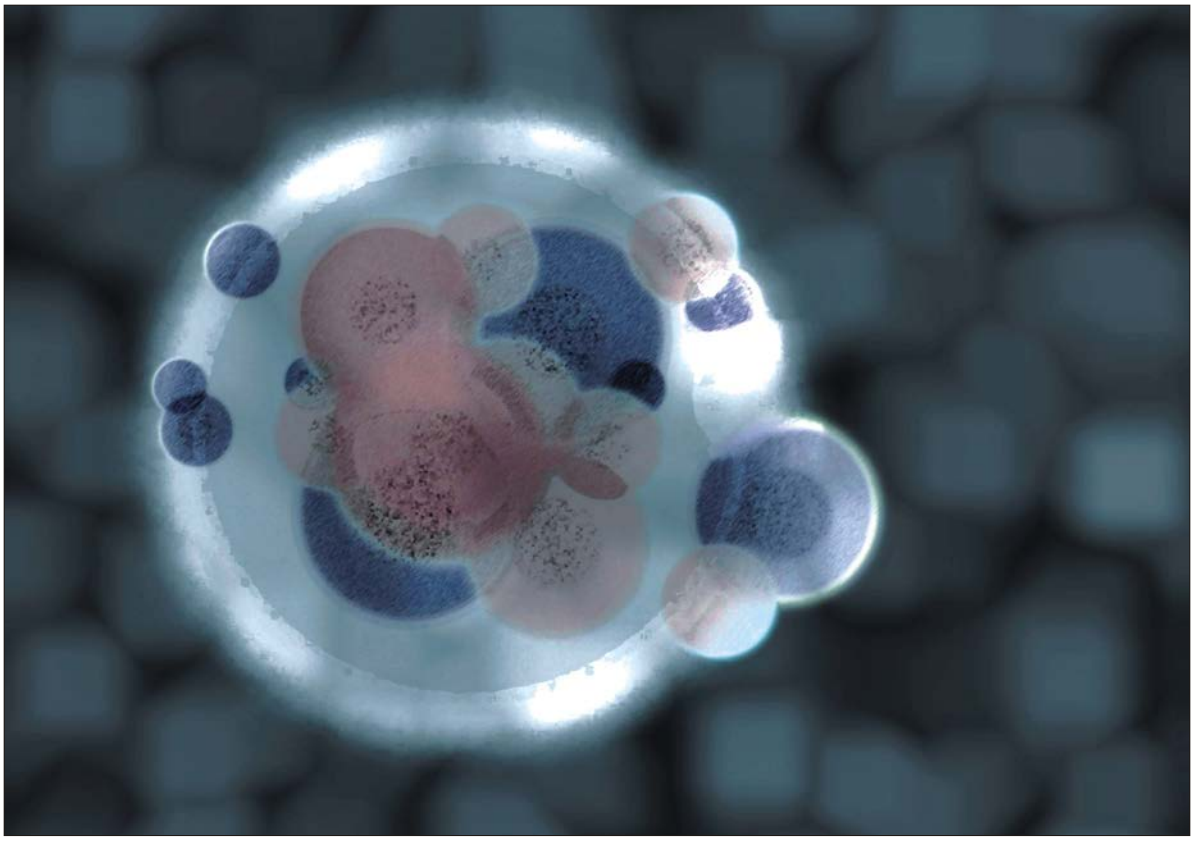

Journal of Biological Sciences

ISSN 1727-3048

science alert

ANSInet
an open access publisher
http://ansinet.com

Journal of Biological Sciences 6 (4): 754-757, 2006
ISSN 1727-3048

Karyotype Analysis of Ground Squirrel (Mammalia: Rodentia) in Malatya (Türkiye)

[1]Muhammet Gaffaroglu and [2]Esref Yuksel
[1]Department of Biology, Faculty of Arts and Science,
University of Ahi Evran, 40200, Kirşehir, Türkiye
[2]Department of Biology, Faculty of Science and Arts,
University of Gazi, 06500, Ankara, Türkiye

Abstract: The study was carried out in order to determine chromosomal variations both within and between populations in *Spermophilus* in Malatya. By the analysis of karyotypes we obtained the diploid chromosome number 2n = 42 and NF = 68 and NFa = 64 of these one pair of chromosome was metacentric, seven pairs were submetacentric, four pairs were subtelocentric and eight pairs were acrocentric. The X chromosome was metacentric and Y was acrocentric. In the result it was shown that there was difference neither in the number nor in the morphology of the chromosomes both within and between populations. The results were compared with previous studies and the karyological and taxonomical status of *Spermophilus* were discussed.

