Journal of Applied Biological Sciences 7 (3): 37-41, 2013
ISSN: 1307-1130, E-ISSN: 2146-0108, www.nobel.gen.tr

Kariological and Biological Study on Genus *Allactaga* Cuvier,1836 (Mammalia:Rodentia) in Iran

Mohammad MORADI[1*] Pooyan MORADI [2]
[1] Faculty of Science, Takestan Branch, Islamic Azad University, Takestan, Iran
[2] Department of Biology, Faculty of Science, Zanjan University, Zanjan, Iran

Corresponding Author
E-mail: moradi_g@yahoo.com

Received: October 20, 2013
Accepted: December 18, 2013

Abstract

In this study, 64 specimens of *Allactaga* collected from various areas of Iran were evaluated based on morphological, biometrical, karyological, ecological and biological characteristics. It was determined that three species *Aallactaga elater*, *Allactaga euphratica* and *Allactaga williamsi*. That *Allactaga euphratica euphratica* and *Allactaga euphratica williamsi* , are different species rather than two subspecies. *Allactaga elater* , *Allactaga euphratica* and *Allactaga williamsi* were found to have identical karyotype consists of the diploid number of chromosomes 48 (2n=48) and the number of autosomal arms 92 (NFa=92).

It was determined that the period March-August is breeding season of *Allactaga euphratica* and the period April-August of *Allactaga williamsi*.

Key Words: Iran,*Allactaga*,biology,karyology

INTRODUCTION

Thomas defined 2 specimens collected from Iraq in [1] year as *Allactaga euphratica*. Ellerman [2], reported that 6 specimens collected from Syria and Amman (Jordan) and 8 specimens collected from Bagdad (Iraq) and Kuwait belonged to *Allactaga euphratica* species. Misonne[3] evaluated 15 *Allactaga euphratica* specimens collected from Turkey and reported that *Allactaga euphratica* looked like *Allactaga williamsi*. Ellerma and Morrison- Scott [4], Hatt [5] ,Misonne [3]. Lewis et al [6], Lay [7], Atallah [8] reported *Allactaga euphratica* as a monotypical species and that its certain distribution boundaries in west were unknown. Harrison [9] reported that this taxon was distributed in southeastern regions of Iran, while Kumerloeve (10) reported that it can be found in steppe of Central and Eastern Iran. Thomas identified a specimen collected from Qazvin in [1] as *Allactaga williamsi*. Atallah [8] identified a specimen collected from Gökçekısık as *Allactaga williamsi laticeps*; Satunin [11] identified specimens collected from Azerbaijan as *Allactaga williamsi* schmidti according to interior characteristic dimensions. Ellerman[2] evaluated the specimens collected from Erzurum and Konya (Turkey) as *Allactaga williamsi williamsi* and LEHMANN [12] evaluated the specimens collected from Tosya (Kastamonu) as *Allactaga williamsi williamsi*. Ogvev [13], Hatt [5] and Lay [7] didn't point out that *Allactaga williamsi* can be distributed in Iran without showing a record of any specimen. Based on 32 specimens collected by other researchers, 28 of which were from Iran, Atallah and Harrison [9] who studied higher number of specimens than other researchers reported that *Allactaga elater* and *Allactaga euphratica* was distributed in an area from Afghanistan to west of Turkey, Saud Arabia, North Caucasians and Caspian Sea. The researchers attributed distinguishing characteristic differences of *Allactaga williamsi* and *Allactaga euphratica* species with type locations located in 500 mile distance from each other to characteristic grading from south to north according to Bergman law. They reported that distribution areas of these two species were the continuation of each other and were not sympatric. Based on 4 specimens collected from Palmyra (Suriye), approximately 300 km south of Urfa, they reported that there was an interrupted hybridity between *Allactaga williamsi* and *Allactaga euphratica*; that the specimens collected from Jordan strengthened this view and thus *Allactaga williamsi* can only be a sub-species of *Allactaga euphratica*. In addition to these studies, karyologic studies were carried out on *Allactaga* species. Matthey [14] found diploid chromosome number in *Allactaga williamsi* as (2n) 48, Gray[15] and Bobrinskii[16], carried out a study on 7 different populations of *Allactaga elater*, which were

