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Further Studies on Chromosome Polymorphism of the Common Shrew

DALSZE BADANIA NAD POLIMORFIZMEM CHROMOSOMÓW RYJÓWKI AKSAMITNEJ

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Fedyk S., 1982 Further studies on chromosome polymorphism in the common shrew. Acta theriol., 27, 12: 149—153 [With 1 Table]

This paper forms a continuation of studies carried out during the period 1968—1974. Examination was made of the chromosomes of 20 shrews (*Sorex araneus* Linnaeus, 1758) caught in 1977 and 1980 in the Białowieża Primeval Forest. 17 homozygotes (A_8—) and 3 heterozygotes in respect of the fifth pair of chromosomes (A_8H_5—) were found in the study material. The results of earlier studies (Fedyk, 1980) have shown that gradual elimination of heterozygotes is taking place in the study population. This process has currently been inhibited, and the study population did not attain extreme frequencies.

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There is already abundant literature on the subject of Robertsonian polymorphism in *Sorex araneus*. There are at least two reasons for the great interest taken by cytologists in the chromosomes of this species. In the first place in *S. araneus* six pairs of autosomes (pairs 3—8) are potentially subject to polymorphism. In different populations these polymorphic pairs of chromosomes may form different combinations of arms (cf. Fredga & Nawrin, 1977). A similar situation has been observed in mice (*Mus*) occurring in the valleys of the Alps and Appenines. In the case of mice the potential possibilities of formation of Robertsonian combinations are even greater than in *Sorex araneus* (cf. Gropp *et al.*, 1972; Capanna *et al.*, 1973), but this phenomenon is limited to the Alpine and Appenine populations. The second reason for undertaking numerous studies on the chromosomes of *S. araneus* is the fact that polymorphism in this species has a wide geographical range: polymorphic populations occur over almost all of the geographical range of *Sorex araneus*.

The majority of studies on chromosomes of the common shrew have been carried out from the geographical aspect, and they contain comparisons of more or less distinct populations, or the status of given populations is quite simply described. The majority of these studies are based on limited amounts of material.

The majority of the populations so far described are polymorphic, but in some cases it proved impossible to find polymorphism (*e.g.*, Ford & Hamerton, 1970). Usually only small samples were taken from

these populations, and it is therefore impossible to be certain whether it is a case only of failing to find heterozygotes, or whether in fact we have to do with monomorphic populations. Some data (Ford & Graham, 1964; Meylan, 1965; Orlov & Alenin, 1968) suggest that monomorphic populations of *Sorex araneus* do in fact exist, while other populations are polymorphic with differing proportions of given morphs. It may be concluded from these facts that the given chromosome morphs have varying adaptational value under different habitat conditions. In order to throw light on the question of the stability of the polymorphic system it is essential to study a population for several years.

Long-term studies of a chosen *S. araneus* population have rarely been carried out, in fact up to the present this has been done in the case of two populations only. The first of these was the population near the village of Chilton (Berkshire, England), where material was collected for three successive years starting in 1956 (Ford *et al.*, 1957; Ford & Hamerton, 1970). A relatively stable polymorphic system was found in this population, which has recently been re-examined after a lapse of over 20 years. (J. B. Searle, pers. inform.) but no detailed data are available as yet. The second instance relates to the Białowieża population, studied of which were made over the period from 1968 to 1974 (Fedyk, 1980). Gradual decrease in the presence of heterozygotes was found in this population. Since variation in this population tends in the direction of eliminating heterozygotes, it is useful to take samples from this population at certain intervals of time in order to ascertain if frequencies have attained extreme values. The results of studies on the chromosomes of *S. araneus* from the Białowieża population collected in 1977 and 1980 are presented in this paper.

The material used in this study consisted of 13 shrews caught in 1977 and 6 shrews caught in 1980. In addition one shrew was caught in 1976 and kept captive in the laboratory for nearly a year. The shrews were trapped in the Białowieża Primeval Forest (Table 1). The numbers of the trapping sites have been given in accordance with the numeration used in the Mammals Research Institute (cf. also map in the previous paper — Fedyk, 1980), the greater part of the material coming from area no. 132, which was also included in studies during the period 1968—74.

Chromosome preparations were made from the spleen using colchicine. The chromosomes were conventionally stained with Giemsa stain or orceine.

Results are given in Table 1. In all, out of 20 individuals examined, three heterozygotes were found in respect of the 5th pair of chromosomes. One of the heterozygotes — no. 610 — was caught in the area towards the end of September 1976 and kept in the laboratory for 11 months. The remaining 17 shrews were homozygotes.

Shrew no. 610 was one of many caught in 1976 and kept in the laboratory, but as one of a very few survived in captivity to 1977. A similar fact was observed in 1964 when Dr. Ted Evans (Harwell) made preparations from three shrews caught in the Białowieża National Park in 1963 and kept in the laboratory for several months. Of these

three shrews two were heterozygotes in respect of pair. no. 4. Taking the frequency of acrocentric chromosomes no. 4 from 1968—1974 as a basis, it was found that the likelihood of obtaining 2 heterozygotes in a sample of three individuals is very small. On these grounds it has been suggested (Fedyk, 1980) that in 1963 frequency a_4 must have been far greater than that found for the period 1968—1974. The present observations point to the possibility of another explanation: it would seem probable that homozygotes (A_8—) have far poorer chances of surviving in captivity than heterozygotes. It must, however, be emphasised that these two cases apply to different heterozygotes

Table 1

The common shrews used in the studies.

