNANTII* WROUGHTON, 1905 IN IRAN

Siamak Yousefi*, Mona Izadian and Neda Kheradpir*****

* Department of Biology, Faculty of Basic Science, Varamin (Pishva) Branch, Islamic Azad University, Varamin, IRAN. E-mail: siamak_yousefi1@yahoo.com
** Shilamayesh Environmental Consulting Engineers co. P.O.Box: 15175-583 Tehran, IRAN. E-mail: monaizadian@yahoo.com
*** Department of Plant Protection, Faculty of Agriculture, Varamin(Pishva) Branch, Islamic Azad University, Varamin, IRAN. E-mail: kheradpir_neda@yahoo.com

[Yousefi, S., Izadian, M. & Kheradpir, N. 2013. Survey of morpho-metric features of Palm Squirrel (*Funambulus pennantii* Wroughton, 1905) in Iran. Munis Entomology & Zoology, 8 (1): 154-161**]**

ABSTRACT: Species data recording and echo-niche characteristics of Palm squirrel, as one of the unique species in Iranian fauna (Sistan-Balouchestan province) were conducted in Chabahar, Nikshahr and Sarbaz states throughout a year, February 2008-February 2009. Two trapping stations have been considered for each state. Of forty animal trapped, number of palm squirrel males and females were 23 and 7 respectively with the sex ratio of 1:1.3. There was no significant difference in measured features between males and females. The highest weight was recorded as 123.5 g. and the lowest as 50 g.. Moreover; the longest body length of animal and the shortest were 292 and 127 centimeter, respectively. Two features, head-body length and ear size showed significant difference among animals caught from three states. Regression analysis among features showed correlation between head-body length and leg length. On the other hand, ear size and leg length had significant correlation.

KEY WORDS: Palm Squirrel, *Funambulus pennantii,* Iran, Biology.

Palm Squirrel, *Funambulus pennantii* Wroughton, 1905 is a rodent species in Sciuridae family, suborder Sciuromorpha and the order Rodentia. It is naturally found in south-east Iran, Pakistan, India and Nepal (Nowak, 1999).

Distribution pattern of the species has been studied in Australia, also data about its niche and behaviour are provided (Barrett, 1934; Sedgwick, 1968; Watts & Aslin, 1981; Seebeck, 1984) and moreover, in addition to the mentioned academic study, it was analyzed out of Australia especially in India and Pakistan (Wright, 1972).

Dense hairs and wooly- thick tail are the major morphological features of the species. Also, this species can be distinguished by its considerable flat head and neck, big eyes and triangular or circular sensitive ears. Five light-colored lines on their back, three from neck to the end of the tail and the other two externals are seen till leg. Head color is grey from auricle to their ear-backs and conjugate with dark back lines.

Sometimes there are some yellow spots is some parts of the body especially on back. Ventral section goes to white, legs are grey on back and white on internal parts. They have long and shaggy tail covered by white and black hairs. Dorsal part of the tail is blacker and inclines to grey in ventral part. Long hairs cover the end of the tail, mostly black in color and turn to white at the end. Auricles are medium sized, rarely there is any ungula on legs, if there is, they are dark on the base and light to the end.

***Feeding*:** This species is mainly herbivorous but some carnivorous feature has been reported as its feeding preference. They strip of the bark especially in farms with fig and plane trees which lead to considerable damage. Sometimes insect

larvae and pupae are fed in small amount, also. Madso (1964) reported that insects comprise to four percent of their food regime. Squirrels pray on eggs and young of birds, frogs and lizards. In addition, they provide and absorb some vitamins through feeding on soil and mines. D vitamin is produced by sunshine in their furry skin and absorbed during self-cleaning process (Barkalow & Shorten, 1973). Although squirrels provide their needed water via food, they drink. They are mainly gallinaceous throughout the year, but it is seen that they feed on leaves and soft and sweet fruits in autumn and insects especially grasshoppers in summer. They never save food and mostly rehabilitate close to human and consume on kitchen remains especially bread. Scalan et al. (1978) reported the fruit, tree leaves and food remains are among their diet.

***Reproduction*:** Male squirrels gather around females to find their own mate. Reproduction starts by chasing and perusing and leads to tail-biting by several males. Males engage in a battle for 10-20 minutes to obtain their own female. Polygamous females mate with one or several males for 3-4 times in a day. In suitable weather and abundant food, they reproduce in most of the months.

