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Robertsonian chromosomal variation in subalpine voles *Microtus* (*Terricola*), (*Rodentia, Arvicolidae*) from Greece

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Sixteen specimen of *Microtus* (*Terricola*) collected in subalpine meadows of the Pindos and Iti mountains were karyotyped. All 11 animals from the Pindos mountain had the same karyotype with 2n = 42, NF = 42. The individuals collected on Iti mountain had a karyotype with 2n = 40, NF = 42 characterized by a large pair of metacentric chromosomes. The two karyotypes were closely related and one might have derived from the other by a Robertsonian centric fusion/fission. In both karyotypes the X and Y chromosomes were large acrocentrics. The karyotypes of the voles studied were more similar to that described for *M.* (*T.*) *thomasi* than to the other species of *Terricola* known in Greece.

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Introduction

Very little is known about the systematics of the voles of genus *Microtus* (subgenus *Terricola*), formerly known as *Pitymys*, in Greece. Three species have been described from northern and central parts of the country: *M.* (*T.*) *thomasi* Barrett-Hamilton, 1903, *M.* (*T.*) *subterraneus* (de Sélys-Longchamp, 1836) and *M.* (*T.*) *felteni* Malec and Storch, 1963 on the basis of morphological characteristics (Ondrias 1966, Niethammer 1982, 1986, Vohralik and Sofianidou 1986, Sofianidou and Vohralik 1991). However, the systematic surveys have not been extensive and may lack precision.

Since it is generally accepted that karyological studies contribute to the solution of taxonomic problems, an effort was undertaken to clarify the various taxa of voles in Greece as well as the inter- and intrapopulation relationships by means of karyological analysis.

The voles of subgenus *Terricola* have long been known to have variable karyotypes (Král and Zima 1978) with pericentric inversions and Robertsonian translocations as the most frequent rearrangements (Kratochvíl and Král 1974,

Lyapunova *et al.* 1988). Previous studies have shown that there are two chromosomal races of *M.* (*T.*) *thomasi* in southern Greece which differ by a pericentric inversion (2n = 44, NF = 44 and 46) (Giagia and Ondrias 1973, Giagia 1985, E. B. Giagia, unpubl.) (Fig. 1). Laboratory hybrids between these races are fertile (E. B. Giagia and C. V. Stamatopoulos, unpubl.). In the present work we describe the karyotypes of some subalpine voles from northwestern and central Greece.

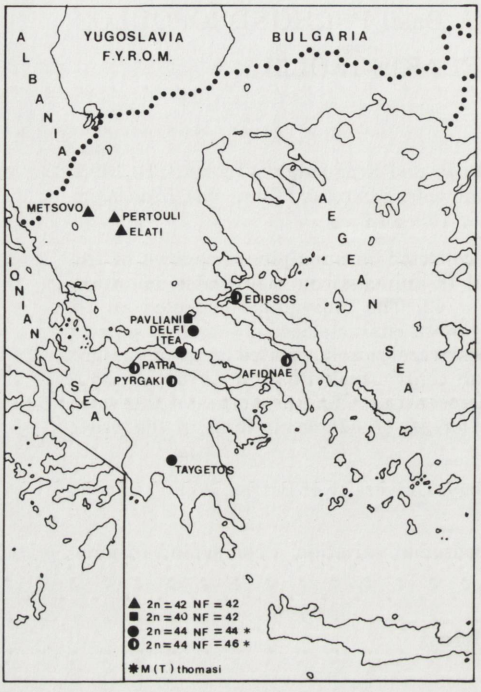

Fig. 1. Map of Greece showing the sites for which there is karyotypic information on *Microtus* (*Terricola*).

Material and methods

Sixteen specimens of *Microtus* (*Terricola*) *thomasi* were collected in four localities within the Pindos and Iti mountains (Fig. 1). All the individuals were collected in subalpine meadows. Direct chromosome preparations were made from bone marrow (Hsu 1969), and the G-band method of Seabright (1971) was used to stain the chromosomes. The specimens studied were deposited in the collections of Zoological Museum of Patras University.

Results

All the individuals collected in the Pindos mountains (Table 1) had the same karyotype with 2n = 42, NF = 42 (Fig. 2). The individuals collected near Pavliani (Iti mountain) had a karyotype with 2n = 40, NF = 42, characterized by a large pair of metacentric chromosomes (Fig. 3). From comparison of the G-band patterns

Table 1. Details of the animals studied.

