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A comparison of the electrophoretic haemoglobin pattern of the commensal rodent species

M S PRADHAN

Zoological Survey of India, Western Regional Station, Pune 411 016, India

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Abstract. The present paper reports the haemoglobin pattern by paper electrophoresis of seven rodent and one insectivore commensal species collected from Bombay–Pune region. Almost all the samples possess 1/1 type of haemoglobin which is slower in mobility than that of the normal human type. While the genus *Bandicota* possesses polymorphic haemoglobin types, it is quite surprising that *Suncus murinus* has the haemoglobin of anodic mobility as against its *Soricidae* counterpart's, *Sorex's*, haemoglobin showing cathodic mobility.

Keywords. Electrophoresis ; haemoglobin pattern ; commensal species.

1. Introduction

Use of haemoglobin due to its species specificity has been introduced in taxonomy by modern workers. Of interest to the taxonomists, is the frequent occurrence of genetically controlled multiple haemoglobins in wild species ; these may be population, species or genus characteristics. While dealing with 324 mammalian and 300 vertebrate species, Johnson (1974) and De Smet (1978) showed the similarities and the differences in the mobility of the haemoglobin patterns of various species. The polymorphism could be located even at the lowest level of the taxonomic groups. In India haemoglobin studies have revealed many variants in man and in domestic animals (Sukumaran 1975; Naik *et al* 1969 ; Naik 1975). Wild rodent populations have yet not been touched so far by the Indian taxonomists to study the comparative account of the haemoglobin patterns by the electrophoretic techniques. The present article is an initial attempt to report the haemoglobin types of some of the Indian commensal rodent species.

2. Materials and methods

Sixtytwo specimens belonging to seven rodent and one insectivore species were collected from the various residential localities and godown areas of Bombay and Pune cities. Live rats were caught by a number of methods, like trapping, cynogassing, etc., with the help of workers of the Municipal Corporations. The animals were sacrificed by cutting their heads on the spot of collection and the blood samples

were collected in the heparinised tubes. The identification of rats was done at ZSI, WRS, Pune.

Haemoglobin solution was prepared and subjected to paper electrophoresis following the method of Naik *et al* (1969) and Wright (1974) with some modifications. The buffer used for the studies was Barbitone (pH 8·6) supplied by M/s Centron Research Laboratories, Bombay. The electrophoresis was run for four hours and the strips were studied directly after drying. The anodic mobility of the haemoglobins of different species was recorded and confirmed by repeated runs.

Normal human blood samples (twentyfive in total) were provided, as and when required, by ESIS Hospital Aundh Camp, Pune, for comparison.

3. Results and discussion

The diagrammatic representation shown in figures 1 and 2 of haemoglobins of commensal rodent species clearly indicates the occurrence of Hb–1/1 type of haemoglobin in these rats except in *Bandicota bengalensis kok* which shows subspecific polymorphism. The nomenclature for haemoglobins is given according to Johnson (1974). No minor or trailing fractions could be located in these species. Hb–1/1 type of haemoglobin has already been reported in the Euresian rodent species except in those of the genera like *Peromyscus* and *Apodemes* (Johnson 1974). It also appears from the present studies that the haemoglobins of most of the species belonging to the genera, *Rattus*, *Mus* and *Bandicota*, show relatively slower mobility than that of the normal human haemoglobin (HbA). However, Johnson (1974) has reported the equal mobility for normal human and European *R. rattus* haemoglobins. *R. r. wroughtoni* possesses faster moving haemoglobin than that of *R. r. rufescens* and has the same mobility as that of the normal human type. That means there is a difference even at the protein level in these two sympatric subspecies. Tiwari *et al* (1971) who awarded the specific status to *rufescens* get the support from the different Hb patterns of these rats. However, the haemoglobins in the species like *R. norvegicus* and *Mus musculus* show the same mobility as that of *R. r. rufescens*. Thus, further studies have become necessary for the taxonomic confirmation of various species and subspecies of the genus *Rattus*.

Haemoglobin of the insectivore, *Suncus murinus*, quite surprisingly showed the same mobility as that of the normal human type (figure 1). It is interesting to note that while Johnson (1974) has reported cathodic migration of haemoglobins for most of the insectivore species, including those of the genus *Sorex*, the present observations show the anodic mobility for *Suncus murinus*. Confirmation and further studies on the haemoglobins of the order *Insectivora* will also be interesting.

No common type of haemoglobin could be traced for any of the bandicoot species under the present studies. All the species possess multiple haemoglobins. Taking the present findings as sample drawn at random the probabilities of multiple haemoglobins for the seven rodent and one insectivore species can be roughly estimated to 50 %. De Smet (1978), while comparing the haemoglobins of approximately 300 vertebrate species, reported 40% occurrence of multiple haemoglobins in the order *Rodentia*. He has also pointed out that the existence of intra-subspecific haemoglobin polymorphism is a common phenomenon. If the slow moving