No. coll.	Sex	Age	2N	Karyomorph	Grid. no.
1977					
603	♂	juv	24	A_8H_5—	93
604	♂	juv	23	A_8—	132
605	♀	juv	22	A_8—	132
607	♀	ad	22	A_8—	—[1]
608	♂	juv	23	A_8—	132
609	♀	juv	23	A_8H_5—	—[1]
610	♂	ad	24	A_8H_5—	132[2]
611	♂	juv	23	A_8—	132
613	♀	juv	22	A_8—	132
614	♂	juv	23	A_8—	132
615	♂	juv	23	A_8—	132
618	♂	juv	23	A_8—	132
619	♂	juv	23	A_8—	132
620	♂	juv	23	A_8—	132
1980					
687	♀	juv	22	A_8—	193
688	♀	juv	22	A_8—	193
702	♀	juv	22	A_8—	150
707	♂	ad	23	A_8—	150
731	♂	juv	23	A_8—	197
733	♂	juv	23	A_8—	197

[1] Individual caught in the Castle Park; [2] Iindividual caught in 1976.

(A_8H_4 — in 1963 and A_8H_5 — in the present material) and probably the adaptational values of these heterozygotes also differ from each other. Differentiating staining established that the 4th pair of autosomes is formed of arms 1j in all the study populations (Halkka *et al.*, 1974; Kral & Radjabli, 1974; Fredga & Nawrin, 1977; Olert & Schmid, 1978; Fedyk & Michalak, 1980; Fedyk, 1980; Searle, pers. communicat.). Morph A_8H_4 — has a wide range but never attains high frequencies (Fredga & Nawrin, 1977; C. E. Ford, pers. commun.; Fedyk, 1980), and it may therefore be concluded that under natural conditions the heterozygotes A_8H_4 — are not favoured by selection.

In the present material three heterozygotes were found in respect of pair no. 5 (A_8H_5—), and thus polymorphism is still maintained in the Białowieża population. The amount of material is too small, and in addition originates from two non-successive years, to be able to

test is statistically but it would seem that degree of heterozygosity does not differ from the range found for the period 1968—74.

In the previous paper (Fedyk, 1980) heterozygosity was found to be gradually decreasing in the Białowieża population, connected with the existence of transient polymorphism. Homozygotes distinctly predominated (86.09%) from 1968—1974, and in addition frequency of homozygotes regularly increased in successive years. The Białowieża population is thus evolving in the direction of complete elimination fo heterozygotes. Transient polymorphism does not, however, necessarily continue to the end, *i.e.* to complete elimination of heterozygotes (Ford, 1967). The present studies suggest that maintenance of heterozygote frequency in a population on an exceptionally low level may prove favourable. This agrees with other observation of genetic polymorphism in the transient stage. Several examples of this have been convincingly documented (Ford, 1967).

Average frequency of twin acrocentric chromosomes of pair no. 4 ($\bar{a}_4$) was lowest (0.011) during the previous period (1968—74). Out of 230 individuals there were only 5 heterozygotes A_8H_4—, 4 of which were found during the first study year (Fedyk, 1980). Thus the absence of heterozygotes of the fourth pair of chromosomes in the present material would appear normal. Average frequencies of $\bar{a}_7$ and $\bar{a}_5$ were far higher and similar to each other (0.026 and 0.033 respectively, which corresponds to thirteen and fifteen individuals in a sample of 230 shrews). From 1968—74 frequencies of a_5 decreased to a greater extent than frequencies of a_7 (Fedyk, 1980). In view of the foregoing the fact would appear astonishing that in the present material heterozygotes occurred only in respect of the fifth pair of chromosomes. It is thus possible that in 1976 and 1977 there was some increase in the frequency of a_5. No opinion can be formed on the basis of the present sample as to the stability of polymorphism in pair no. 7.

The sample at present examined does not permit of concluding that the polymorphic system has undergone stabilization in the Białowieża population. The conclusion that the rate of elimination of heterozygotes has only slowed down would appear closer to the truth. Taking a successive sample several years later would certainly contribute to a clearer explanation of this problem.

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Maternal Behavior of a Short-Tailed Shrew (Blarina brevicauda)

BEHAWIOR MACIERZYŃSKI U *BLARINA BREVICAUDA*

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Martin I. G., 1982: Materal behavior of a short-tailed shrew (*Blarina brevicauda*). Acta theriol., 27, 12: 153—156 [With 1 Fig.]

The maternal behavior of a short-tailed shrew (*Blarina brevicauda*) in simulated natural conditions was described. The female shrew was seen to constrict the nest openings during lactation as well as reinforce the nesting material. Her activity, measured as time out of the nest, increased during pregnancy and increased greatly during lacation. The shrew retrieved her pups both by dragging and with a behavior similar to caravanning. Maternal behavior ceased completely on day 22, the time of weaning.

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I. INTRODUCTION

Descriptions of maternal behavior in shrews are rare. Maternal behavior has been described for captive *Suncus etruscus* (Fons, 1974), and pup retrieval has been detailed in *Crocidura bicolor* (Dippenaar, 1979). Pearson (1944) described parturition and care of neonatal *Blarina*. Caravanning, a line of shrew pups led by their mother, has been known in crocidurine species for some time (*e.g.*, Herter, 1957; Zippelius, 1972). These species form a caravan in which shrews actually bite onto the rump of the shrew in front of them. Recently, caravanning has been described in two soricine species. Harper (1977) observed a caravan of *Sorex araneus* in the field and Goodwin (1979) noted caravanning in