

TWO NEW POLYMORPHIC MARKERS IN BLOOD FROM ARCTIC FOXES (ALOPEX LAGOPUS) AND ONE IN BLOOD FROM SILVER FOXES (VULPES VULPES)

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SUMMARY

Two new polymorphic markers, adenosine deaminase (ADA) and mannose phosphate isomerase (MPI), have been found in blood from arctic foxes (Alopex lagopus) and one, diaphorase (DIA), in blood from silver foxes (Vulpes vulpes). The inheritance has been confirmed by family studies. Each of the polymorphic markers is determined by one locus with two or three codominant alleles.

INTRODUCTION

Both the arctic fox and the silver fox are important to the fur industry and hence knowledge of genetic markers for parental control of the foxes is valuable. Previously five genetic markers in blood cells and plasma of the arctic fox have been found polymorphically, for a review see Juneja et al. (1989) and Andersen & Braend (1989). Seven genetic polymorphic markers have been revealed in blood cells and plasma of the silver fox as referred by the authors mentioned above.

The present investigation has revealed another two polymorphic markers in blood from the arctic fox. The two markers are adenosine deaminase (ADA) and mannose phosphate isomerase (MPI). The new polymorphic marker in blood from the silver fox is diaphorase (DIA). The inheritance of each of the polymorphic loci is established through segregation in families.

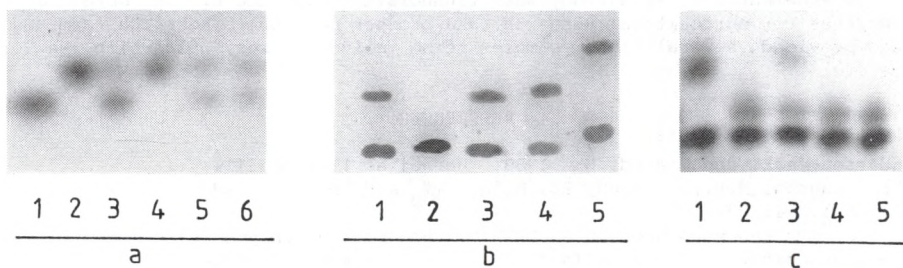
MATERIAL AND METHODS

The blood samples were provided from foxes at the fur farm at the National Institute of Animal Science and from Farm Syd. The collection of blood samples is described by Christiansen et al. (1989). The preservation of blood and the electrophoretic procedure are described by Simonsen et al. 1990. The staining procedure for DIA is described by Harris & Hopkinson (1976).

RESULTS AND DISCUSSION

The zymogram of ADA reveals one or two electromorphs per individual which can be explained as the product of one locus with two codominant alleles, named Ada^r and Ada^s. The heterozygous individuals express a two banded phenotype which is expected for a monomeric enzyme (Harris & Hopkinson 1976). For MPI, three electromorphs are observed and the heterozygous individuals express two electromorphs, which fits in with the genetic hypothesis that MPI in the arctic fox is determined by one locus with three alleles and is a monomeric enzyme. The alleles of the Mpi locus are designated Mpi^r, Mpi^m and Mpi^s. The zymogram of DIA is similar to that of ADA, so DIA is determined by one locus with two codominant alleles, named Dia^r and Dia^s. The observed variation is shown in Figure 1.

Figure 1 Part a shows ADA phenotypes in the arctic fox, lane 2 and 4 FF, lane 3, 5 and 6 FS and lane 1 SS. Part b shows MPI phenotypes in the arctic fox, lane 2 SS, lane 1, 3 and 4 MS and lane 5 FS. Part c shows DIA phenotypes in the silver fox, lane 1 FF, lane 3 FS and lane 2, 4 and 5 SS.



The family data for the ADA enzyme are presented in Table 1, for MPI in Table 2 and for DIA in Table 3. The segregation data are in accordance with the genetic hypothesis mentioned in the previous paragraph.

Table 1 Inheritance data on the adenosine deaminase (*Ada*) in arctic foxes, the mating type is listed as male x female.

Mating type	No. of litters	No. of offspring of phenotype			Sum
		FF	FS	SS	
FF x FS	1	4	4		8
FF x SS	1		4		4
FS x FF	2	5	5		10
FS x FS	3	2	10	5	17
FS x SS	1		1	1	2
SS x FF	1		2		2
SS x SS	1			11	11
Total	10	11	26	17	54

Table 2 Inheritance data on the mannose phosphate isomerase (*Mpi*) in arctic foxes, the mating type is listed as male x female.

Mating type	No. of litters	No. of offspring of phenotype			Sum
		FS	MS	SS	
FS x MS	1		2		2
SS x FM	2	1	5		6
SS x FS	1	2			2
SS x MS	2		5	6	11
SS x SS	4			33	33
Total	10	3	12	39	54

Table 3 Inheritance data on the diaphorase (*Dia*) in silver foxes, the mating type is listed as male x female.

Mating type	No. of litters	No. of offspring of phenotype			Sum
		FF	FS	SS	
FS x FS	2	1	7	1	9
FS x SS	1			5	5
SS x FS	1		2	3	5
Total	4	1	9	9	19

The frequency of the allele Ada^V among 16 adult arctic foxes is 0.53 ± 0.09 and of Mpi^r and of Mpi^M 0.16 ± 0.06 and 0.19 ± 0.07 , respectively. The frequency of Dia^r among 24 adult silver foxes is 0.44 ± 0.07 .

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