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A Robertsonian population of Mus musculus L. in the Orobian Alps

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Biologia. — *A Robertsonian population of* Mus musculus *L. in the Orobian Alps* (*). Nota di ERNESTO CAPANNA (**) e MARCO VALLE (***), presentata (****) dal Socio A. STEFANELLI.

RIASSUNTO. — È stata descritta una popolazione di topo delle abitazioni (*Mus musculus* L.), individuata nelle Alpi Orobie, caratterizzata da $2n = 22$. Il cariotipo analizzato su 14 animali provenienti da 3 differenti località (Gorno, in Val Seriana; Civo in Valtellina; Bergamo sul versante padano delle Orobie) si è costantemente dimostrato costituito da 9 coppie di metacentrici Robertsoniani, dalla coppia di acricentrici no. 19 dello Standard Mouse Karyotype e dagli eterocromosomi. È stato discusso il significato di questo popolamento nell'ambito del problema della variabilità del cariotipo di *Mus musculus* in generale ed in particolare sul suo ruolo nel sistema Robertsoniano Retico.

In a recent paper Capanna *et al.* (1976) [1] summed up data available in the literature up to that time on the presence of populations homozygous through multiple Robertsonian metacentrics in natural house mouse populations. In fact, the phenomenon of the Robertsonian type karyotype variability in *Mus musculus* has in recent years taken on considerable significance owing to the discovery of an increasing number of natural populations affected by this kind of chromosomal change. So far 4 natural populations homozygous for multiple Robertsonian metacentrics have been described:

i) Val Poschiavo, $2n = 26$, Robertsonian Metacentrics Rb 1-7 Bnr. (Gropp, Tettenborn and Lehman, 1970 [2]);

ii) Val Mesolecina, $2n = 28$, Rb 8-12 and 1 Bnr (Gropp, Winking, Zech and Muller, 1972 [3]).

iii) Central Apennines (Abruzzo and northern Lazio), $2n = 22$, Rb 1-9 Rma (Capanna, Civitelli and Cristaldi, 1973 [4]).

iv) Central Apennines (Molise and northern Puglia), $2n = 22$, Rb 10-18 Rma (Capanna, Civitelli, Cristaldi and Noack, 1977 [5]).

Neglecting the data related to the Apennine populations which are not directly connected with the observations reported here, it must also be mentioned that heterozygous situations, as revealed by variable chromosome numbers within the population and by trivalents in meiotic diakinesis, have been desribed in Val Bregaglia, Val S. Giacomo and other sites in the Grisons by Gropp [3] as well as in the eastern Dolomites by our group [6].

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(****) Nella seduta del 16 aprile 1977.

Evidence thus exists of a large complex of house mouse populations changed through Robertsonian translocations, independent as far as Robertsonian metacentric composition is concerned, but interrelated with hybrid populations and centered round the Rhaetian Alps. This complex of Robertsonian populations has been called the " Raethian complex " by Capanna [7].

During a house mouse collection campaign for the very purpose of clarifying problems connected with the interdependence of homozygous and heterozygous Robertsonian populations of the Raethian complex, a number of populations situated in the Orobian range were found to be characterized by a diploid number of $2n = 22$, i.e. showing 9 pairs of Robertsonian metacentrics.

The table shows the sites inspected, the ecological characters of these sites, the number of animals examined karyologically for each sex. The technique used for chromosomal analysis was the customary air-drying one for bone marrow, while a modified method proposed by Evans *et al.* (1964 [8]) was used for the spermatocyte diakineses. The material examined has been deposited with the *Museo Civico di Storia Naturale* of Bergamo.

TABLE I

Source of Material

Localities	Environment (Altitudes a.s.l.)	No. of Animals		Preparation Code
		♂	♀	
Gorno	Farmstead (700 m)	4	5	From ZM 5 to ZM 13
Civo	House in rural district (660 m)	—	1	ZM 14
Bergamo (New City)	House in urban environment (249 m)	1	—	ZM 17
Bergamo (Old Town)	Victual warehouse (365 m)	—	3	From ZM 23 to ZM 25
Number of animals: TOTAL		5	9	

As already mentioned, the 22-chromosome karyotype is characterized by 9 pairs of large metacentric autosomes which pair off, in spermatocyte diakinesis, to form 9 large bivalents. Because of its size and the presence of characteristic secondary constrictions, the pair of acrocentrics is definitively related to no. 19 of the *Standard mouse karyotype* [9]. The karyotype is completed by the pair of heterochromosomes.