Key words: Rodentia, *Spermophilus*, ground squirrel, chromosome, karyotype, Türkiye

INTRODUCTION

Ground squirrels were first described by Linne and called as *Mus* in 1766, then *Citellus* in 1816 and finally *Spermophilus* in 1825 (Doğramaci *et al*., 1994). The first record of *Spermophilus* from Turkey was given by Bennet (1835) as *Citellus citellus xanthoprymnus*. Then Mursaloğlu reported two species from Turkey one was from Thracia called as *C. c. thracius* (Mursaloğlu, 1964) the other was from Niğde and called as *C. c. gelengius* (Mursaloğlu, 1965). Doğramaci *et al.* (1994) carried out a karyological study on ground squirrel in Turkey and they concluded that there are two species of ground squirrels in Turkey and one was *S. citellus* and the other *S. xanthoprymnus.*

In the classification of some taxa such as Mammalia and Insecta biochemical and cytogenetical studies have been widely used besides morphometric and diagnostic characters. Within last two or three decades, the chromosomes are to be the most important and indispensable tool in the classification and solving taxonomic problems (Savic and Soldatovic, 1979). Chromosomal analysis is one of the most convenient tools in the explanation of speciation and taxonomic problems. Chromosomal analyses are being widely used both in discriminating sibling species and in establishing phylogenetic relationship among related taxa. In specific chromosomal analysis ensure indispensable knowledge in the establishment of relationship among mammalian groups. There are also number of study on the speciation which brought about by chromosomal mutations such as translocation, inversion, duplication, deletions etc.

MATERIALS AND METHODS

Fifty specimens of the ground squirrels were collected from the predetermined two localities in Malatya (Türkiye). The specimens were live-trapped in their natural habitats and kept in laboratory for 5-6 days in order for their adaptation to laboratory conditions. A direct method of Patton (1967) "colchicine-hypothonic-citrate" technique was applied for the preparation of chromosomes. Then the specimens stuffed and preserved according to standard museum techniques. In order to determine the diploid chromosome number of each animal an average of 20 to 30 metaphase cells were counted. Determination of diploid chromosome numbers, number of fundamental (NF), number of fundamental autosomes (NFa) and chromosome morphology was made by standard analytical procedure (Yüksel, 1984).

RESULTS

It is determined that the specimens in both two populations belong to *Spermophilus xanthoprymnus.* Representative karyotypes of species and chromosomal forms are presented in. By the karyotype analysis of both intra and inter populations, it was established that the diploid number of chromosomes was 42, NF 68 and NFa 64 (Fig. 1 and 2). According to the position of the centromere

Corresponding Author: Muhammet Gaffaroglu, Department of Biology, Faculty of Arts and Science, University of Ahi Evran, 40200, Kirşehir, Türkiye

