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Karyotype of *Apodemus flavicollis* in Giresun, Turkey

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Abstract

In this study, the karyotype analysis of four *Apodemus flavicollis* specimens caught alive and delivered to the laboratory and also four specimens born in the laboratory has been performed using the technique of “Colchicine hypotonic citrate”. The diploid chromosome number (2n), the basic chromosome number (NF) and the autosomal chromosome number (NFa) have been determined by examining about 30 metaphase cells of each specimen. It has been determined that the diploid chromosome number is 2n=48, the basic chromosome number is NF=48 and the autosomal chromosome number is NFa=46. It has been found that all autosomal chromosomes are acrocentric and they are in different sizes; while the X chromosome is in a big acrocentric structure, the Y chromosome is not. In the overwintered land specimens and the laboratory specimens, it has been determined that there is not any B chromosome and there are not any differences between their karyotypes.

Keywords: Yellow-necked Field Mouse, *Apodemus flavicollis*, B chromosome, Giresun.

Introduction

The types which belong to the *Apodemus* kind are rodents ^[1-3] that have the largest distribution area in the temperate zone of the Palearctic region. About 20 *Apodemus* kinds have been known to be distributed in the Asia and the Europe ^[4].

According to the recent researches, it has been determined that in Turkey, there are six types which belong to this kind (*A. sylvaticus*, *A. flavicollis*, *A. mystacinus*, *A. agrarius*, *A. uralensis*, *A. iconicus*) ^[5, 6]; *A. flavicollis* is distributed in Turkey, in all Thrace, in the forested lands situated on the coastal strip in the north of the Anatolia, in the woodlands of the Mediterranean region in the west and the south and in the Imbros ^[7-13].

It is hard to distinguish these two types, *A. flavicollis* and *A. sylvaticus*, in the regions where they live and exist sympatrically. For this reason, Neuhäuser ^[14], Osborn ^[15], Lehmann ^[16], Ondrias ^[17], and Harrison ^[18] have done researches; and it has been recorded by them that *A. flavicollis* and *A. sylvaticus* are the closest two types to each other. Although Doğramacı ^[19] finds the crossbreeds of these two types which their taxonomies are still debated, in the geographic contact zones, he specifies that there are differences in the kind levels in terms of many characteristics in the areas out of these regions, and these two types are the closest types to each other. Doğramacı and Kefelioğlu ^[20], record that each three types have 2n=48 chromosome by examining the specimens of *A. flavicollis* and *A. mystacinus* as karyological; and there are not any differences between *A. sylvaticus* and *A. flavicollis* as karyological. Çolak *et al.* ^[21] examines these three types (*A. sylvaticus*, *A. flavicollis*, *A. agrarius*) which belong to *Apodemus* from Thrace with the methods of the morphometric, the karyotypical and the electrophoretic; and he reports that *A. sylvaticus* and *A. flavicollis* have the same karyotypically features.

Zima and Macholan ^[22], record that in the specimens which are taken from different lands of the distribution area of the *A. flavicollis* in the European range, there are additional (B) chromosomes changing between 1 and 6. In addition to this, Zima *et al.* ^[23], report that male's specimens with B chromosome have a selective advantage and also this situation is possibly in relation to survival during the winter season. Vujosevic *et al.* ^[24], report that in the central Balkans, the frequency of animals with B chromosomes increases with altitude and is negatively correlated to average temperature and habitat suitability. Therefore, the presence of B chromosomes is putatively widening the genetic variability and hence enabling the species to extend its response to the environment by occupying more habitats. Zima and Macholan ^[22], record that in European Turkey, approximately one quarter of the specimens have from one to three additional chromosome in their karyotypes; however, in their study carried out in 1997, in the Anatolian populations, there are not B chromosomes ^[25].

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Although a lot of researches in relation to the taxonomical situations of the *Apodemus* types have been carried out, there are disputes about distinguishing among *A. flavicollis*, *A. sylvaticus*, and *A. ponticus* types; the latest evidences in the matter of the karyological structure of the *A. flavicollis* or the possibility of the deficiencies in the studies of these types directed the researchers to these studies.

In this study, B chromosomes of the karyological structures of the overwintered specimens of *A. flavicollis* taken from Giresun and the overwintered specimens taken from the same region and bred in the laboratory. In this way, the existence of B chromosome in the Anatolian and the laboratory specimens has been tried to be found. Furthermore, the karyological structures of both specimens which are overwintered in the laboratory and the overwintered specimens taken from the land have been studied.