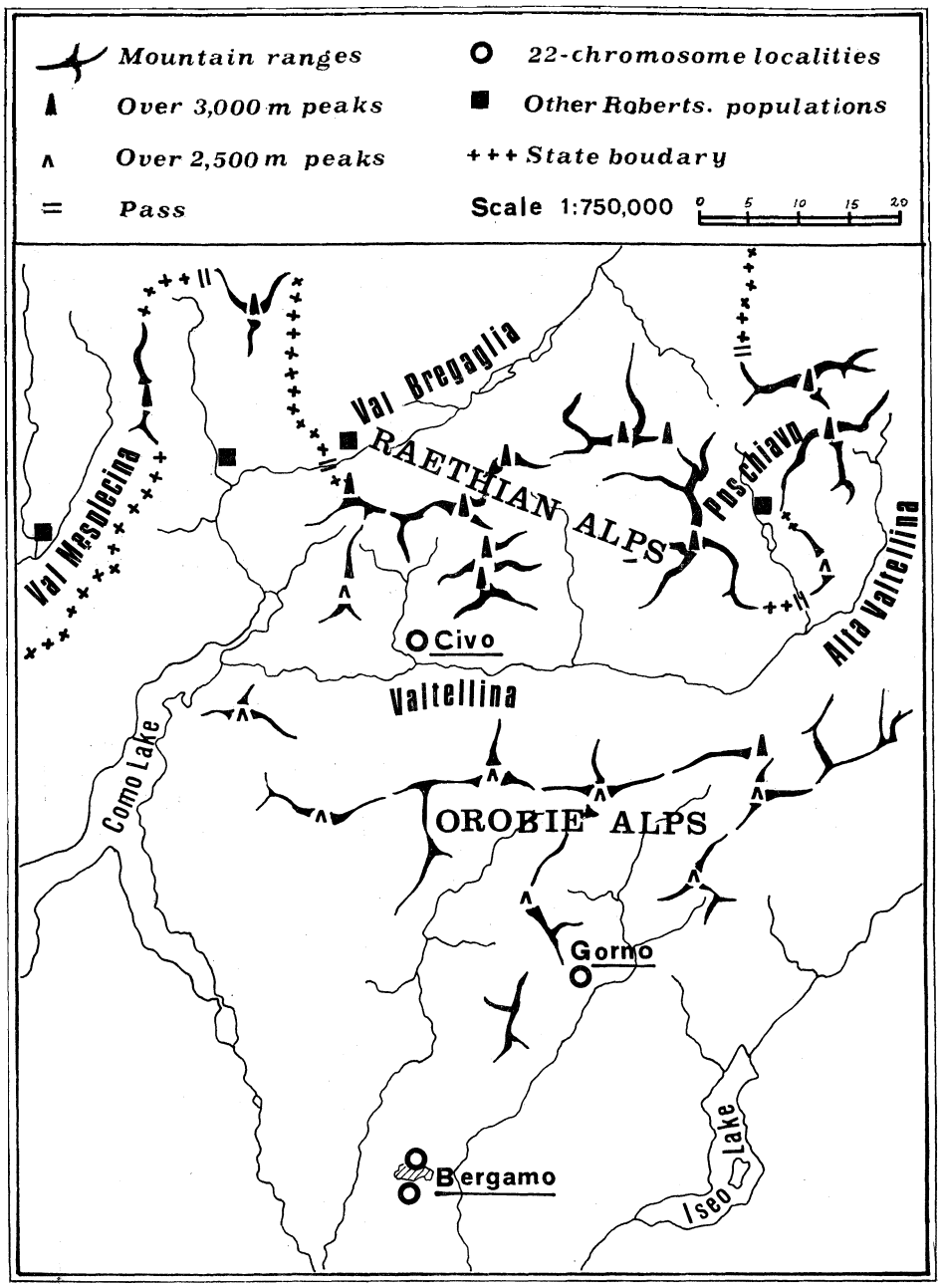

Fig. 1. – Map of the Lombardy Alps where the connections are emphasized between the Robertsonian populations of the Orobian Alps and those previously described in the Raethian Alps.

The morphology of the Robertsonian metacentric pairs as determined by biometric characters, i.e. arm ratio and centromeric index, was found to be the same in the karyotypes of animals coming from the various sites

(see Table I). It could thus be inferred that the house mouse karyotype is homogeneous within the area delimited by the sites of capture (fig. 1). On the contrary, the general appearance of the 22-chromosome karyotype found in the Orabian Alps mice differs considerably from the one described by our group for the Central Apennines mice, although it is composed of the same number of chromosomes. What are missing in the « Orobian » karyotype are the large elements with a sub-median centromere, typical of the « Apennine » karyotypes deriving from the centric fusion of the larger acrocentrics of the *Standard* with some of its smaller elements, e.g. Rb (18.2) 6 Rma of the « CD » population and Rb (18.1) 10 Rma and Rb (17.2) 11 Rma of the « CB » population [1].

