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BIOCHEMICAL POLYMORPHISM IN THE SOUTH AFRICAN IMPALA (*AEPYCEROS MELAMPUS*)

by

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Abstract – In a random sample of impala, biochemical polymorphism could be established in the serum transferrins (144 animals), the haemoglobins (101 animals) and the serum albumins (49 animals). Possible applications of these results are discussed.

Introduction

Generally, polymorphism is the simultaneous occurrence of two or more varieties in the same population at the same time in such proportions that the rarest of them cannot be maintained by mutation alone. Biochemical polymorphism has already been established by Osterhoff (1966) in zebra, by Osterhoff and Keep (1970) in white rhino, and by Osterhoff, Young and Ward-Cox (1972) in elephant although it has not been found in the African buffalo (Osterhoff, Young and Ward-Cox, 1970) or the black rhino (Osterhoff and Keep, 1970). Preliminary investigations show a similar lack of polymorphism in the blesbok (Osterhoff, Ward-Cox and Emslie, 1972).

In this study an attempt has been made to identify blood substances displaying polymorphic characteristics in the impala of the Kruger National Park in order to establish the degree of homogeneity in these animals.

Material and Methods

Dividing the Kruger National Park into four regions viz. north (Pafuri and Shingwidzi), upper central (Gudzane Dam, Ngirivane, Nsemane, Satara and Nwanedzi), lower central (Mazite, Nwamariwa, Tinongane, Orpen Dam, Tshokwane and Sundweni) and south (Crocodile Bridge, Malelane, and Lower Sabie), blood samples were collected as in Table 1.

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Table 1

Samples collected for the investigation of impalas

Area/region	Transferrin	Haemoglobin	Albumin
North	10	0	0
Upper Central	50	19	31
Lower Central	25	42	3
South	59	40	15
Total No.	144	101	49

All samples were subjected to starch gel electrophoresis, all the procedures having been executed at the Veterinary Investigation Centre at Skukuza.

Results

The *transferrin* investigations are illustrated in Fig. 1, showing that two transferrin alleles are responsible for the variations observed. The frequency of the transferrin genes varied within the National Park as indicated in Table 2.

Table 2

Transferrin gene frequency in impala of the Kruger National Park

Area/region	Gene frequencies	
	Tf^A	Tf^B
North	0,600	0,400
Upper Central	0,550	0,450
Lower Central	0,520	0,480
South	0,619	0,381
Overall frequency	0,574	0,424

In Fig. 1 it is also shown that two new variants were observed, one fast variant with one band migrating faster than the A-band, and a slow variant with two bands moving slower than the B-band.

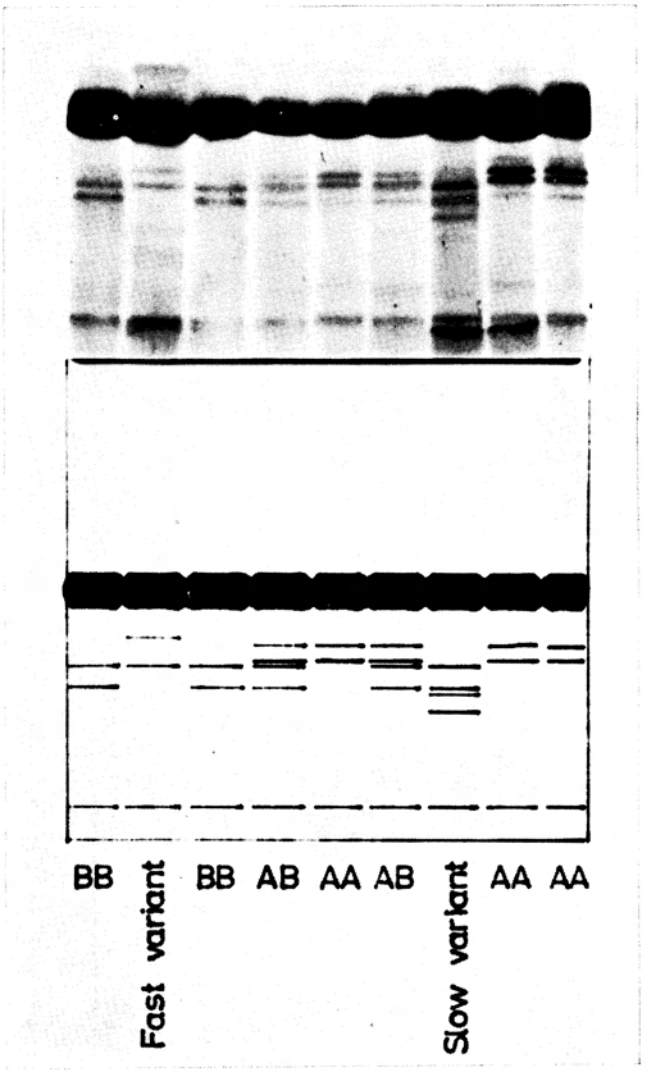

Fig. 1 Transferrin types in the impala.