Males are sexually inactive from November to January. Females usually try to make a nest within a week after mating and cover inside with dry herbs, plant fibers, cotton and feather. Normally, the bests time for birth is late-winter to summer. Pregnancy period lasts about 42 days and generally 2-3 babies (up to 5) can be born in a nest full of fiber and herbs on a tree or wall. They usually get milk to the tenth month old, although maturity occurs in 8-9 months old. Adult females can give birth to their children twice a year. Older females, more annual accouchements. Totally, pregnancy depends on food availability and climate condition through reproduction season.

Growth and development: Pal squirrels are pink and naked at birth, however their back-lines are hardly visible. Sensory hairs (around nose and mouth) exist and they have closed eyes and curly auricles. Head and body length is about 50 mm, tail up to 30 mm, legs 12.5 mm and they weigh 5-8 grams. They can open their eyes in 15-25 days old; the auricles unfold in 7-10 days after birth. They furry skins grow monotonously and their back lines are embossed in the second week, as the animal turns to adult colors in 8-10 weeks old. Teeth's are hardly visible at birth but bicuspid teeth can be seen in one week old babies. Teeth` structure of adults is completed in 12-13 weeks and more than 70% of development occurs within eight weeks after birth.

MATERIAL AND METHODS

Sampling and bioassay: To bioassay palm squirrels in considered area, animal sampling method by preying and trapping them was chosen. Trapping was done in (Sistan-Balouchestan Province) throughout in Chabahar, Nikshahr and Sarbaz states in a year, February 2008-Feb. 2009. Geographical features of each state are provided in table as below. Selection of the sampling units was upon the residents' reports and field observation. During sampling in summer and autumn, total number of 40 squirrels was trapped.

To bioassay the captured animals, digital balance and caulis for measuring head and body length, tail length, leg length, ear length and head width. Samples were released after biometry, sex determination and taking photo.

Geographical features of the sampling units

	state	Station (village)	Height (m)	N º	Eº
1	Chabahar	Delgan	2.5	25º47'3″	61º24'92″
2	Chabahar	Mandirou	10	25º59'23″	61º7'83″
3	Sarbaz	Kahir	59	25º90'73″	61º51'57″
4	Sarbaz	Rasak	403	26º23'49″	61º39'4″
5	Nikshahr	Zirak Abad	449	26º21'71″	60º23'23″
6	Nikshahr	Shagim Bala	864.5	26º45'3″	60º18'26″

RESULTS

Sampling started on February 2007 and continued to February 2008. totally forty palm squirrels were trapped that 23 were male and the others, female. Complete biometry test was conducted on samples and the results are shown in Table 1.

As the results reveal, the weightiest and lightest squirrel was measured as 123.5 g. and 50 g, respectively. Mean weight of squirrels was about 96 g. The longest and shortest head and body length were measured as 292 mm and 127 mm, respectively; mean length of head and body was equal to 222 mm among captured samples. In tail length, the longest tail was recorded as 157 mm and the shortest as 90 mm, the mean length of tail was measured as 133 mm. Maximum length of leg in trapped samples was recorded as 41 mm and the minimum observed sample was 25.6 mm; mean length of leg was 36.5 mm. The most stretched ear was 20 mm and the smallest one as 12 mm; mean length of ear was equal to 16.5 mm. The widest and thinnest head was recorded as 22 mm and 20 mm, respectively; mean head width was measured as 21 mm among samples. Traits frequencies were measured for each trait and are shown in figure 1-6.

Mean differences for all traits between sexes: T-test was used to obtain significant difference for all traits between sexes and the results showed there were no significant differences between sexes in any trait (Table 2). The frequency of traits observed in two sexes are shown in figure 7.

Mean differences for all traits among sampling units: Two main traits, head and body length and ear size, showed significant difference among sampling units; the difference among the other traits was not significant. The results of ANOVA test are given in Table 3.

Correlation among the morphological traits: According to regression analysis, there were significant correlation between head-body length, ear size and leg length. On the other hand, there was significant correlation between ear size and leg length. Differences between the other regression indices were not significant (Table 4).

