

Contribution to the Biological Characteristics of *Allactaga williamsi* Thomas, 1897 in Kırıkkale Province (Mammalia: Rodentia)

Kubilay TOYRAN* İrfan ALBAYRAK

University of Kırıkkale, Faculty of Sciences and Arts, Department of Biology, 71450, Yahşihan, Kırıkkale, TURKEY

*Corresponding Author
E-mail:kubilaytoyran@hotmail.com

Received: October 01, 2008
Accepted: December 25, 2008

Abstract

This study is based on 31 specimens of *Allactaga williamsi* obtained from the Kırıkkale province between 2002 and 2004. The animals, searched in the field with a projector or car headlight, were either shot dead or caught alive by using an aerial net. The specimens were divided into three age groups as young, juvenile and adult. Diagnostic characters, habitat, some biological characteristics such as fur colour, reproduction, feeding, hair morphology and karyological features of the species were recorded. Twelve specimens were kept and fed at laboratory to carry out karyological analysis and to observe their feeding habits. It was determined that breeding season for *Allactaga williamsi* was on April and May and births on June. The chromosome number is (2n) 48 and the fundamental numbers (NF) are 96 and 95 for female and male respectively.

Key words: *Allactaga williamsi*, biology, karyology, Kırıkkale.

INTRODUCTION

The order Rodentia is represented by 2277 species in the world [1]. Of these species 51 are recorded in Turkey [2]. The genus *Allactaga* belonging to the family of Dipodidae is represented by *Allactaga elater*, *A. euphratica* and *A. williamsi* in Turkey [2, 3].

In Turkey, *Allactaga elater* are represented by *A. e. elater* and *A. e. aralychensis*, and *Allactaga williamsi* by *A. w. williamsi*, *A. w. laticeps*, *A. w. schmidtii* [2]. However, *A. euphratica* is known to be monotypic form [2, 4].

Allactaga williamsi was described the basis of a single specimen from Van by Thomas [5]. Later, Ellerman [6], Osborn [7] and Kral and Benli [8] recorded the species on two specimens from Erzurum and Konya, on five specimens from Amasya (4 specimens) and Kayseri (1 specimen) and on a specimen from Ürgüp near Nevşehir respectively.

It was recorded that *Allactaga williamsi* showed a distribution in steppe areas and plateaus in eastern, middle and western Anatolia regions [2, 7, 9, 10, 11, 12, 13, 14]. Kumerloev [12] stated that *Allactaga williamsi* is widely distributed in central and eastern Anatolia and he also added that the modern agricultural applications imposed unfavourable conditions on them. Çolak et al. [15] carried out a study on the karyology of *Allactaga williamsi*.

Some rodent species can infect highly dangerous diseases such as plague, typhus and tularemia to the human being and animals, and they are also the carrier of various parasite species [16, 17, 18]. The assessment of distribution of rodent species therefore becomes extremely significant for health concerns.

The purpose of this study is to determine some ecological, biological, and karyological characteristics of *Allactaga williamsi* in Kırıkkale province.

MATERIAL AND METHODS

Field work was carried out between September 2002 and October 2004 in the Kırıkkale province and a total of 31

specimens of *Allactaga williamsi* were obtained. A projector or car headlight in the night was used to search for the presence of specimens in the field. Detected specimens were either shot dead or caught alive by using an aerial net. Twelve specimens were kept and fed at laboratory. Four standart external measurement and weights of the specimens were recorded. The specimens were skinned, stuffed and prepared as conventional museum type. The samples were deposited in the University of Kırıkkale, Faculty of Sciences and Arts, Department of Biology. The specimens were divided into three age groups as infant, juvenile and adult with respect to degree of tooth wear, fur colour and field notes. Since the variance analysis produced no statistically significant differences between the sexes [19] (student t test, $p>0,05$), measurements were evaluated together for each sex. Comparisons and evaluations were made considering with the adults data.