The *haemoglobin* types could be studied on 101 animals and the following phenotypes could be clearly established: AA, AB, AC, BB, BC, and CC. In Fig. 2 several of these phenotypes are depicted. The feint bands appearing in front or behind the migrating Hb-bands are from serum proteins, because many of the samples were haemolysed after long storage periods.

In view of the fact that the samples are not evenly distributed over the whole park, only the overall gene frequency is calculated for the three alleles Hb^A, Hb^B and Hb^C being 0,233, 0,683 and 0,084 respectively.

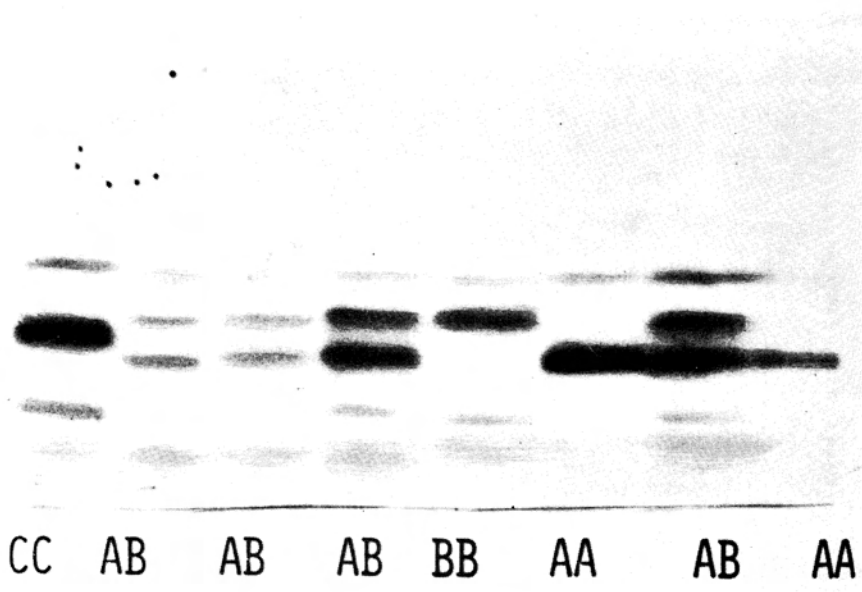

Fig. 2 Haemoglobin of the impala.

Serum albumin polymorphism was revealed in the form of two clear bands migrating at different rates, giving rise to three phenotypes AA, AB and BB. The frequency of the two alleles Alb^A and Alb^B has been calculated as 0,827 and 0,173 respectively.

Discussion and Conclusions

Many species of wild animals have been studied for biochemical polymorphism, as indicated in the Introduction, but in no species has such a heterogeneous polymorphism been found as in the South African impala.

So far, only three polymorphic systems have been investigated and for each one the almost ideal gene frequencies have been established. It would be of value to extend these studies to a larger sample and to investigate the possible reasons for this heterogeneity.

The variation within one of the polymorphic systems studied, the transferrins, is of considerable interest, especially the flow of Tf^A alleles from the central regions to the southern and northern region and the flow of Tf^B alleles in the opposite direction. These gene flows have to be studied carefully and could possibly be correlated with earlier distribution and migration patterns.

The finding of two new variants in 144 transferrin typings is also of considerable interest. Eliminating any possibility of contamination, clinical abnormalities or deterioration of samples, these variants could be looked upon as either the expression of rare genes or otherwise of primor-

dial genes. If the latter is the case, one could speculate that the gene pool of the impala population is still fluid, possibly due to one or other evolutionary process, with natural selection possibly playing a major role. The primordial genes probably played an integral role in the maintenance of the genetic equilibrium of the early impala population, but have become rare, due to a hitherto unexplained genetic process. In this connection, an interesting speculation has been advanced by Wallace and Fairall (1967) in their work on the impala karyotype, where similar phenomena have been noticed with respect to its karyotype evolution.

The impala is a very interesting animal with regard to its behaviour (Schenkel, 1966), fertility (Skinner, 1969) and to its meat production potential (van Zyl, Von la Chevallerie and Skinner, 1969) and Young and Wagner (1968), and should be studied from all possible angles. The application of the data gleaned from the present investigation would be of even greater importance in future projects when the species could possibly be used in large scale breeding and selection experiments.

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