DISCUSSION

As among total 40 trapped samples, 23 were male and 17 were females, sex ratio was calculated as 1:1.3 which can be accorded to previous data in India (1966-1967) that males squirrels occupy the most portion of adult population. Purohit et al. have stated that longevity can be more in isolated males than females, they reported sex ration as 1:1 at birth but females mortality through life

span makes it to 1:2.3 (Purohit et al., 1966; Prasad et al., 1966; Chaudry & Beg, 1977).

The comparison of the obtained results in this study with Wright (1972) and Watts & Aslin (1981), the mean weight of palm squirrel was reported as 135 g which can get to 200 g.; variation in habitat and food availability and other environmental features would lead to these differences. Scalan et al. (1978) studied nine squirrels and reported their mean body length as 243 mm (in 200-300 mm range). One sample in west Australia measure as 292 mm in its head-body length. Available reports based on rare previous studies in Iran indicated: head-body length 133-143 mm, tail length 145-185 mm, leg length 32-37 mm, ear size 13-18 mm (Ziaee, 1997; Etemad, 1977). So the results obtained in this study have several similarities to the previous data.

As there was no significant difference among two sexes in traits, there is no difference in their developmental rate and difference in measurement can be due to their feeding diet and there is no relation to sexuality.

Significant difference in just two traits, head-body length and ear size, among sampling units could be also related to variation in plant canopy and food availability which would lead to different growth rate in squirrels.

LITERATURE CITED

Barkalow, F. S. & Shorten, M. 1973. The World of the Gray Squirrel. J.B. Lippincott Co.: New York 160 pp.

Barrett, C. 1934. The grey squirrel in Melbourne. Victorian Naturalist, 51: 108-110.

Chaudrey, M. A. & Beg, M. A. 1977. Reproductive cycle and population structure of the Northern Palm Squirrel, *Funambulus pennantii*. Pakistan Journal of Zoology, 9: 183-189.

Etemad, A. 1978. Iran mammals: rodents and their identification keys, 1st. vol. National association for natural resources reservation publishing 287 pp.

Firouz, A. 2000. Iran widelife. Academic publisher publishing center Ziaee, H. (1997): Field manual for Iran mammals. Iranian Environmental reservation organization publishing, 298 pp.

Madson, J. 1964. Gray and Fox Squirrels. Olin Mathieson Chemical Corporation: Illinois, East Alton, 112 pp.

Nowak, R. M. 1999. Walker's mammals of the world. The John Hopkins University Press, London.

Prakash, I., Kametkar, L. R. & Purohit, K. G. 1968. Home range and territoriality of the Northern Palm Squirrel, *Funambulus pennantii* Wroughton. Mammalia, 132: 604-611.

Purohit, K. G., Kametkar, L. R. & Prakash, I. 1966. Reproduction biology and post-natal development in the Northern Palm Squirrel, *Funambulus pennantii* Wroughton. Mammalia, 30: 538-546.

Scanlan, H., Gorton, J. & Pearsall, L. 1978. The study of the native Indian Palm Squirrel. Unpublished project report, Biology Department, Como Senior High School, Western Australia. 18 pp.

Sedgwick, L. E. 1968. The squirrels of South Perth. Western Australian Naturalist, 11: 1-4.

Seebeck, J. H. 1984. The Eastern Grey Squirrel, *Sciurus carolinensis*, in Victoria. Victorian Naturalist, 101: 60-66.

Thorington, R. W. & Ferrell, K. 2006. Squirrels: The animal answer guide, The John Hopkins University press, 204 pp.

Watts, C. H. S. & Aslin, H. J. 1981. The Rodents of Australia. Angus & Robertson: Sydney, 321 pp.

Wright, J. M. 1972. The biology of *Funambulus pennantii* Wroughton, feral in Western Australia. Unpublished BSc Honours Thesis, University of Western Australia: Perth, 78 pp.

1

2

Pictures 1-2. 1. Palm squirrel in nature, 2.Palm squirrel in urban area.