The guard hairs were taken from the shoulder blades dorsally and prepared according to Hayat [20]. Hair specimens were placed in acetone for 30 min, in an acetone-distilled water solution (1:1) for 15 min, and finally in distilled water for 10 min. Dried hairs in petri dishes were placed on stubs and coated with gold dust for 2 min with a Polaron SC 500. The tip, middle, and basal parts of the hairs were photographed at 1200X magnification with a JSM 5600 scanning electron microscope (SEM). The determination of hair scale forms was defined according to Benedict [21]. Definition of fur colour was made according to Ridgway [22], phallus to Lidicker [23] and karyology to Patton [24]. Sentromeric index of the chromosomes was evaluated according to Shahin and Ata [25].

RESULT

In the present study, amongst the genus *Allactaga* which shows distribution in Turkey, only *Allactaga williamsi* was found to exist in Kırıkkale province.

Allactaga williamsi Thomas, 1897

1897. *Allactaga williamsi* Thomas, Ann. Mag. Nat. Hist. 20: 309-311.

Type locality: Van, Turkey.

Diagnostic Characters: The glans penis is a naked part on the tip and covered with about 25-35 spines. Total length is 300-358 mm, hind foot length 61-74 mm, ear length 42-51 mm, condylobasal length 29.5-31.9 mm, basilar length 25.8-28.4 mm, occipitonasal length 30.3-32.8 mm, zygomatic breadth 21.4-24.0 mm and interorbital breadth 8.6-9.7 mm.

Habitat: *Allactaga williamsi* was found at altitudes between 700-1200 m in Kırkkale. Animals were observed to have lived in the areas having sparse grassy and oak trees. In the research area, *Cricetulus migratorius*, *Meriones tristrami* and *Microtus guentheri*, *Vulpes vulpes*, *Buteo* sp., *Coluber* sp. and *Lacerta* sp. were encountered.

Tooth Structure: The upper incisors are pro-odont. The upper and lower molars are with roots and there is no enamel folded. Only maxilla have premolar (Figure 1). M^1 and M^2 are with four roots, M^3 , M_1 and M_3 with two roots, M_2 with three roots. Dental formula is $i\ 1/1, c\ 0/0, pm\ 1/0, m\ 3/3 = 18$.

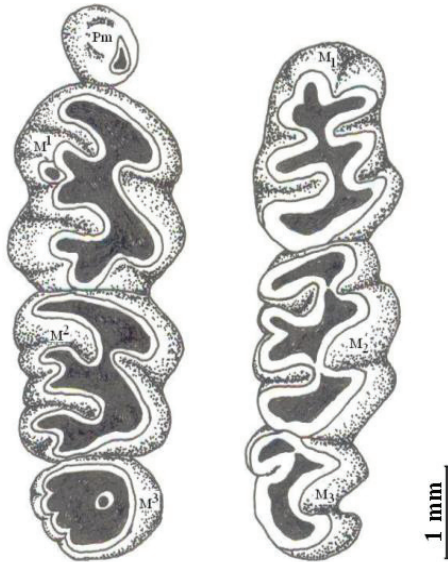


Figure 1. Maxillary (left) and mandibular tooththrow (right) of *Allactaga williamsi*

Phallus Features: There is no baculum in this species. The glans penis is a naked part on the tip and covered with about 25-35 spines (Figure 2). Very slight longitudinal groove is visible on dorsal surface.

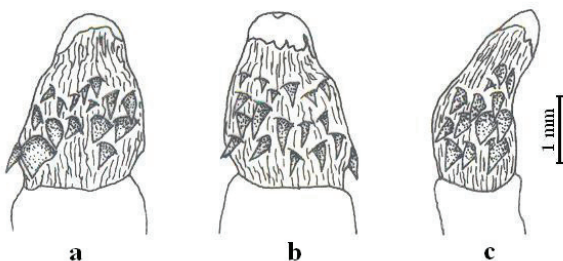


Figure 2. Views of glans penis: dorsally (a), ventrally (b), laterally (c)

Karyological Features: It was determined that the diploid chromosome number is $(2n)\ 48$, the fundamental (NF) numbers are 96 and 95 for female and male respectively and the number of autosomal arms (NFa) is 92. The chromosome set consists of metacentric, submetacentric and subtelocentric chromosome pairs. The first pair of the set are submetacentric and the largest of chromosome pairs. The X chromosome is medium-sized submetacentric, the Y chromosome is small-sized acrocentric (Figure 3). A secondary constriction was determined on one of 19th metacentric autosome pair.