Sampling locality	Altitude	Number of individuals			Chromosome number	
		Males	Females	Total	2n	NF
Metsovo, Pindos Mts	1200 m	4	4	8	42	42
Pertouli, Pindos Mts	1100 m	1	–	1	42	42
Elati, Pindos Mts	1000 m	1	1	2	42	42
Pavliani, Iti Mt.	1250 m	4	1	5	40	42

of these two karyotypes it is clear that chromosomes 5 and 8 occur as acrocentrics in the 2n = 42 form and combined together as a metacentric in the 2n = 40 form.

In female individuals of both karyotypes two pairs of similarly-sized acrocentric chromosomes were observed (Fig. 2). However, in males only three large acrocentric chromosomes were present. The largest acrocentric pair in females (present in one copy in males) is presumably the X chromosome, while the smaller pair is autosome number 1.

Traditionally the Y chromosome is thought to be the smallest acrocentric in most species of *Terricola* (Král and Zima 1978). However, in nearly all male metaphases examined in this study, a single large acrocentric was observed. This chromosome, which was almost totally heterochromatic and missing from female metaphases, is presumed to be the Y chromosome.

Discussion

The subalpine voles of the genus *Microtus* (subgenus *Terricola*) from the Pindos and Iti Mts have similar karyotypes with 2n = 42, NF = 42 and 2n = 40, NF = 42 respectively. One karyotype has presumably arisen from the other by a Robertsonian centric fusion/fission event. The karyotypes of the specimens studied are more closely related to *M.* (*T.*) *thomasi* with 2n = 44, NF = 44, 46 (Giagia 1985) than to *M.* (*T.*) *subterraneus* with 2n = 54, 52, NF = 60 (Kratochvíl and Král 1974) or to *M.* (*T.*) *felteni* with 2n = 54, NF = 56 (Petrov *et al.* 1976) which are the three species of the subgenus *Terricola* that have been described in Greece (Niethammer 1982).

A comparison of our karyotypes with those given by Zima (1984) for *M.* (*T.*) *subterraneus* reveal similar G-banding patterns for most autosome pairs. However, it should be noted that such similarities are very common among the karyotypes of arvicolids (Nadler *et al.* 1976, Gamperl 1982).

A subalpine vole species from Caucasia, Transcaucasia and Asia Minor, the *M.* (*T.*) *daghestanicus* Shidlovskii, 1919 is characterised by a stable NF = 58 and various chromosome numbers 2n = 54, 52, 46, 42, 40 and 38, due to Robertsonian translocations (Lyapunova *et al.* 1988). Although the diploid chromosome numbers described in the present paper are the same as some of those of *M.* (*T.*) *daghe-*

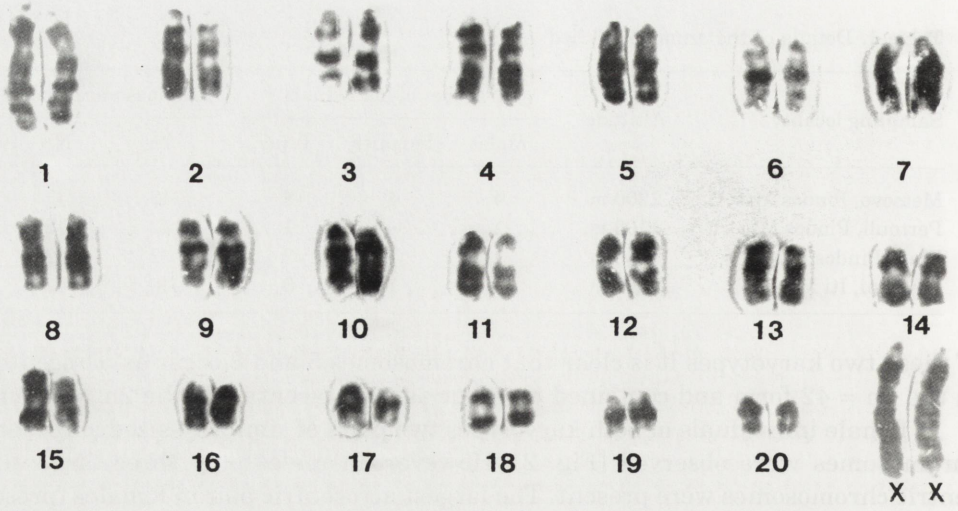

Fig. 2. G-band karyotype of a female *Microtus* (*Terricola*) from Elati (Pindos Mts).

Fig. 3. G-band karyotype of a male *Microtus* (*Terricola*) from Pavliani (Iti Mt.).

stanicus (2n = 42, 40) it is unlikely that the animals we studied belong to this taxon because *M.* (*T.*) *daghestanicus* have NF = 58, while we found NF = 42.

Further G-banding chromosomal studies in conjunction with morphological investigations are necessary to clarify the taxonomy of the subgenus *Terricola* in Greece.

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