2. Material and Methods

In this study, between the years 2005 and 2012, three female and one male specimens which were taken from three different localities (Keşap, Yağlıdere, Merkez) and three male and one female specimens which were born in the laboratory in other words in total 8 adult specimens were used in the karyological studies. According to Ford and Hamerton [26], the karyotype

analysis was done in accordance with the “Colchicine hypotonic citrate” technique. About 30 metaphase cells of each specimen were studied with x100 immersion objective from the prepared karyotype slides. As a result, the numbers of the diploid chromosome number (2n), fundamental chromosome number (NF) and autosomal chromosome number (NFa) were determined and the photographs and the ideogram of the metaphase plaques were obtained.

3. Results

Karyological analysis of *A. flavicollis* revealed that the diploid chromosome number was $2n=48$, the fundamental chromosome number was $NF=48$ and the autosomal chromosome number was $NFa=46$. All autosomal chromosomes were acrocentric and they were in different sizes; the X chromosome was in a big acrocentric and the Y chromosome was in a small acrocentric. In the overwintered land and the laboratory specimens, it was determined that there was not B chromosome and there were not any differences between the karyotypes (Figure 1). It was also determined that there was not B chromosome and there were not any differences between the *A. flavicollis* specimens and the laboratory specimens.

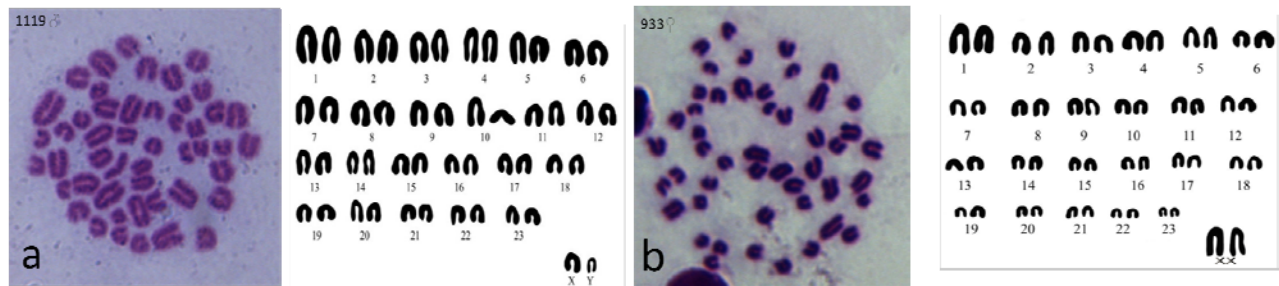


Fig 1: In *A. flavicollis*, the metaphase plaque and the ideogram of the male (a) and female (b) specimens.

4. Discussion

Niethammer [27], records that in *A. flavicollis* and *A. sylvaticus* the karyotypes are not different; however, there are differences in the chromosome number in the three specimens which belong to the *A. flavicollis* ($2n=50$) in a region called Sar-Planina; and in one sample ($2n=49$) from Bonn. *A. flavicollis* have B chromosome, however, this chromosome is not available in the Anatolian populations in Turkey [22-25]. However, in our study we have not determined that there are B chromosome in the overwintered *A. flavicollis* specimens and the laboratory specimens.

Doğramacı and Kefelioğlu [20], Çolak *et al.* [21] record that $2n=48$ fundamental chromosome number of *A. flavicollis* has $NF=48$ acrocentric chromosome, and the autosomal chromosome number of it has $NFa=46$ acrocentric chromosome; and the X chromosome is big acrocentric and the Y chromosome is small acrocentric. It has finally been understood that the result of the karyotype analysis carried out in this study is in accordance with the literature findings and there are not any differences between the karyological structures of the adult *A. flavicollis* specimens and the laboratory specimens.

5. Conclusion

From the findings of the karyological structure of *Apodemus* species, the presence of B chromosomes in the species has been recorded by many researchers. Zima and Macholan noted in their studies dated 2005 and 2007 that B chromosomes were

found in the specimens of Turkey in the European side, however it was also noted that there weren't any specimens in the Anatolian side.

The adult specimens of *A. flavicollis* used in the field and laboratory were found to have no are B chromosomes and this finding is consistent with Zima and Macholan's findings.

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