

## SHORT PAPERS

### Natural selection and colour blindness: fresh data on Indian castes

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#### SUMMARY

Incidence of colourblindness among 3325 males belonging to 21 endogamous Dhangar castes (shepherds) of Maharashtra, India, has been reported. Of the 21 castes studied 5 lacked the *gene* for colourblindness, while in other groups it varied from 1% to 5.5%, with a series average of 2.65%. The low incidence of observed colourblindness has been discussed in the light of the nomadic way of the life of some of the Dhangar castes. The results have been compared with other nomadic populations of Maharashtra. The results, in general, are compatible with the Post and Pickford's hypothesis of differential selection for colourblindness.

#### 1. INTRODUCTION

The hypothesis of Post (1962) and Pickford (1963) regarding the differential incidence of colourblindness and its relationship with varying modes of life has stimulated discussion and research on this inherited X-linked recessive trait in various populations of the world. The main arguments of the hypothesis, have recently been substantiated by the work of Malhotra *et al.* (1974) among four nomadic castes of India.

This paper addresses itself to providing additional data on colourblindness amongst 21 endogamous Dhangar castes (shepherds) of Maharashtra, India, in support of the above hypothesis.

The materials embodied here form part of a multi-disciplinary project, initiated by the late Professor Mrs Irawati Karve, amongst the Dhangar caste-cluster of Maharashtra. Results on some of the genetic markers, based on this research, have been reported elsewhere (Das *et al.* 1974; Mukherjee, Das & Malhotra, 1976; Malhotra, 1977; Malhotra *et al.* 1976).

#### 2. METHODS AND MATERIALS

A sample of 3325 unrelated males, between 10 and 60 years, belonging to 21 Dhangar castes, was drawn from 210 villages spread over 82 taluka (counties) of all the 26 districts of the state of Maharashtra. The field work was conducted during the period 1969-73. Table 1 shows the number of subjects tested from each of the 21 endogamous castes, with abbreviations used together with the percentages of defectives. The geographical location of the castes studied is shown in Fig. 1.

The trait was tested using the third edition of the Ishihara tests (1960). The tests were conducted in a room or shady place with sufficient indirect daylight. The literates were shown plates 1-17, while the illiterates were asked to trace the configurations on

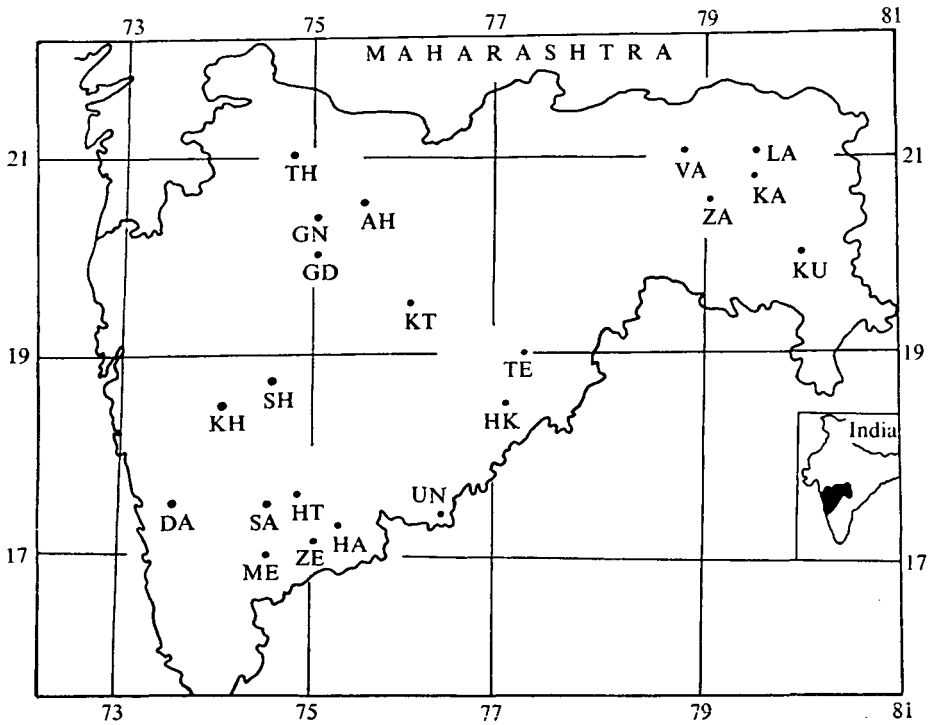


Fig. 1

plates 18-24 with a brush. The subclassification of the abnormal was established as per the diagnostic procedures laid down by Ishihara.

### 3. THE DHANGAR CASTES

The Dhangar caste-cluster, comprising 23 endogamous castes, numbering over three million, are found in all the 26 districts of Maharashtra State in India. Some of the castes are highly localized while others are found in several districts; and some number a few thousands while a few others number over 100 000. These castes are in different stages of sedentarization; some are settled, others are semi-nomads and a few continue to be true nomads. Dhangars are engaged in a variety of occupations: sheep rearing, sheep rearing and blanket weaving, cattle breeding, agriculture, meat selling, etc. At least four different languages are spoken by these people: Hindi, Marathi, Kannada and Telugu. All castes practice consanguineous marriages, though the type and incidence varies (Malhotra, 1976).