geographically isolated from each other, which also included aralychensis sub-species and found diploid chromosome number as (2n) 48 and number of autosome chromosome arms as (Nfa) 92. They reported that there was no change with the chromosome in the species. The literature contains various studies on the biology and ecology of *Allactaga* species. Fenyuk[17], Argyropulo [18] and Kolesnikov [19] studied nutrition and reproduction biology of *Allactaga elater* species. They reported that *Allactaga elater* fed on plant seeds, trunks of alliaceous and succulent plants, insects and insect larvae, fresh shootings of melon and water melon plants and were generally pesticides for agriculture. They also reported the species living in Caucasia and Central Asia reproduced for 3 times in a year and that number of youngs varied between 2-5; they described nest structure of the distinguishing species and reported that the nest had 2 entrances however there was one structure gallery opening to the nest chamber. Kadhim [20] reported that *Allactaga euphratica* species living in Iraq changed fur once a year; Naranjo [21] reported that the most favorable reproduction period in Iraq was February-May although low number of reproductions was observed in October. Ognev [13]reported that the biology of *Allactaga williamsi* species was not known much and that they damaged wheat fields. Kral and Benli [22] made taxonomic evaluation of *Allactaga willimsi* species around Nevşehir and reported that the species damaged wheat, melon and water melon fields. However, there is no detailed study on the biology or ecology of the taxa distributed in Iran. Yalnız Lay [7] reported that this species consumed some herbaceous flowering plants in Iran. It is understood from abovementioned studies that 3 species belonging to *Allactaga* Cuvier,1836 genus can be Allactaga elater, *Allactaga euphratica* and *Allactaga williamsi*.

MATERIAL AND METHOD

This study used stuffed fur, skull, karyotype and caught field and laboratory notes belonging to 65 *Allactaga* specimens collected from various locations in Iran in 2006-2007. Since it was not possible to analyze holotype specimens, topotype specimens were collected from type locations. Dead and alive specimens were collected from neighboring areas to the distribution area of the taxa outside Iran, from the locations recorded in literature and from possibly hybrid locations and randomly selected locations. 4 exterior measurements (mm) and weights (gr) of dead caught specimens were recorded. The ones whose furs were not damaged were frozen in the form of standard museum research specimen while the only the head was taken in the ones whose furs were damaged. In addition, sex, testicle, uterus and lactation status, embryo number and embryo dimensions of each specimen were measured in the field. Skulls were kept in 80 C water batch in 15% ammoniac for 1-2 hours and were cleaned using a fine tip pens. They were then dried in 35 incubator. In addition to characteristic measurements recorded in literature, 36 characteristic measurements which were considered as necessary were collected from each skull using callipers and micrometer with a sensitivity of 0.01 mm. Skull was analyzed under l up; the most significant formations which were decided to have distinguishing characteristics were drawn under binocular. They were prepared according to Corbet [23] and phallus length was taken in the field from the material whose glans penis measurements were prepared. After determining the chambers, shape of lower jaw condyloid process like a head of an eagle, status of skull joints, enlargement of zygomativ arches to backwards, teeth erosion and fur characteristics. The animals were divided into four age groups. Alive specimens required for karyologic studies were supplied by digging the nests and removing the animals whose nests were detected by automobile or tractor headlamp or projector at night or day. Karyologic studies were performed according to Ford –Hemarton [25], Scherz [26],Tjio and Whang [27],Patton [28]and Cuyier [29]. Karyological studies were performed on alive specimens (8 males and 8 females) collected from type locations and also which were obtained from the areas apart from type locations irrespective of number of specimens. 25-30 metaphase plates were analyzed from the preparates prepared for each specimen and diploid chromosome number (2n)was determined. Among the analyzed preparates, 15-20 appropriate karyotypes were photographed. metacentric (m), submetacentirc (sm) ,subtelocentric(st) ,telocentric (t) and acrocentric(a) chromosome numbers and number of autosomal arms (Nfa) and shapes of sex chromosomes were identified according to centromere position reported by Patton[28]and Lidicker[30] with the aim of using these in future studies.

RESULTS

1. Allactaga elate (Lichtenstein,1825)

Habitat

Allactaga elate lives in localities where *Artemisietum spp, Halostachys spp* and *Haliidium spp* plants are widely distributed. Although these areas are flooded by rain in winter and spring, it has a calcareous, hard soil with sometimes weak flora. *Allactaga elater* live in one-entrance nests in this locality.