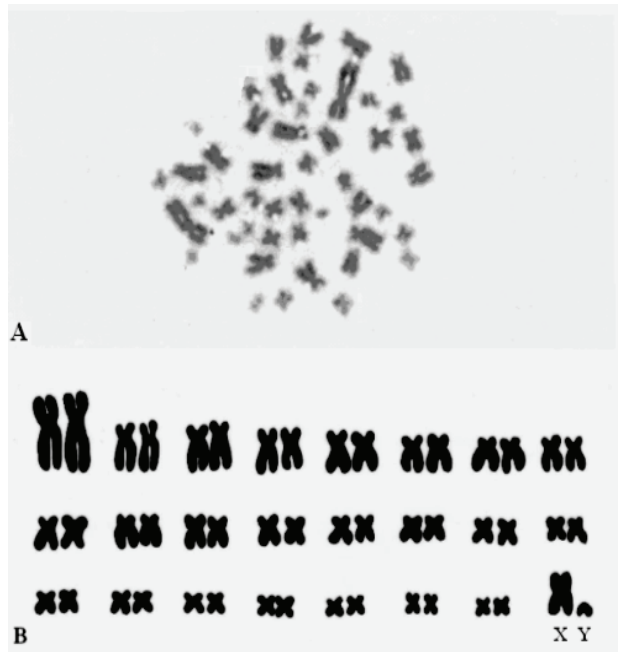


Figure 3. Metaphase spread (A) and idiogram (B) of *Allactaga williamsi*

Fur Colour and Molting: Dorsal colour of adult males and females varies from pale light yellowish gray to slightly reddish yellowish gray. Ventral colour is dirty white. Dorsal and ventral colours formed a slightly clear border on each flanks. Dorsal colour of juvenile males and females is slightly darker than the adults. Ventral colour is dirty white and dorsal and ventral colours are formed a slightly clear border on each flanks.

Dorsal hair of adults and juveniles of both sexes is pale gray from hair roots to hair tips, and pale yellow or reddish yellow below hair tips while hair tips are gray. Hairs on ventral are completely dirty white. The dorsal colour varies from gray to pale light yellow toward flanks. Tail colour is the same colour of the dorsal towards the flag. The subterminal part of the flag is pale black while terminal part is white.

Molting was observed only in individuals collected on July and August during this study. Therefore it was determined that *Allactaga williamsi* is molting once a year in the months, July or August. The base, shaft and tip parts of guard hairs are "annular" type on *Allactaga williamsi* (Figure 4). Hair scale form of this species was given for the first time with this study.

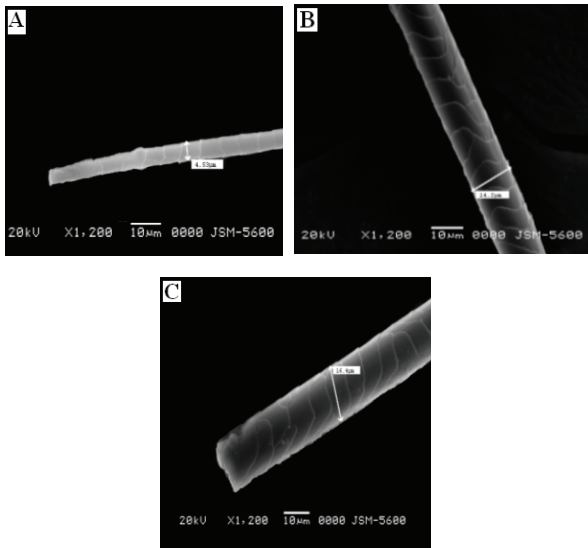


Figure 4. Hair morphology of *Allactaga williamsi*. Tip (A), shaft (B), and base (C).

