Zeitschrift: Mémoires de la Société Vaudoise des Sciences Naturelles
Herausgeber: Société Vaudoise des Sciences Naturelles
Band: 19 (1991-1999)
Heft: 1: The cytogenetics of the Sorex araneus group and related topics

Artikel: The karyotype of the North American Sorex tundrensis (Mammallia, Insectivora)
Autor: Meylan, A. / Hausser, J.
DOI: https://doi.org/10.5169/seals-260084

MÉM. SOC. VAUD. SC. NAT. 19.1, 1991: 125-129.

The karyotype of the North American *Sorex tundrensis* (Mammalia, Insectivora)

BY

A. MEYLAN[1] AND J. HAUSSER[2]

Summary - MEYLAN A. and HAUSSER J., 1991. The karyotype of the North American *Sorex tundrensis*. *In*: J. HAUSSER, ed. The cytogenetics of the *Sorex araneus* group and related topics. Proceedings of the ISACC's Second International Meeting. *Mém. Soc. vaud. Sc. nat. 19.1*: 125-129.

The karyotype of *Sorex tundrensis* from the Yukon territory is presented. With 2N male = 33, 2N female = 32, NFa = 54, it looks identical to some of the karyotypes described for the same taxon in Eurasia and clearly different from those of *S. arcticus*. The present data confirm that the Eurasian XY_1Y_2 shrews colonized America at least twice.

Résumé - MEYLAN A. et HAUSSER J., 1991. Le caryotype de *Sorex tundrensis* d'Amérique du Nord. *In*: J. HAUSSER, dir. The cytogenetics of the *Sorex araneus* group and related topics. Proceedings of the ISACC's Second International Meeting. *Mém. Soc. vaud. Sc. nat. 19.1*: 125-129.

Le caryotype de *Sorex tundrensis* du Territoire du Yukon est présenté. Avec 2N mâle = 33, 2N femelle = 32, NFa = 54, il apparaît identique à certains des caryotypes décrits pour le même taxon en Eurasie, et se distingue nettement de ceux de *S. arcticus*. Ces données confirment que les musaraignes du groupe XY_1Y_2 ont colonisé l'Amérique à deux reprises au moins.

INTRODUCTION

The history of mammal crossings from Asia to North America through Beringian land bridges, their evolution and the present pattern of their distribution are of great interest to biologists as well as to paleontologists. Many publications deal with this important subject and, for shrews of the genus *Sorex*, it is well known that their arrival in the Nearctic region occured

[1]Station fédérale de recherches agronomiques de Changins, CH-1260 Nyon, Switzerland.
[2]Institut de Zoologie et d'Ecologie animale, Université de Lausanne, Bâtiment de Biologie, CH-1015 Lausanne, Switzerland.

ISSN 0037-9611
CODEN: MSVNAU

during several successive connections (see DANNELID 1991). With regard to the species of the *Sorex araneus-arcticus* group, characterized by the same XY_1Y_2 trivalent, it is now admitted that two forms penetrated successively into North America (see VOLOBOUEV 1989, 1991). The first one evolved into the typical *Sorex arcticus* and the second is regarded as *S. tundrensis*, the only species which may exist both sides of the Bering Strait.

Cytotaxonomy and biochemical taxonomy can provide valuable information for a better understanding of present and past biogeographical situations. Until now, the chromosome complement of *S. tundrensis* was studied exclusively for Palearctic specimens (see REUMER and MEYLAN 1986, IVANITSKAYA *et al.* 1986, ANISKIN 1987). According to VOLOBOUEV (1983), a chromosome polymorphism concerning five autosome pairs characterizes *S. tundrensis* and the process of chromosome diversification of this species is probably not yet completed.

In North America, although *S. tundrensis* and *S. arcticus* have been examined by allozymes analysis (GEORGE 1988), karyotypes were only described for the latter species (MEYLAN and HAUSSER 1973, VOLOBOUEV and VAN ZYLL DE JONG 1988). The two different subspecies which have been analysed, *S. a. arcticus* and *S. a. maritimensis*, have the same 2N but differ in their NFa. The present note provides a first observation on the chromosomes of *S. tundrensis* from the Nearctic region.

MATERIAL AND METHODS

Three *S. tundrensis*, one male and two females, were caught alive in the surroundings of the Tombstone Campground, south of the North Fork Pass, Ogilvie Mountains, Yukon Territory. Two types of preparations were realized directly after the shrews had been trapped: bone marrow cells suspension for G-banding and spleen squashes. Spreading and staining were performed afterward in the laboratory. Due to the conditions of field work (cold), only the latter method proved to be successful, although rather old and out of date (MEYLAN 1967).

The preserved animals may be found in the collections of the National Museum of Natural History in Ottawa (male, field number YXY 31) and of the Institute of Zoology and Animal Ecology in Lausanne (females, YXY 32 and YXY 39).