External morphological characteristics

Dorsal of the body varies from reddish dark brown to blackish brown gray to sections of these hairs are reddish brown in color. Median line at the back is in the form of a significant line. The color becomes lighter to the sides and turns to light reddish brown. However, in one of the analyzed 8 adult specimens the color was found to be reddish orange. Posterior) of the head is lighter in color than the dorsal of the body and has dark yellow or grayish marks. The cheeks and the area under the chin are white. Outer sections of earlaps are reddish; while inner sections are covered with white hairs. There is a white-like circle around the eyes. the area under the abdomen is white. This section is divided to side parts of the body by a line which is more reddish brown than the belly at the back of earlaps to the hind feet and kneepans.

Karyological characteristics

Number of diploid chromosomes was 48 (2n=48), number of autosomal chromosome arms was 92 (Nfa=92). The most prominent characteristic of *A.elater* karyotype was that 1.pair autosome chromosomes are significantly larger and submetacentric than others. There is a gradually shrinking in chromosomes; the karyotype consisted of 14 pairs of submetacentric; 5 pairs of subtelocentric and 4 pairs of

metacentric chromosomes. Chromosome X was medium and submetasentrik, while chromosome Y was telocentric and the smallest chromosome of the karyotype (Figure - 1)

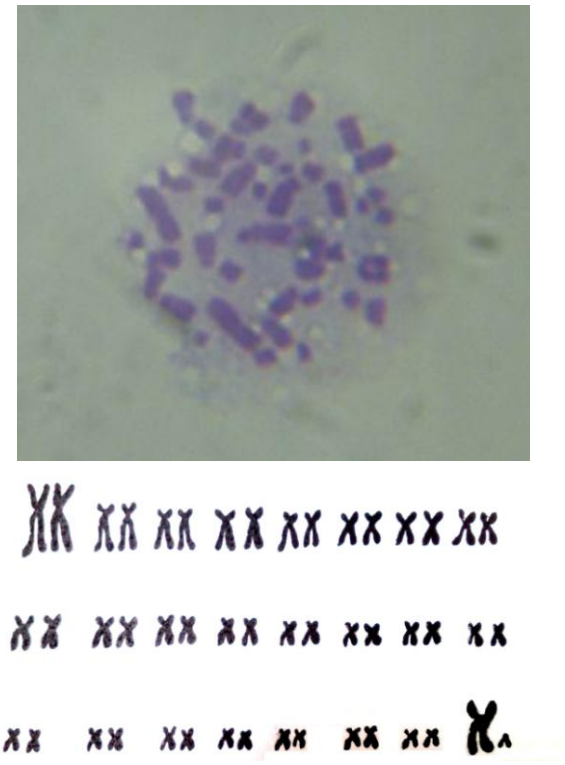

Figure 1. A = Metafaz plate and B = Idiogram series in *Allactaga elater*

Reproduction biology

In a nest dug on 25 June 2006 in Qazvin basin, 4 young and 3 lactating specimens and also a female specimen with four youngs were obtained. The youngs were weaned; their eyes and ears were open. Since we didn't have enough data, it is not possible make a statement about time of reproduction, number of birth, number of youngs.

***2. Allactaga euphratica* Thomas,1881**

Habitat

A.euphratica live in one-entrance nests in the locality which has undamaged natural flora, hard soil with rare stones and a weak flora around Zanjan state.

External morphological characteristics

Dorsal of the body is dark brown along the media line. Base sections of these hairs are dark gray. Top sections are pale yellowish white. Posterior of the head is lighter than the dorsal of the body and this color varied from light pale yellow to yellowish color in analyzed 11 adult specimens. The cheeks and area under the chin are white. Inner edges of each earlaps are covered with dark brown black hairs which become less intense to the edges. Outer layer of earlaps is brown while inner sections are covered with white, thin, sparse hairs. area under the abdomen is white. This section is divided from the sides of the body by a reddish pale yellow line extending from the back of earlaps to the kneecaps or hind feet. Outer parts of hips are reddish while inner parts are white. This whiteness extends to the base section of tail from the lower sections of hips. Dorsal of the tail is brown yellow while ventral is lighter in color. Tail flag has 3 colors. Proximal region has longer hairs which are brownish yellow; subthermal region is covered with black and edge section is covered with whit hairs.