Reproduction: A female caught in Karakeçili on June 2004, possessed 5 embryos. On a male from Keskin district, caught on May 2004, total weight of testis was recorded as 0.8 g. The testes of 12 adult males, collected on July 2004, were not clearly distinguishable. Two females with distinct mammae were caught alive from Çelebi on August 2003 and from Keskin on July 2004, and fed in the laboratory for two months, but no birth was observed. During this study between years 2002 and 2004, juvenile individuals were observed at the beginning of July on the field. Results showed that breeding season for *Allactaga williamsi* was on April and May and births were on June.

Measurements: External and cranial measurements and weights for four juveniles and 27 adults were recorded. No statistically significant difference was found between males and females ($P>0.05$) (Table 1).

Table 1. Statistical data of weight (g), external and cranial measurements (mm) of juveniles and adults of *Allactaga williamsi*: number of individuals (n), range (r), mean (m) and standard deviation (\pm Sd).

MEASUREMENTS	Juvenile (♂♂, ♀♀)				Adult (♂♂, ♀♀)			
	n	r	m	\pm sd	n	r	M	\pm sd
Total length	4	84.00-118.00	109.00	5.56	27	300.00-358.00	333.96	14.27
Head and body length	4	62.00-82.00	72.20	3.93	27	110.00-139.00	124.81	6.40
Tail length	4	33.00-44.00	37.90	3.46	27	190.00-229.00	209.15	10.65
Hind foot length	4	11.00-15.00	13.80	0.87	27	61.00-74.00	68.37	2.63
Ear length	4	19.00-29.00	25.20	1.87	27	42.00-51.00	44.52	1.95
Weight	4	13.50-28.00	19.30	3.76	27	53.60-142.70	90.22	22.02
Condylbasal length	1	29.40	29.40	-	22	29.50-31.90	30.89	0.62
Basal length	1	26.50	26.50	-	22	27.40-29.80	28.40	0.61
Basilar length	1	24.70	24.70	-	22	25.80-28.40	26.87	0.65
Condylbasilar length	1	27.30	27.30	-	22	28.10-30.10	29.02	0.61
Occipitonasal length	1	29.90	29.90	-	22	30.30-32.80	31.72	0.66
Diastema	3	9.20-9.70	9.47	0.25	25	9.80-10.90	10.21	0.25
Foramen incisivum	3	5.90-6.60	6.28	0.26	25	6.10-7.20	6.63	0.26
Nasal length	3	11.40-12.20	11.93	0.46	24	12.00-13.60	12.98	0.42
Upper molar alveoli length	4	5.70-6.40	6.05	0.29	25	5.70-6.78	6.23	0.29
Upper molar length	2	5.40-5.60	5.50	0.14	23	5.40-6.10	5.69	0.14
Tympanic bullae	1	8.80	8.80	-	22	8.10-9.20	8.65	0.32
Interorbital constriction	4	8.30-9.60	8.86	0.55	25	8.60-9.70	9.02	0.31
Occipital breadth	1	15.20	15.20	-	21	14.80-16.50	15.55	0.42
Nasal breadth	3	4.20-4.46	4.33	0.13	24	4.30-5.10	4.73	0.26
Palatal length	4	17.60-18.30	17.85	0.31	25	18.10-20.10	19.33	0.47
Rostral breadth	3	4.80-5.40	5.03	0.32	24	5.00-6.00	5.53	0.25
Palatinal length	4	16.30-17.00	16.60	0.30	25	17.00-18.60	17.77	0.44
Zygomatic breadth	1	21.40	21.40	-	24	21.40-24.00	22.78	0.64
Skull height with bullae	1	14.90	14.90	-	21	14.30-15.40	14.86	0.35
Braincase breadth	1	17.70	17.70	-	22	17.10-18.30	17.60	0.36
Lower molar alveoli length	4	6.50-7.26	6.92	0.37	26	6.60-7.40	7.02	0.20
Mandible length	4	16.60-17.40	16.90	0.38	26	17.50-19.00	18.27	0.47