However, only after an accurate identification through the G-banding pattern of the acrocentric involved in the Robertsonian fusions on which the 9 metacentrics of the " Orobian " karyotype are based, will it be possible to discuss with any certainty the relation between the various Robertsonian populations of house mouse found in Italy. Indeed, whereas simple zoogeographical considerations seem to rule out derivation relationships between Alpine and Apennine populations, it seems highly probable that a relationship exists between the Orobian Alps populations and the other populations of the Raethian complex, both homozygous and heterozygous.

Identification of the G-banding pattern of the karyotype of the Orobian Alps mouse is being carried out at the *Institut für Pathologie* of the Lubeck school of Medicine (directed by Prof. A. Gropp). We deemed it useful, however, to give a brief advance communication of this finding before the data on the composition of the Robertsonian metacentrics became available, in view of the interest this population is expected to arouse as regards our understanding of the genesis of the Raethian Robetsonian populations. In fact, the very position of this population, its high number of metacentrics, the relations of contiguity or proximity with areas in which heterozygous populations have been described (Andalo [6] and Val S. Giacomo—Chiavenna [3]), and homozygous ones through multiple metacentrics (Poschiavo [2] and Mesolecina valleys [3]), are all factors foreshadowing the importance the Orobian population will have in the interpretation of speciation problems connected with Robertsonian transformations.

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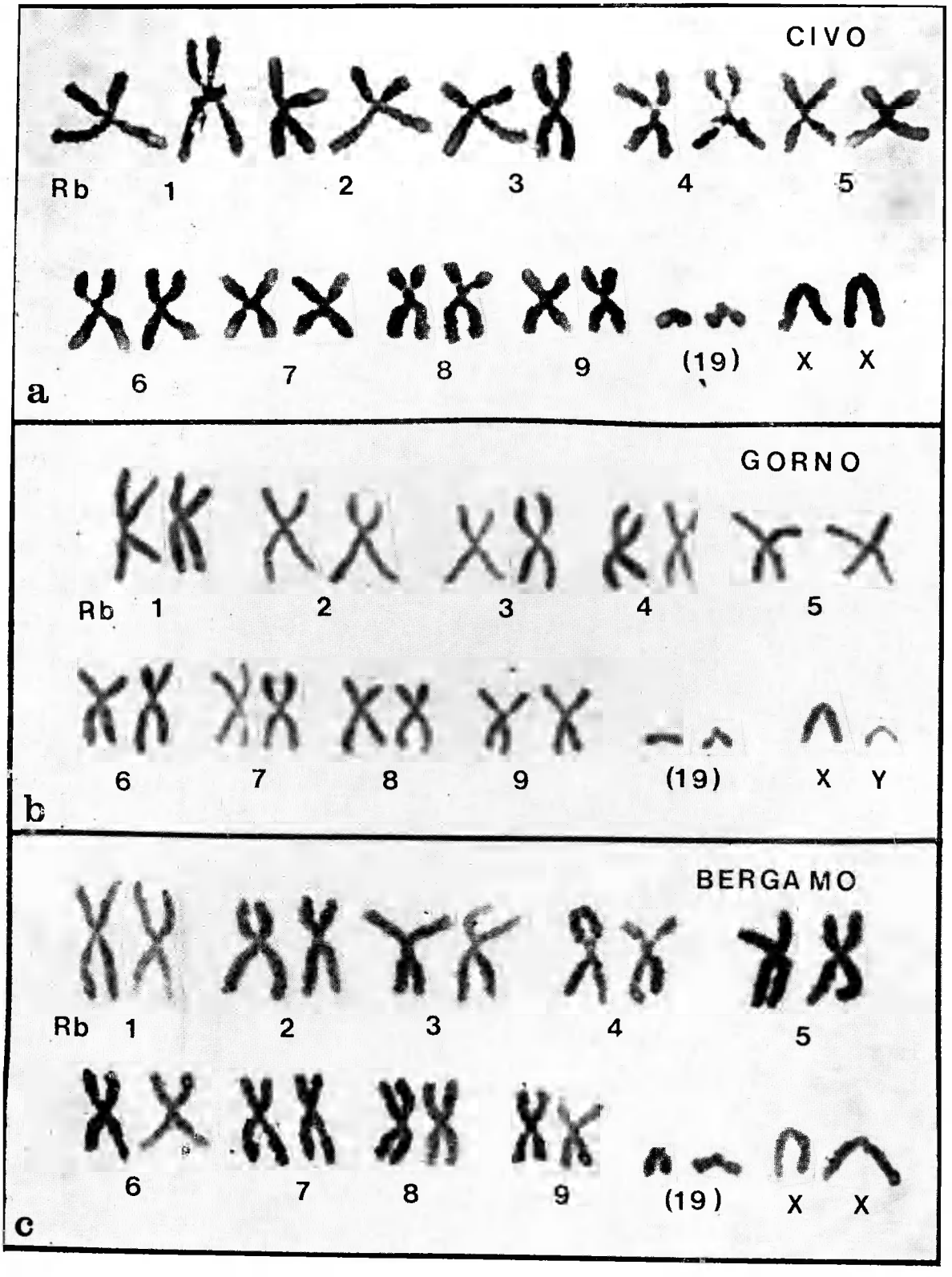
EXPLANATION OF PLATES I–II