Karyological characteristics

Number of diploid chromosomes was 48 (2n= 48) number of autosome chromosome arms was 92 (NFa=92). The most important characteristic of *A.euphratica* karyotype is that like in *elater* and *williamsi* , 1.pair autosomal chromosomes are significantly larger and submetacentric than others. In addition, when compared to two other species, this chromosome pair is closer to the center of centromere chromosome. The karyotype consists of 16 pair submetasentric ,7 pair metasentric chromosomes. Chromosome X is submetacentric, chromosome Y is telocentric and the smallest chromosome of the karyotype (Figure-2).

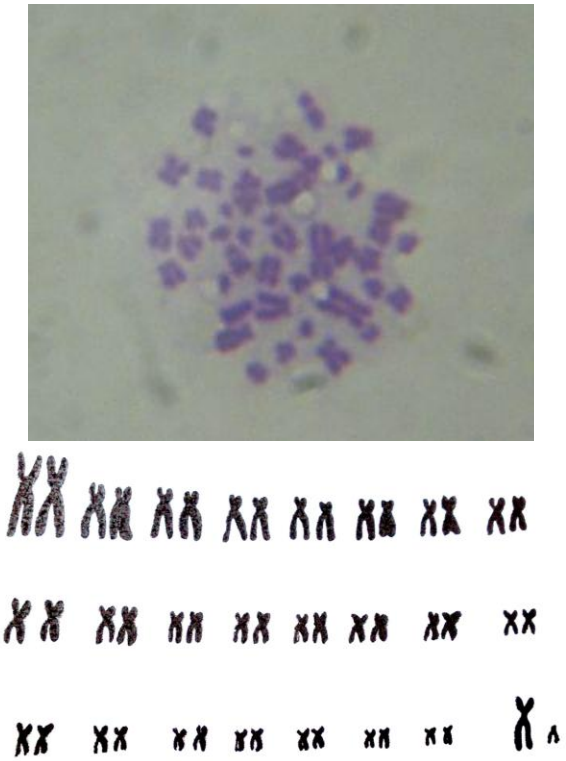

Figure 2. A = Metafaz plate and B = Idiogram series in *Allactaga euphratica*

Reproduction biology

Based on field notes on reproduction obtained from field studies in Zanjan in May and September and data collected from a female with 6 youngs and a specimen which gave a birth in laboratory, reproduction period, number of birth, number of young, number of birth development, care of youngs and young behaviors were identified.

3. Allactaga williamsi Thomas ,1897

Habitat

A.williamsi live in central and eastern Iran in areas with natural flora, sparse plants, hard soil with an elevation of 350 - 2500 (m).

External morphological characteristics

Dorsal of the body is blackish dark brown along the median line. Base sections are these hairs are reddish gray; top sections are dark yellowish. The color becomes lighter to the sides and becomes light reddish to yellow. Posterior of the head is lighter in color than the dorsal of the body and is brown. The cheeks and area under the chin are white. Outer section of earlaps are covered with very dark, fine hairs; the edges are hairless; inner sides are covered with sparse whitish hairs.

Karyological characteristics

Diploid chromosome number was 48 (2n=48), number of autosome chromosome arms was 92 (NFa = 92). The most important characteristic of *A.williamsi* is that like in *elater* and *euphratica* 1.pair autosome chromosomes are submetacentric and larger than other chromosomes (Figure-3). In addition in this chromosome pair, centromere is further than the center. II. autosome pair is submetacentric. In the karyotype, 15 pairs of submetacentric; there are one pair of subtelocentric, 7 pairs of metacentric chromosomes. Chromosome X is medium in size and submetacentric, chromosome Y is telocentric.