Specimens examined (n=31) and localities: Kırıkkale: Çelebi, n=5 (no. 1, 1♀, 6 May 2004; no. 22, 1♀, 27 September 2004; no. 24, 1♀, 12 October 2004; nos. 29, 30, 2♀♀, 26 October 2004); Karakeçili, n=16 (no. 4, 1♀, no. 5, 1♂, 22 June 2004; no. 6, 1♀, 5 July 2004; nos. 7, 8, 2♀♀, 13 July 2004; no. 9, 1♂, no. 10, 1♀, 14 July 2004; no. 11, 1♂, 16 July 2004; no. 12, 1♂, 19 July 2004; nos. 13, 14, 2♂♂, 28 July 2004; no. 15, 1♀, 2 August 2004; no. 17, 1♀, 15 September 2004; no. 18, 1♂, 17 September 2004; nos. 26, 27, 2♀♀, 26 October 2004); Keskin, n=5 (no. 1831, 1♂, 30 July 2002; no. 2, 1♂, no. 3, 1♀, 17 May 2004; no. 16, 1♂, 9 August 2004; no. 23, 1♂, 5 October 2004); Sulakyurt, n=5 (no. 19, 1♂, nos. 20, 21, 2♀♀, 21 September 2004; nos. 25, 28, 2♂♂, 26 October 2004).

DISCUSSION

Thomas [5] described the general colour of *Allactaga williamsi* as “mixed yellowish buff and black” and ventral part white. The colour of our specimens was the same as that recorded by Thomas. However, the colour of adult specimens fed in the laboratory was found to be different, having heavily dark colouration.

Vinogradov [26] and Ognev [9] pointed out that there were 25-30 spines on the phallus surface of *Allactaga williamsi*. In this study, we encountered 25-35 spines in this species.

Comparing our data to those given for the one specimen by Thomas [5], three external characters (tail length, hind foot and ear length) and six cranial characters (basilar length, nasal length, interorbital breadth, braincase breadth, upper molar length, diastema length) except head and body length were similar. Measurements given by Osborn [7] for head and body, tail, hind foot and ear for the specimens collected from Amasya (4 specimens) and Talas (1 specimen), Tosya (2 specimens) from Berlin Zoology Museum, Van (5 specimens) from British Museum and 13 Van specimens from Chicago Natural History Museum were compared with those of our specimens and differences were found to be statistically insignificant ($P>0,05$). Atallah and Harrison [27] stated that two species, *Allactaga euphratica* and *A. williamsi* showed an increasing pattern in their external and cranial measurements from south through north in their distributional areas being in accordance with the Bergman's Rule.

In addition, they collected some specimens of *A. williamsi* in Turkey. Comparison made between adult *A. williamsi* specimens used in this study with those of *A. williamsi* obtained by Atallah and Harrison [27] from Turkey showed similarities on some cranial characters; condylobasal length, zygomatic width, braincase breadth, interorbital width, maxillary toothrow length and bullae length. Nine specimens collected by Çolak et al. [14] from different parts of Turkey were also compared to our specimens and differences in five external and 17 cranial character measures were determined to be statistically insignificant.

Ognev [9] stated that *Allactaga williamsi* distributed in steppe, semi steppe, with firm soil areas and up to 2500 m altitude. In addition, Çolak and Yiğit [3] recorded that this species existed at 500 m in plains in middle Anatolia and about 2500 m in western and eastern Anatolia. Our findings are similar to those of the above authors.

Kral and Benli [8] stated that *Allactaga williamsi* gave damages to agricultural areas. However during this study it was observed that *Allactaga williamsi* distributed in regions far from agricultural areas, this species is therefore not harmful to cultivated areas in Kırıkkale province. It is most likely that habitat restrictions in the study area affect the population of jerboa adversely because following the conversion of the area in the vicinity of Karakeçili town to the rice field all burrows in the area have been diminished (personal observation).

Çolak and Yiğit [3] indicated that *Allactaga williamsi* reproduced twice a year and average young number was recorded as 4,9 in their study. They also determined that this species molts once a year between June and September and was active between 12th of April and 2nd of November although there was no specimen detected between December and April. These results are found to be consistent with those in our study.