3

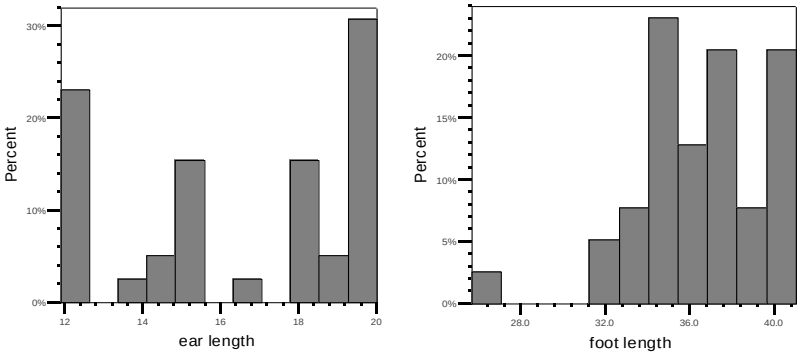
4

Pictures 3-4. 3.Male and female squirrel on a palm tree, 4. Trapping palm squirrels by net.

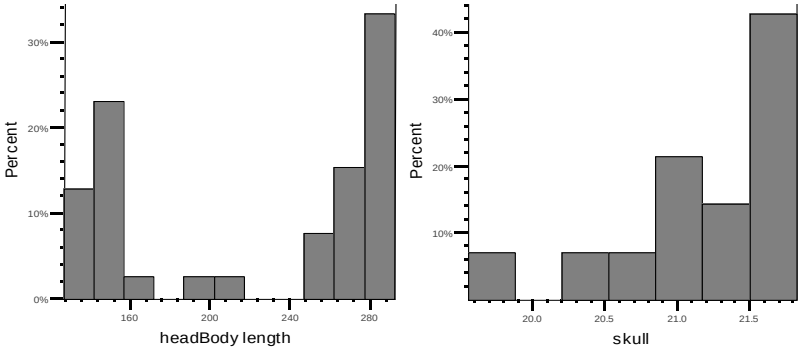
Picture 5. Sampling palm squirrels by trap.

Table 1- Data obtained through biometery (measurements are given in mm).

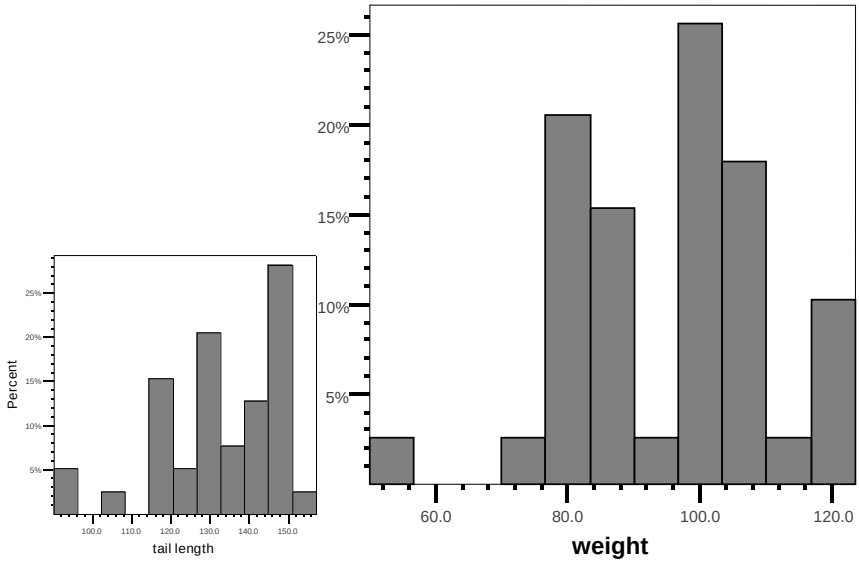
trait	Minimum	Maximum	Mean		Standard deviation
			measurement	Standard error	
Weight	50.0	123.5	96.244	2.4614	15.3712
Head-body length	127	292	222.26	10.418	65.060
Tail	90.0	157.0	133.098	2.5668	16.0299
Leg	25.6	41.0	36.516	.4745	2.9632
Ear size	12	20	16.57	.497	3.103
Head width	20	22	21.19	.164	.613



Figures1-2. 1. Ear size frequency, 2. Foot length frequency.



Figures 3-4. 3. Head-body length frequency, 4. Head width frequency.



Figures 5-6. 5. Tail length frequency, 6. Body weight frequency.