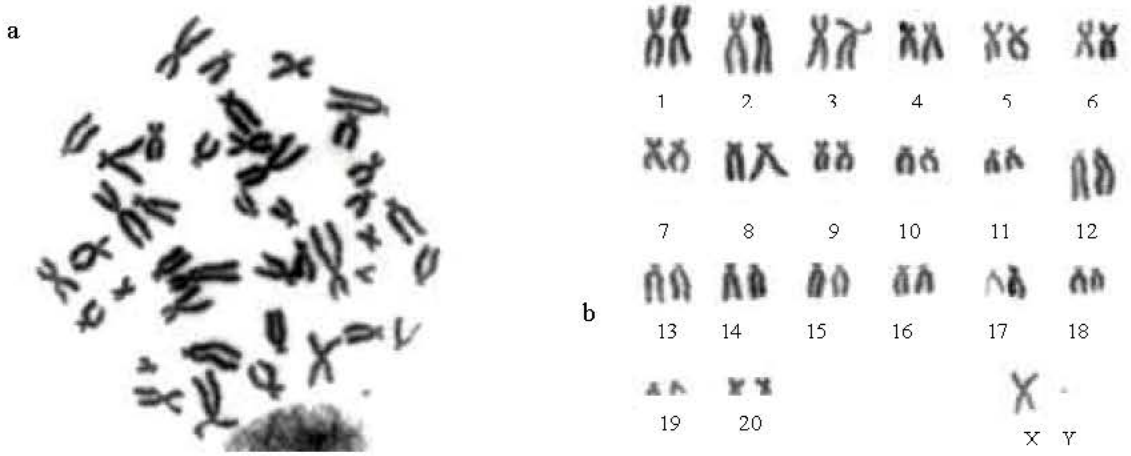

Fig. 1: Male metaphase (b) of *Spermophilus xanthoprymnus*

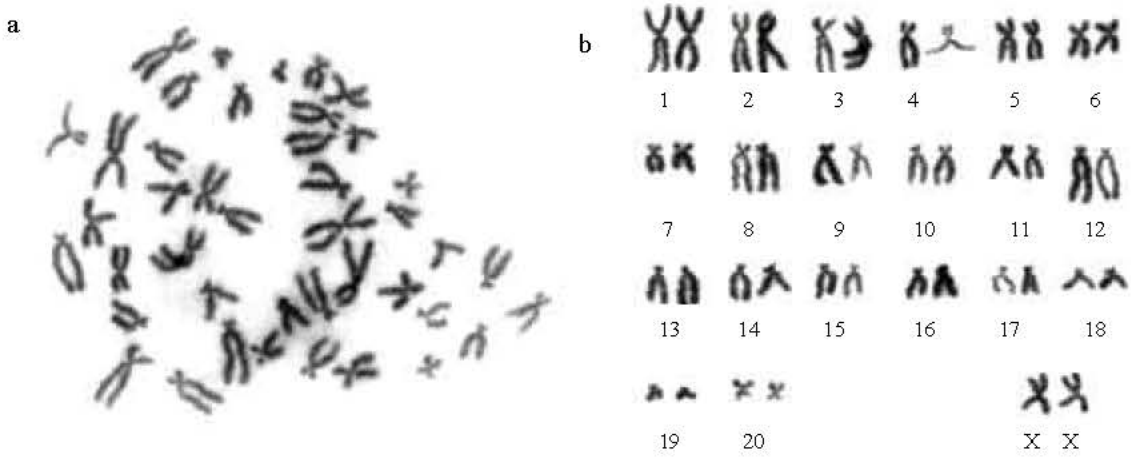

Fig. 2: Female metaphase (b) of *Spermophilus xanthoprymnus*

Table 1: Summarized data on chromosome studies of *Spermophilus xanthoprymnus* arranged from Giemsa-stained chromosomes, m-metacentric, sm-submetacentric, st-subtelocentric and a-acrocentric chromosomes

				Chromosomes							
				Autosomes				Gonosomes			
Sex	Specimen No.	Metaphase No.	Diploid No. (2n)	m	sm	st	a	X	Y	NF	Nfa
						4	8				
Male	30	100	42	1	7			m	a	68	64
Female	20	100	42	1	7	4	8	m	-	68	64

the chromosomes could be placed in four groups. The first group consists of one pair of metacentric autosomes. The second group consisted of seven pairs of submetacentric autosomes. The third group of subtelocentric chromosomes consists of four pairs of autosomes. The last group consisted of eight pairs of acrocentric autosomes The X-chromosome was metacentric, while Y-chromosome was acrocentric and the smallest of the chromosome (Table 1).

DISCUSSION

As a result, significant differences neither in chromosome number nor in chromosome morphology were observed between populations. Also, the populations were similar in the cranial characteristics. Ellerman and Morrison-Scott (1951) and Corbet (1978) argued that there is only *S. citellus* species, which was the only species of the genus *Spermophilus* in Türkiye.

(Ellerman and Morrison-Scott (1951) and Yuksel (1984) classified the species *S. xanthoprymna*, which described by Bennet (1835) from Erzurum, as a subspecies and called *S. citellus xanthoprymnus*. Mursaloğlu (1965) in an investigation on the morphology of ground squirrels, notified that there were at least four subspecies of *S. citellus* in Türkiye. The first karyological study in Türkiye on ground squirrels was carried out by Doğramaci *et al.* (1994). According to their results there were two species of ground squirrels in Türkiye. One was *S. citellus* found in Thracia part of Türkiye and the other was *S. xanthoprymnus* (Bennet, 1835) found in Anatolian part of Türkiye. They showed that the diploid chromosome numbers in *S. citellus* was 2n=40 and in *S. xanthoprymnus* was 2n = 42. Thus it became apparent that *S. citellus xanthoprymnus* was not a subspecies. Instead it is a species and should be classified as *S. xanthoprymnus*. In a study carried out by Orlov *et al.* (1969) on the karyotype of *S. xanthoprymnus* from Armenia, the diploid number was found to be 2n = 42. The karyotype contained 13 pairs biarmed and seven pairs single armed chromosomes with a metacentric X chromosome and a small biarmed Y chromosome. The similar results were obtained by Voroncov and Lapunova (1967). These investigators described the karyotypes of *S. citellus* from Thracia part of Türkiye and found 2n = 40. There were two pairs of metacentric, 12 pairs of submetacentric, four pair of subtelocentric and one pair of acrocentric chromosomes.