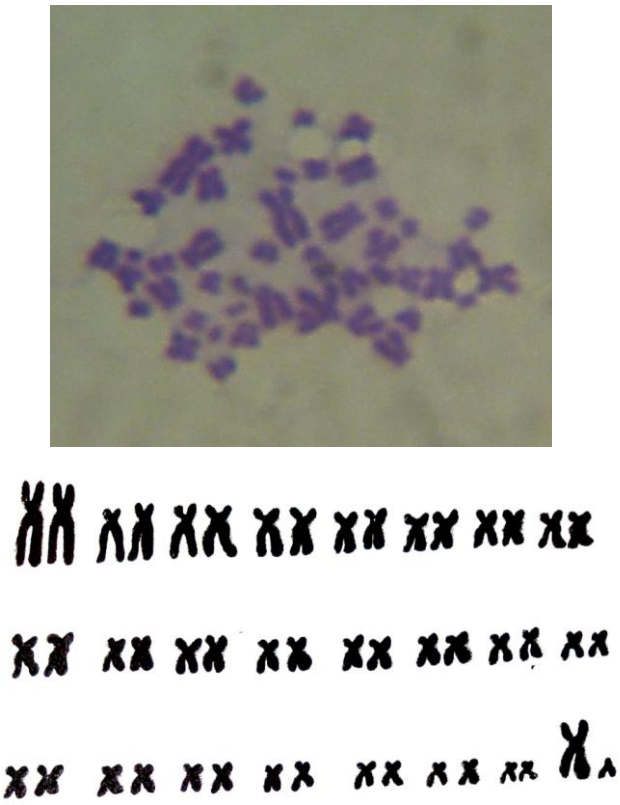

Figure 3. A = Metafaz plate and B = Idiogram series in *Allactaga williamsi*

Reproduction biology

Based on the data notes on reproduction collected in field studies in 2006-2007 and 5 specimens which gave birth in laboratory, reproduction period, number of births, number of youngs, birth behavior, development after birth, care for youngs and behaviors of youngs of *A.williamsi* were determined.

DISCUSSION

***Allactaga elater* (Lıchtenstein,1825)**

Lichtenstein [31], Argyropulo [18] and Ognve [13] reported that dorsal fur color of *A.elater* is brownish and light sand color. The colors reported by the researchers were found to be similar with the color of the adult collected from Qazvin however the color was brighter. However, no specimen with light sand color was found. Misonne [3] Gray[15] and Bobrinskii[16] reported that *A.elateriin* had diploid chromosome number of 48 (2n = 48), number of autosome chromosome arms of 92 (NFa = 92). It was found that karyologial characteristics reported by the researchers for the species were the same with those of the specimens collected from Qazvin.

Comparison with *Allactaga euphratica*

In karyological terms, *A.elater* has 14 pairs of submetasentrik,5 pairs of subtelocentric and 4 pairs of metacentic chromosomes while *A.euphratica* has 16 pairs of submetacentric and 7 pairs of metacentric chromosomes. Comparison of two species in ecologic and biologic terms reveals that the species are distinguished from each other particularly in terms of nest structure. Although some nests have two entrance holes in *A.elater*, all nests have single entrance in *A.euphratica*.furthermore, nest gallery is in the form of interrupted lines while it is smooth in *A.euphratica*.

Comparison with *Allactaga williamsi*

In *A.williamsi*, which is the largest one in size among Iran *Allactaga* species, is easily distinguished from *elater* with its dark brown and blackish dorsal fur color. Subtermibal region of tail flag is light brown in *elater* and chestnut color in *williamsi*. In karyological terms, these two species are easily distinguished as *A.elater* has 14 pairs of submetacentric, 5 pairs of subtelocentric and 4 pairs of metacentric chromosomes while *williamsi* has 16 pairs of submetacentric and 7 pairs of metacentric chromosomes. In terms of nest structure, the differences between *elater* and *euphratica* are the same for *A.* elater and *A.williamsi.*

Aknowledgment

This study financially supported by **Iran National Science Foundation (INSF).** (Research project no: 91000074)

REFERENCES

[1] THOMAS, O. 1881. Description of a new species of *Allactaga* from Mesopotamia. Ann. Mag. Nat. Hist. 8(5): 15.

[2] ELLERMAN, J.R. 1948. Key to the Rodents of southwest Asia in the British Museum collection. Proceedings Zool. Soc. Lond. 118: 765-816.

[3] MISONNE, X. 1959. Analyse zoogeographique des Mammiferes de I'Iran. Memoires Inst. r. Sci. nat. Belg. 59(2): 1-157.

[4] ELLERMAN, J.R. and MORRISON-SCOT=T', T.C.s. 1951. Checklist of Palaearctic and Indian mammals, 1758 to 1946. Brit Mus. nat. Hist. Lond. s. 1-810.

[5] HATT, R.T. 1959: The Mammals of Iraq. Miscellaneous Publ. Mus. Zool. Univ. Mich. No. 106: 1-113.

[6] LEWIS, RoE., LEWIS, J .H., and HARRISON, DL. 1965. On a collection *of* mammals from Northern Saudi Arabia. Proc. Zool. Soc. London 144(1): 61-74.