RESULTS

Only the male provided numerous good metaphases. The 2N is 33, and the sex trivalent XY_1Y_2 characteristic of the *araneus-arcticus* group is present. As plain staining only was available, chromosomes have been paired according to their size and morphology (Figure 1). The X is the largest element of the karyotpye; Y_1 and Y_2 are respectively acrocentric and

subacrocentric, and differ slightly from autosomes of the same shape. Autosomes can be matched into 15 pairs and divided into two groups. The first one contains 12 pairs of meta- and submetacentric chromosomes of regularly decreasing size. The third pair of this group has smaller short arms and could be considered as subacrocentric. The second group comprises 3 pairs of small acrocentric autosomes. The NFa is therefore 54.

In the slides of one of the females, 32 chromosomes have been counted, but the bad quality of the metaphases does not allow any further analysis of the karyotype.

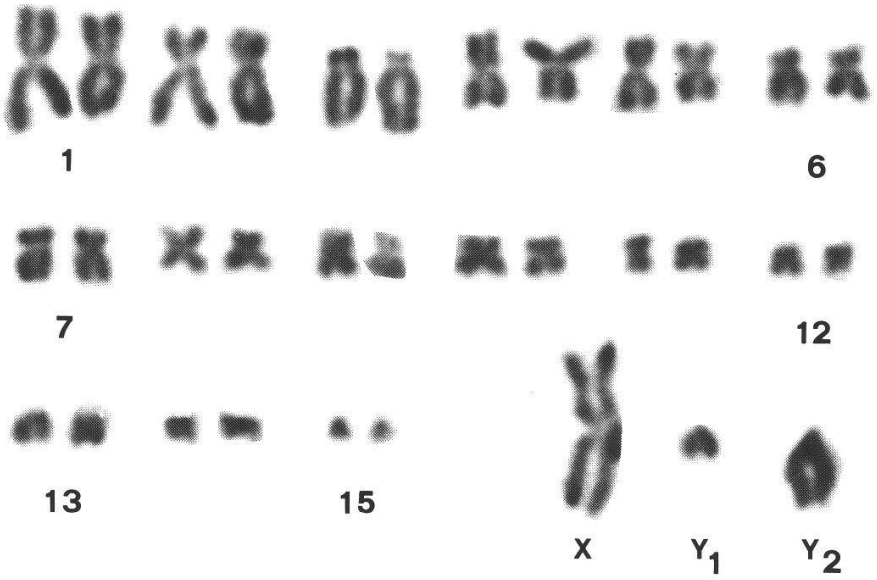

Figure 1.–Karyotype of *Sorex tundrensis* male from Tombstone, Yukon Territory, Canada.

DISCUSSION

With the chromosome complement of *S. tundrensis* from the Yukon Territory, the karyotypes of the Nearctic shrews belonging to the *araneus-arcticus* group can be summarized as follows:

S. tundrensis	2N male = 33, 2N female = 32, NFa = 54
S. arcticus arcticus	2N male = 29, 2N female = 28, NFa = 34
S. arcticus maritimensis	2N male = 29, 2N female = 28, NFa = 30

The karyotype of *S. tundrensis* described here clearly differs from those of the two subspecies of *S. arcticus* (MEYLAN and HAUSSER 1973, VOLOBOUEV

and VAN ZYLL DE JONG 1988). Therefore, these data, together with the genetic distances computed using allozymes data (GEORGES 1988), confirm that *S. tundrensis* is a distinct species, an opinion now generally admitted by taxonomists on the basis of morphological studies (YOUGMAN 1975, OKHOTINA 1983, JUNGE, HOFFMANN and DEBRY 1983). Moreover, the distributions of *S. tundrensis* and *S. arcticus* do not overlap: a gap seems to exist in the dry belt of the Central Yukon, south of which the range of *S. arcticus* appears to be discontinuous (VAN ZYLL DE JONG 1983).

If *S. tundrensis* and *S. arcticus* are not conspecific in North America, the situation is entirely different with the *Sorex* regarded as *tundrensis* and inhabiting a large part of Asia. Named "*arcticus*" until recently, they are morphologically very similar to North American *S. tundrensis* and must be referred to the same taxon (OKHOTINA 1983, JUNGE, HOFFMANN and DEBRY 1983). Chromosomes of these Asiatic shrews have been described for several localities and different karyotypes have been found (see REUMER and MEYLAN 1986, IVANITSKAYA *et al.* 1986, ANISKIN 1987).