Karyotypes of our specimens were compared with the those of *Allactaga elater*, *A. euphratica*, *A. tetradactyla*, *A. williamsi* and *A. jaculus* [15, 25, 28, 29, 30] (Table 2). No karyotypic difference was detected on species of the genus *Allactaga*. However chromosomal differences between the species were observed only on the number of autosomal arms and shape of the X and Y chromosomes. Our results were similar to previous karyotypes given by different researchers for the same species.

Table 2. Karyotypic data of the genus *Allactaga*. 2n: Diploid chromosome number, NF: Fundamental number, NFa: Number of autosomal arms, M+SM+ST: Metacentrics, Submetacentrics and Subtelocentrics chromosomes, X: X chromosome, Y: Y chromosome

Country	Species and subspecies	2n	NF	NFa	M+SM+ST	X	Y
Europe [28]	<i>A. jaculus</i>	48	-	92	23	M	ST
Armenian [28]	<i>A. elater</i>	48	-	92	23	SM	-
Turkey [15]	<i>A. w. williamsi</i>	48	-	92	23	SM	A
Turkey [29]	<i>A. elater aralychensis</i>	48	-	92	23	SM	ST
Turkey [30]	<i>A. euphratica kivanci</i>	48	-	92	23	SM	A
Egypt [25]	<i>A. tetradactyla</i>	48	95-96	92	23	M	A
Turkey (This study)	<i>A. williamsi</i>	48	95-96	92	23	SM	A

Acknowledgements

We would like to thank Assoc. Prof. Dr. İlhami Tüzün for linguistic revision of the article.