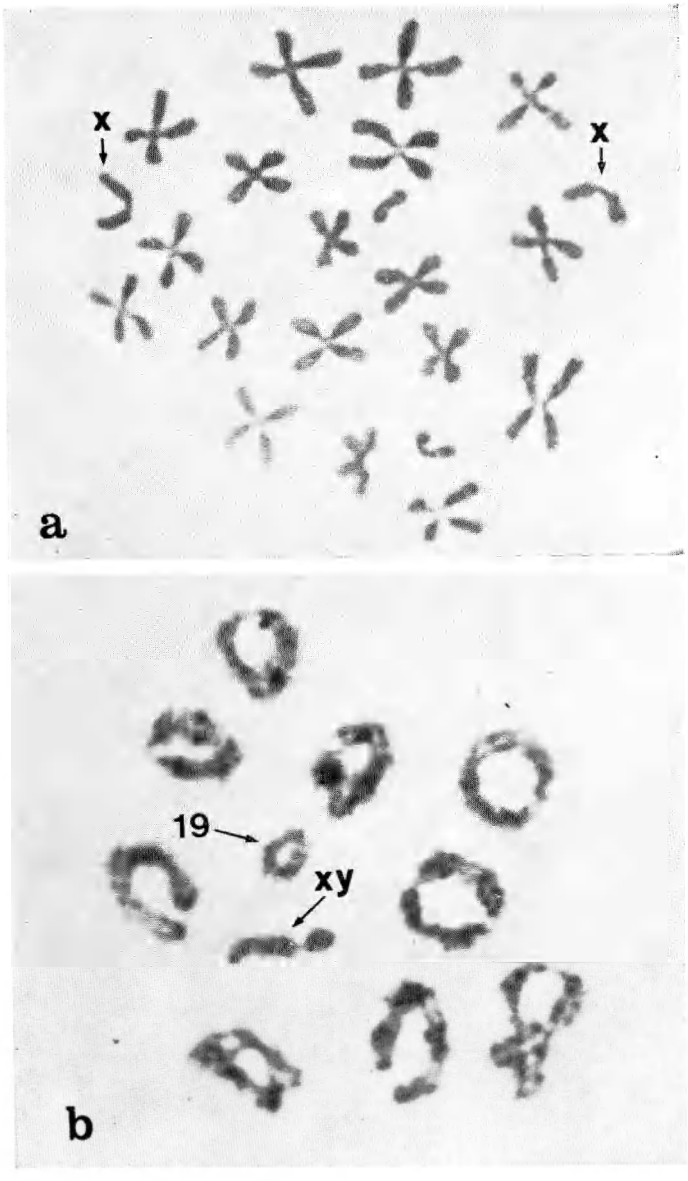
PLATE I

22-chromosome karyotypes of Orobian Alps mice: *a*) Z.M. 14 ♀ from Civo; *b*) Z.M. 13 ♂ from Gorno; *c*) Z.M. 24 ♀ from Bergamo.

PLATE II

a) Metaphase from bone marrow preparation of Z.M. 12 ♀; *b*) meiotic diakinesis from testes preparations of Z.M. 13 ♂.


CIVO
Rb 1 2 3 4 5
6 7 8 9 (19) X X
a
GORNO
Rb 1 2 3 4 5
6 7 8 9 (19) X Y
b
BERGAMO
Rb 1 2 3 4 5
6 7 8 9 (19) X X
c


x
x
a
19
xy
b