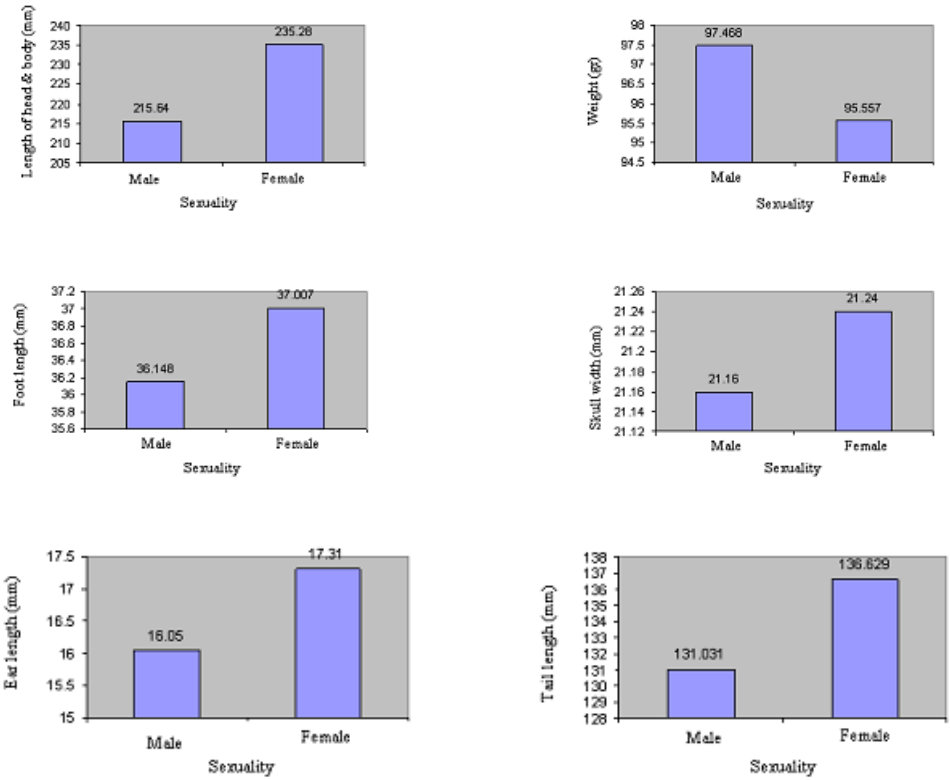


Figure 7. The frequency of traits observed in two sexes.

Table 2. The differences in traits between sexes.

Trait	sex	Mean	Standard deviation	Standard error mean
Weight	Male	97.468	17.4362	3.8049
	female	95.557	12.8968	3.1279
Head-body length	Male	215.64	69.496	15.165
	female	235.28	57.924	14.049
Tail	Male	131.031	16.1661	3.5277
	female	136.629	15.7329	3.8158
foot length	Male	36.148	3.4690	.7570
	female	37.007	2.3138	.5612
Ear size	Male	16.05	3.203	.699
	female	17.31	2.992	.726
Head width	Male	21.16	.742	.247
	female	21.24	.340	.152

Table 3. ANOVA results.

Traits	sampling site	SS	df	MS	F	P
Head-body length	Intra-sampling sites	107615.032	5	21523.006	56.922	.000
	Inter-sampling sites	10587.216	28	378.115		
	total	118202.248	33			
Ear size	Intra-sampling sites	246.359	5	49.272	22.570	.000
	Inter-sampling sites	61.126	28	2.183		
	total	307.484	33			

Table 4. Regression analysis of the traits.

Trait		weight	Head-body length	Tail length	Foot length	Ear size	Head width
Weight	Regression index	1	-.020	.216	-.145	-.093	.392
	P		.903	.187	.380	.572	.166
	n.	39	39	39	39	39	14
Head-body length	Regression index	-.020	1	.300	.342(*)	.856(**)	.338
	P	.903		.063	.033	.000	.237
	n.	39	39	39	39	39	14
Tail length	Regression index	.216	.300	1	.100	.259	-.107
	P	.187	.063		.545	.111	.715
	n.	39	39	39	39	39	14
Foot length	Regression index	-.145	.342(*)	.100	1	.323(*)	-.473
	P	.380	.033	.545		.045	.088
	n.	39	39	39	39	39	14
Ear size	Regression index	-.093	.856(**)	.259	.323(*)	1	-.015
	P	.572	.000	.111	.045		.960
	n.	39	39	39	39	39	14
Head width	Regression index	.392	.338	-.107	-.473	-.015	1
	P	.166	.237	.715	.088	.960	
	n.	14	14	14	14	14	14