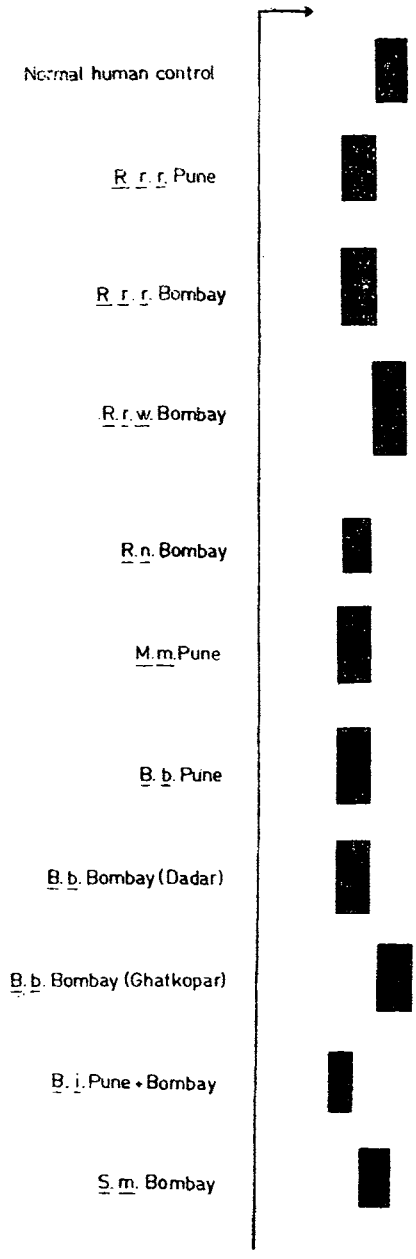

Figure 1. Diagrammatic representation of the haemoglobin pattern of seven rodent and one insectivore species collected from Bombay–Pune region.

haemoglobin band of *B. b. kok* is included, it will be seen that this type of haemoglobin is a common type found in all the three genera under the present study. If all the rodent species are studied, an evolutionary trend of rodent haemoglobin could be unravelled.

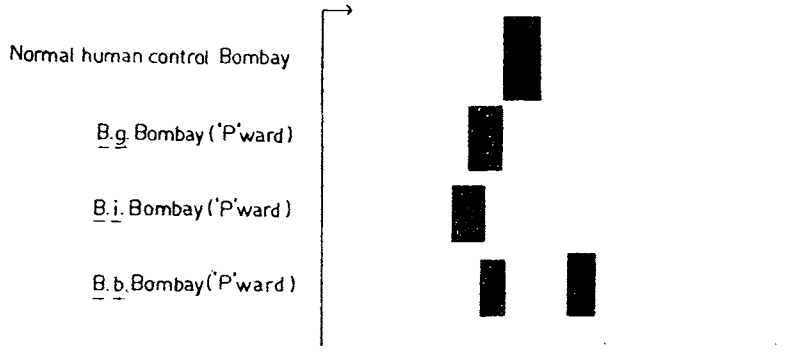

Figure 2. Diagrammatic representation of the genus *Bandicota* haemoglobins showing the heterozygous form trapped from Malad, Bombay.

The *B. b. kok* populations caught from Bombay–Pune region possess the multiple haemoglobins with a mixing of the two genotypes (figure 2). The populations from Bombay city ward (Dadar) and Pune city possess slow moving haemoglobin, while the other collected from a distant suburb (Ghatkopar) on NE side of the Bombay city has the fastest moving haemoglobin. The animal with heterozygous haemoglobins depicted in figure 2 was caught from another distant suburb (Malad) on NW side of the Bombay city. Existence of the different homozygous alleles for the haemoglobins in the separate populations and also of the heterozygous form in the subspecies indicates their genetic control over the two polymorphic haemoglobins. So, if the allelic variation at the genetic loci controlling the structure of haemoglobin in the *kok* populations is studied further in detail, it might be possible to estimate the degree of heterozygosity in the populations. This evidence can be supported by estimating the degree of variations in the other proteins also. Selander *et al* (1969) have reported a wide range of genetic variations in the degree of differences in the wild populations of European house mouse. As all the proteins are genetically controlled, the effect of these degree of differences on the morphotaxonomy of the above-mentioned subspecies will be studied in detail in future.

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References

De Smet and Willem H C 1978 A comparison of the electrophoretic haemoglobin pattern of the vertebrates ; *Acta Zool. Pathol. Antverp.* **70** 119–131

Johnson M L 1974 Mammals. In : *Biochemical and immunological taxonomy of animals* (ed.) C A Wright (London : Academic Press) pp. 1–87

Naik S N 1975 Haemoglobin polymorphism in Indian domesticated and wild ruminants ; *Indian J. Hered.* **7** 23–30

Naik S N, Sukumaran P K and Sanghvi L D 1969 Haemoglobin Polymorphism in Indian Zebu cattle; *Heredity* **24** 239-247

Selander R K, Grainger Hunt W and Suh Y Yang 1969 Protein polymorphism and genetic heterozygosity in two European subspecies of the house mouse ; *Evolution* **23** 379–390

Sukumaran P K 1975 Abnormal haemoglobins in India. In : *Trends in haematology* (eds.) N N Sen and A K Basu, J B Chatterjee Memorial Committee, Calcutta, School of Tropical Medicine, Calcutta, India

Tiwari K K, Ghosh R K and Chakraborty S 1971 Notes on a collection of small mammals from Western Ghats, with remarks on the status of *Rattus rufescens* (Gray) and *Bandicota indica malabarica* (Shaw) ; *J. Bomb. Nat. Hist. Soc.* **68** 378–384

Wright C A 1974 (ed.) *Biochemical and immunological taxonomy of animals*, 1st Edition (London : Academic Press) pp. 490 + xii.

Abbreviations

R. r. r.	..	*Rattus rattus rufescens*
R. r. w.	..	*Rattus rattus wroughtoni*
R. n.	..	*Rattus norvegicus*
M. m.	..	*Mus musculus*
B. b.	..	*Bandicota bengalensis*
B. i.	..	*Bandicota indica*
B. g.	..	*Bandicota gigantea*
S. m.	..	*Suncus murinus*