REFERENCES

- [1] Wilson DE, Reeder DM. 2005. Mammal Species of the World. A Taxonomic and Geographic Reference. 3rd ed. Johns Hopkins University Press. Baltimore, 1-2000.
- [2] Kurtonur C, Albayrak İ, Kıvanç E, Kefelioğlu EH, Özkan B. 1996. Memeliler, Mammalia. 3-23, in: Türkiye Omurgalılar Tür Listesi, (A. Kence, C.C. Bilgin, eds), Nural Matbaacılık A.Ş., Ankara, 1-183.
- [3] Çolak E, Yiğit N. 1998. Ecology and Biology of *Allactaga elater*, *Allactaga euphratica* and *Allactaga williamsi* (Rodentia: Dipodidae) in Turkey. Tr. J. of Zoology, 22 (2): 105-117.
- [4] Ellerman JR, Morrison-Scott TCS. 1951. Checklist of Palearctic and Indian Mammals 1758-1946. Brit. Mus. (Nat. Hist.), London, 1-810.
- [5] Thomas O. 1897. On two new rodents from Van, Kurdistan. Ann. Mag. Nat. Hist. 20 (6): 308-311.
- [6] Ellerman JR. 1948. Key to the Rodents of South-West Asia in the British Museum collection. Proceedings Zool. Soc. London, 118: 765-816.
- [7] Osborn DJ. 1964. The hare, porcupine, beaver, squirrels, jerboas and dormice of Turkey. Mammalia, 28: 573-592.
- [8] Kral E, Benli O. 1979. Orta Anadolu'nun Kemirici Türleri ve Zarar Yaptığı Kültür Bitkileri. Bitki Koruma Bülteni. 19 (4): 191-217.
- [9] Ognev SI. 1948. Mammals of the U.S.S.R. and Adjacent Countries. Translated from Russian. Rodents. Moscow, VI: 1-508.
- [10] Misonne X. 1957. Mammifères de la Turquie Sud-orientale et du nord de la Syrie. Mammalia, 21: 53-67.
- [11] Oktar İ, İlikler İ. 1964. Türkiye Rodentia (Kemirici) Faunası. Böcü (Aylık Zirai Mücadele Dergisi), 1 (5): 9-15.
- [12] Kumerloev H. 1980. I. Anadolu Memeli Hayvanları Üzerinde Yapılmış Olan Araştırma ve Buluşların Tarihsel Gelişimi. II. Anadolu Rodentia: Kemiriciler. İstanbul Üniv. Orman. Fak. Derg., 30/B (2): 197-223.
- [13] Turan N. 1984. Türkiye'nin Av ve Yaban Hayvanları Memeliler. Olgun Kardeşler Matbaacılık Sanayi, Ankara, 1-177.
- [14] Çolak E, Kıvanç E, Yiğit N. 1994. A Study on Taxonomic Status of *Allactaga euphratica* Thomas, 1881 and *Allactaga williamsi* Thomas, 1897 (Rodentia: Dipodidae) in Turkey. Mammalia, 58 (4): 591-600.
- [15] Çolak E, Kıvanç E, Yiğit N. 1997. Taxonomic Status of *Allactaga williamsi* Thomas, 1897 (Rodentia: Dipodidae) in Turkey. Tr. J. of Zoology, 21 (2): 127-133.
- [16] Corbet GB, Southern HN. 1977. The Handbook of British Mammals, Blackwell Scientific Publications, London, 1-520.
- [17] Özsan K, Erel D, Fazlı A, Beyoğlu K. 1974. Ankara, Konya ve Urfa'dan Yabani Kemirici ve Elde Edilen Pireler. Mikrobiol. Bült., 8(3): 267-269.
- [18] Özsan K, Aktan M, Fazlı A, Beyoğlu K. 1974. Ankara, Konya ve Urfa'dan Yakalanan Yabani Hayvanlarda Leptospirosis Yönünden Araştırma. Mikrobiol. Bült., 8(3): 272-275.
- [19] Parker RE. 1979. Introductory Statistics for Biology. The Institute of Biology's Studies in Biology. London, (43): 1-222.
- [20] Hayat MA. 1972. Basic Electron Microscopy Techniques. Litton Educational Publishing Inc., New York.
- [21] Benedict FA. 1957. Hair structure as a generic character in bats. University of California Publications in Zoology. 59: 285-548.
- [22] Ridgway RA. 1886. Nomenclature of colours for naturalists and compendium of useful knowledge for ornithologist. Boston, 1-129. [23] Lidicker WZ. 1968. A Phylogeny of New Guinea Rodent Genera Based on Phallic Morphology. Journal of Mammalogy, 49: 610-643.
- [23] Lidicker WZ. 1968. A Phylogeny of New Guinea Rodent Genera Based on Phallic Morphology. Journal of Mammalogy, 49: 610-643.
- [24] Patton JL. 1967. Chromosome studies of certain Pocket mice. Genus *Perognathus* (Rodentia: Heteromyidae). Journal of Mammalogy, 48 (1): 27-37.
- [25] Shahin AAB, Ata AM. 2001. A comparative study on the karyotype and meiosis of the jerboas *Allactaga* and *Jaculus* (Rodentia: Dipodidae) in Egypt. Zoology in the Middle East, 22: 5-16.
- [26] Vinogradov BS. 1925. On the structure of the external genitalia in Dipodidae and Zapodidae as a classificatory character. Proc. Zool. Soc. London. 1: 577-585.
- [27] Atallah SI, Harrison DL. 1968. On the conspecificity of *Allactaga euphratica* Thomas, 1881 and *Allactaga williamsi* Thomas, 1897 (Rodentia: Dipodidae) with a complete list of subspecies. Mammalia, 32 (4): 628-638.
- [28] Zima J, Kral B. 1984. Karyotypes of European Mammals II. Acta Sc. Nat. Brno, 18 (8): 1-62.
- [29] Çolak E, Kıvanç E, Yiğit N. 1997. Taxonomic Status and Karyology of *Allactaga elater aralychensis* Satunin, 1901 (Rodentia: Dipodidae) in Turkey. Tr. J. of Zoology, 21 (4): 355-360.
- [30] Çolak E, Yiğit N. 1998. A new subspecies of Jerboa from Turkey; *Allactaga euphratica kıvanci* subsp. n. Tr. J. of Zoology, 22 (2): 93-98.