### 4. RESULTS

The results are summarized in Table 1. Of the 3325 subjects examined 88 (2.65%) were found to be defective for colour vision. Five castes - GD, HK, LA, TE and UN - lacked the gene for colourblindness; but two of the castes, HK and UN, were represented by rather small sample sizes. Among the other 16 castes the incidence of defectives varied from 1% among the HA to 5.5% among the TH. The data further show that the incidence in 5 castes is less than 2%, in 5 other castes between 2 and 3%, while

Table 1. Incidence of colourblindness among the Dhangers

Dhangar castes	Abbrevia- tion	Number tested	Abnormals (%)	Subclassification of abnormals (absolute numbers)					Un- classified
				Prota- nopia	Protano- malia	Deuter- anopia	Deuter- anomalia	Total colourblind	
1. Ahir	AH	318	2.83	4	0	5	0	0	0
2. Dange	DA	193	4.66	3	0	6	0	0	0
3. Gadhari Dhengar	GD	112	0.0	—	—	—	—	—	—
4. Gadhari Nikhar	GN	95	2.1	0	0	2	0	0	0
5. Hande	HA	100	1.0	0	0	1	0	0	0
6. Hatkar	HT	633	2.53	5	2	6	1	0	2
7. Hatkikankan	HK	36	0.0	—	—	—	—	—	—
8. Kannade	KA	64	1.56	1	—	—	—	—	—
9. Khatik	KH	159	2.51	0	0	2	0	1	1
10. Khutekar	KT	451	3.33	8	0	4	1	2	0
11. Kurmar	KU	103	1.94	0	0	2	0	0	0
12. Ladsh	LA	113	0.0	—	—	—	—	—	—
13. Mendhe	ME	167	4.79	4	0	4	0	0	0
14. Sangar	SA	89	2.25	2	0	0	0	0	0
15. Shegar	SH	145	1.38	0	0	2	0	0	0
16. Telangi	TE	83	0.0	—	—	—	—	—	—
17. Thellari	TH	109	5.5	6	0	0	0	0	0
18. Unnikankan	UN	38	0.0	—	—	—	—	—	—
19. Varhade	VR	77	1.3	0	0	1	0	0	0
20. Zade	ZA	79	5.06	1	1	2	0	0	0
21. Zende	ZE	161	3.73	2	0	4	0	0	0
Total		3325	2.65	36	3	41	2	3	3

6 castes record more than 3%. A considerable heterogeneity, from absence to 5.5%, has thus been observed among the Dhangar castes.

An examination of the distribution of subtypes in the 88 defectives reveals that 48.86% were deuteranoid and 44.32% were protanoid, while 3.41% were totally colourblind and 3.41% could not be accurately classified.

The relative incidence of deuteran and protan genes among the 16 castes is as follows: 9 castes have excess of deutan genes, 3 castes reveal equal incidence, while 4 castes have excess of proton genes. It is noteworthy that in 6 castes – GN, HA, KH, KU, SH and VR – proton gene could not be detected, while 3 castes – KA, SA and TH – lacked deutan genes. The series ratio between deutan and proton genes is 1.1:1.

The Dhangar castes, as mentioned earlier, are in various stages of sedentarization. It would be interesting to examine the incidence of this trait in terms of degree of sedentarization of these castes.

The castes ZA and ZE are completely settled while castes KT, ME, TH and DA are semi-settled. In all these castes the incidence is greater or equal to 3.73%. Castes with less than 3% incidence are either semi-nomads or true nomads, with the exception of KT, SA and VR who are more or less settled. The five castes in which the trait has not been detected are all semi-nomads.

The data are thus indicative of possible relationship between the degree of sedentarization and prevalence of colourblindness; settled populations tend to have higher incidence compared to the semi-nomadic and nomadic populations.

## 5. DISCUSSION

Let us now examine the present results within the framework of the hypothesis proposed by Post (1962) and Pickford (1963). Briefly, they postulated that the incidence of colourblindness, in decreasing order of magnitude, will be detected among the hunters and food gatherers, settled agriculturists and urban communities. The Dhangar castes can be grouped in three categories: (1) completely settled but engaged in agriculture (ZE), meat selling (KT), buffalo tending with shift cultivation (DA), and weavers (SA and VR); (2) semi-settled; (3) true nomads – in this case they are all shepherds.

Incidentally it may be mentioned here that none of the Dhangar castes are hunters or gatherers (except DA who do limited gathering in the semi-evergreen forest) but the mode of life led by the nomads and semi-nomads, moving in vast areas with the sheep and camping in the nights in open fields, entails the same amount of risks as hunters and gatherers face.

On the basis of the hypothesis it is expected that the incidence of colourblindness would be higher amongst the populations of category (1) compared to categories (2) and (3) above. The present data, with a few exceptions, satisfy these expectations.

Present results and the earlier findings of Malhotra *et al.* (1974) permit us thus to advance a more generalized predictive statement that the incidence of colourblindness would not only be low amongst the hunter-gatherers as postulated by Post and Pickford but would also be low amongst the populations who lead a nomadic or semi-nomadic pattern of life, for the opportunities for natural selection to operate on the disadvantageous genes are similar in both situations.

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