In his synthesis of the chromosome polymorphism occuring in the Eurasian *S. tundrensis*, VOLOBOUEV (1983) admits a basic karyotype with 14 autosome pairs of which only two are acrocentric. Polymorphism is of Robertsonian type for 5 autosome pairs and additional variations exist in the pair 4. In these conditions, the autosome number can potentially vary from 28 to 38 and the NFa from 52 to 54. But, in some of the karyotypes published by IVANITSKAYA *et al.* (1986), the basic chromosome complement contains 15 autosome pairs with 3 small acrocentric ones.

By comparing this last karyotype from Asia with the one described here, it is possible to assume, even if according only to the general morphology of the chromosomes, that they are very similar and probably identical. As the taxonomic position of the Eurasian shrews related to *S. tundrensis* is not always well established, the small differences observed in karyotypes from fairly distant localities could be attributed to different subspecies –or even to different, but nearly related species. One of those taxa could be holoarctic and actually occur on both sides of the Bering Strait.

Further karyologic and biochemical studies of larger samples from several *S. tundrensis* populations from North America and East Siberia are needed to allow a better understanding of their relationship. Nevertheless, according to the karyotype of *S. tundrensis* from the Yukon Territory presented in this note, we can confirm that the *Sorex* of the *araneus-arcticus* group colonized North America by at least two waves of shrews originating in Asia.

ACKNOWLEDGEMENTS

The material was collected during a field trip granted by the Swiss Academy of Sciences. We owe many thanks to Dr C.G. Van Zyll de Jong and his staff, National Museum of Natural Sciences, Canada, for their kind help in the field work.

REFERENCES

ANISKIN V.N., 1987. Karyological characteristics and phylogenetic relations of some common shrew species of the *araneus-arcticus* complex in the genus *Sorex* (Insectivora, Soricidae). *Zool. Zh. 66*: 119-124.

DANNELID E., 1991. The genus *Sorex* (Mammalia - Soricidae) - distribution and evolutionary aspects of Eurasian species. *Mammal Rev. 21*: 1-20.

GEORGE S.B., 1988. Systematics, historical biogeography, and evolution of the genus *Sorex*. *J. Mamm. 69*: 443-461.

IVANITSKAYA E.YU., KOZLOWSKI A.I., ORLOV V.N., KOVALSKAYA Y.M. and BASKEVICH M.I., 1986. New data on karyotypes of shrews (*Sorex*, Soricidae, Insectivora) in fauna of the USSR. *Zool Zh. 65*: 1228-1236.

JUNGE J.A., HOFFMANN R.S. and DEBRY R.V., 1983. Relationships within the Holoarctic *Sorex arcticus - Sorex tundrensis* species complex. *Acta Theriol. 28*: 339-350.

MEYLAN A., 1967. Formules chromosomiques et polymorphisme robertsonien chez *Blarina brevicauda* (Say)(Mammalia: Insectivora). *Can. J. Zool. 45*: 1119-1127.

MEYLAN A. et HAUSSER J., 1973. Les chromosomes des *Sorex* du groupe *araneus-arcticus* (Mammalia, Insectivora). *Z. Säugetierk. 38*: 143-158.

OKHOTINA M.V. 1983. The taxonomic revision of *Sorex arcticus* Kerr, 1792 (Soricidae, Insectivora). *Zool. Zh. 62*: 409-417.

REUMER J.W.F. and MEYLAN A., 1986. New developments in vertebrate cytotaxonomy IX. Chromosome numbers in the order Insectivora (Mammalia). *Genetica 70*: 119-151.

VAN ZYLL DE JONG C.G., 1983. Handbook of Canadian Mammals 1. Marsupials and Insectivores. *National Museum of Natural Sciences, Ottawa.*

VOLOBOUEV V.T., 1983. Les types du polymorphisme chromosomique et leur rôle évolutif chez les mammifères (Insectivora, Rodentia et Carnivora). *Thèse de doctorat d'Etat, Université Paris 6.*

VOLOBOUEV V.T., 1989. Phyogenetic relationships of the *Sorex araneus-arcticus* species complex (Insectivora, Soricidae) based on high-resolution chromosome analysis. *J. Hered. 80*: 284-290.

VOLOBOUEV V.T. and DUTRILLAUX B., 1991. Chromosomal evolution and phylogenetic relationships of the *Sorex araneus-arcticus* species group. *In*: J. HAUSSER, ed. The cytogenetics of the *Sorex araneus* group and related topics. Proceedings of the ISACC's Second International Meeting. *Mém. Soc. vaud. Sc. nat. 19.1*: 131-139.

VOLOBOUEV V.T. and VAN ZYLL DE JONG C.G., 1988. The karyotype of *Sorex arcticus maritimensis* (Insectivora, Soricidae) and its systematic implications. *Can. J. Zool. 66*: 1968-1972.

YOUGMAN P.H., 1975. Mammals of the Yukon Territory. *National Museum of Canada, Publications in Zoology No 10.*