Zima (1987) described the karyotypes in several populations of the *S. citellus* in different regions of Czechoslovakia and found that the diploid number of chromosomes was 2n = 40 and consist of two pairs of metacentric, 13 pairs of submeta-subtelocentric and four pairs of acrocentric autosomes. The X chromosome was medium sized subtelocentric and Y chromosome was not described in detail. The karyotype of *S. xanthoprymnus* in the present study was similar to those of given for Armenia both in diploid number and in the morphology of the sex chromosomes. However, it differed with one more pair of acrocentric chromosomes. Belcheva and Peshev (1985) studied the karyotype of *C. citellus*, the diploid number of chromosomes was 2n = 40 and Nfa value was 68. The X chromosome was submetacentric and Y-chromosome was small and subtelo-acrocentric. Comparing with the other analyzed populations in Thracian part of Türkiye (Doğramaci *et al*., 1994), Armenia (Orlov *et al*., 1969), Caucasia and Armenia (Voroncov and Lapunova, 1967) and Czechoslovakia (Zima, 1987) the diploid number of chromosomes and fundamental number in the present study were quite similar within explainable variation. In principle most of the authors (Patton, 1967; Savic and Soldatovic, 1979; Yüksel, 1984) agreed that the evolution of Mammalian karyotype took the course of a decrease in diploid number of chromosomes especially in the acrocentrics. From this point of view *S. xanthoprymnus* seem to be the most primitive species. Through centric fusion two acrocentric chromosomes may fuse at the centromere to produce one bi armed chromosome. Thus this mechanism allows for the evolution of the karyotype in such way that diploid number is reduced but the fundamental number is kept constant. Fundamental numbers, on the other hand, may change by pericentric inversions through which some of acrocentric chromosomes may be converted into bi-armed chromosomes without changing chromosome number (Yüksel, 1984).

Chromosomal differences in *Spermophilus* family may be accounted to the above summarized mechanisms. In addition, small chromosomal aberrations such as duplications, deletions and partial translocations may have minor roles in the evolutionary course. Thus it may be concluded that *S. xanthoprymnus* is the initial form from which *S. citellus* might have originated. Our conclusion is that; investigations based on morphologic, anatomic, biometric and other traditional methods of taxonomy is not enough for the classification of sibling species and also more data, such as karyotypic and biochemical analysis, needed in the correct classification of species belonging to the same family. In addition karyological and biochemical data is also needed in the explanation of evolutionary course of this species.

ACKNOWLEDGMENT

We would like to thank Prof. Dr. Erkut Kivanç (University of Ankara, Faculty of Science, Department of Zoology) who helped us for identification of specimens.

REFERENCES

Belcheva, R. and D. Peshev, 1985. Constitutive Heterochromatin in the ground squirrel *Citellus citellus* L. (Sciuridae, Rodentia) from Bulgaria. Zool. Anz., 5: 385-390.

Bennet, E.T., 1835. Mammals of the neighboard of trebizond and erzeroum. Porc. Zool. Soc. London, 3: 89-90.

Corbet, G.B., 1978. The mammals of the Palearctic Region A taxonomic Review. British Museum, N. H. London, pp: 1-314.

Doğramaci, S., H. Kefelioğlu and I. ve Gündüz, 1994. Türkiye *Spermophilus* (Mammalia: Rodentia) cinsinin karyolojik analizi. Tr. J. of Zool., 18: 167-170.

Ellerman, J.R. and T.C. Morrison-Scott, 1951. Checklist of Palearctic and Indian Mammals, 1758 to 1946. London, pp: 1-808.

Mursaloğlu, B., 1964. Stastical significance of secondary sexual variations in *Citellus citellus* (Mammalia: Rodentia) and a new subspecies of *Citellus* from Turkey. Communications, IX: 252-273.

Mursaloğlu, B., 1965. Geographic variation in *Citellus citellus* (Mammalia: Rodentia) in Turkey. Communications, 10: 78-109.

Orlov, V.N., M.A. Rodova and E.V. Kotenkova, 1969. Chromosomal differentiation of the ground squirrel subgenus Citellus. Mat SOV Pomlekopit, II: 48-49.

Patton, J.L., 1967. Chromosome studies of certain pocket mice genus *Perognatus* (Rodentia, Heteromyidae). Mammalogy, 48: 27-37.

Savic, I. and B. Soldatovic, 1979. Distribution range and evolution of the chromosomal forms in the *Spalacidae* of the Balcan Peninsula and bordering regions. J. Biogeogr., 6: 363-374.

Voroncov, N.N. and E.A. Lapunova, 1967. The chromosomes of *Palearctic* ground squirrels (*Citellus*, Marmotinae, Sciuridae, Rodentia). Mat II, SOV, Pomlekopit, pp: 41-47.

Yüksel, E., 1984. Cytogenetic study in *Spalax* (Rodentia: Spalacidae) from Turkey. Communications, 2: 1-12.

Zima, J., 1987. Karyotypes of certain rodents from *Czechoslovakia* (Sciuridae, Gliridae, Cricetidae). Folia Zool., 36: 337-343.