[7] LAY, D.M. 1967. A study *of* the mammals *of* Iran, resulting from the street Expedition *of* 1962-63. Fieldiana Zoo1. 54: 1-282.

[8] ATALLAH, S.I. 1977. Mammals of the eastern Mediterranean region; their ecology, systematics and zoogeographical relationships. Part 2.Sa.ugetierkundliche Mitt. 26: 1-50.

[9] HARRISON, D.L. 1972. The Mammals of Arabia: Laqomorpha and Rodentia. Vol. 3. Ernest Benn Ltd. 385-670.

[10] KUMERLOEVE, H. 1975. Die Saugetiere (Mammalia) der Turkei. VerOff. Zool. Staatssammlung Munchen 18: 69-158.

[11] SATUNIN, K. 1907. Verzeichies der auf Exoursion in die Kreise Geokcai und bohemasha gesammelten Saugetiere. Mitt. Kauk. Mus. 3: 250-254.

[12] LEHMANN, E. 1969. Eine neue Saugetier auf Sammlung aus der TUrkei in Museum Koening (Kumerloeve-Reisc (1968)), 314-315.

[13] OGNEV, S.I. 1948. Mammals of the U.S.S.R. and Adjacent cauntries. Translated from Russian. Rodents. Vol. VI, Moscow, s. 1-508.

[14] MATTHEY, R. 1956. Nouveaux apports a la cytologie comparee des ronqeurs. Chromosoma. 7: 670-692.

[15] GRAY, G.H. 1842. *Allactaga indica.* Ann. Mag. N. H. 10: 262.

[16] BOBRINSKII, N.A. KUZNETSOY, B.A. and KUZY AKIN, A.P. 1965. Key to the mammals of the U.S.S.R. Moscow. 1-381.

[17] FENYUK, B.K. 1928. Biology of Jerboas. Ibidem, No 2: 89-91.

[18] ARGYROPULO, A.I. 1939. The distribution and ecology of certain mammals of Annenia (translation). Acad. Sci. U.S.S.R., Annenian Branch, Trans. BioI. Inst. 3: 47-57.

[19] KOLESNIKOV, 1.1. 1936. Material on significance of certain rodents for new crops. Trudy Instituta pozeshchite rastenii. 4(2): 1-15.

[20] KADHIM, A.H. and W AHID, I.N. 1986. Reproduction of male Euphrates jerboa *Allaclaga euphralica* Thomas (Dipodidae: Rodentia) from Iraq. Mammalia. 50(1): 107-111.

[21] NARANJO, CA., POGGIO, L. and BRANDHARM, P.E. 1983. A practical method of chromosome classification on the basis of centromere position. Genetica, 62: 51-53.

[22] KRAL, E. ve BENLi, O. 1979. Orta Anadolunun kerimici tiirleri ve zarar yaptlgl kiiltOr bitkileri. Bitki Koruma Biilteni. 19(4): 191-217.

[23] CORBET, G.B. 1978. The mammals of the Palaearctic region: a taxonomic review. Brit. Mus. nat. Hist. London/Cornell Univ. press. s. 1-334.

[24] OSBORN, DJ. 1964. The hare, porcupine, beaver, squirrels, Jerboas, and dormice of Turkey. Mammalia. 28: 573-592.

[25] FORD, G.E. and HAMERTON, *JL*. 1956. A colchicine hypotonic-citratc. squash squence for mammalian chromosomes. Stain Tech. 31: 247-254.

[26] SCHERZ, R.G. 1958. Blaze drying, by dipniting the fixative, for improved spreads of chromosome in leucocytes. Stain Technology. 26: 1.

[27] TJIO, J.H. and WHANG, J. 1962. Chromosome preparations of bone marrow cells without prior in vitro culture or in vivo colchicine administration. Stain Techn. 37: 17-20.

[28] PATTON, J. 1967. Chromosome Studies of centain pocket mice, benus Perognathus (Rodentia: Heteromyidae). Journal of Mammalogy. 48(1): 27-37.

[29] CUYlER, F. 1836. *Allactaga.* Proceedings Zool. Soc. Lond. Vol. 4: 141-142.

[30] LIDICKER, W.Z. 1968. A phylogeny of new quinea Rodent Genera based on p~allic morphology. 49(4): 610-643.

[31] LICHTENSTEIN, H. 1825. Ueber die Springmause. Abhandl. d. Bed. Acad. d. Wissench. (2): 26.