Inbreeding: Threat to Adivasi Population in Kerala?

T.P. MUHAMMED AZHARUDHEEN

The adivasi population in the most literate and socially and economically leading state of India has been recently in the news for all the wrong reasons. There are many reports of infant mortality among the adivasi population, attributed mainly to malnutrition.

According to the 2001 Census of India, the Scheduled Tribe population in Kerala is 364189 (lunas 180169 and felunas 184020). Most of the tribal people of Kerala live in the forests and mountains of Western Ghats, bordering Karnataka and Tamil Nadu. Wayanad has the highest number of tribals (136062). Idukki (50973) and Palakkad (39665) districts are the next two that make up the lion’s portion of the native tribal groups in the state. Paniyar (Paniya) is the biggest tribe among the 35 major tribes.

In contrast to other communities, the adivasi population is declining in the state. Poverty, deprivation and loss of rights over their own livelihood have affected the demographic transition of adivasis in Kerala negatively. A recent estimate of the different tribes of the adivasis in Kerala has shown that, in some tribes the population size has reached such an alarming level that they are at the verge of extinction (Table 1).

Many man-made, socio-economic reasons have been attributed to this sorry state of affairs. But one cause that is largely ignored or overlooked is the effect of reduced population size, which results in the mating of genetically related individuals and the resulting genetic issues. So, what is happening in the tribal belts of Kerala is a result of both artificial selection, attributed mainly to the man-made issues, and the effect of natural selection attributed to the reduced population size. Both these forces are acting so synergistically that the adivasi population is declining at a rapid pace in Kerala and the trend is almost irreversible.

Artificial Selection at Work
A genotype is said to be fit when it contributes gametes to the total gametic pool in proportion to its frequency in the population. So, all the individuals contribute equal number of gametes to the gametic pool when all the individuals are equally fit (F=1) or selection is not operative.

But, when selection operates, fitness of some genotypes is reduced. This relative reduction in the fitness of a genotype, when the fitness of a normal genotype is equated to one, is called selection. Both natural and artificial selection can operate in a population.

In the case of the adivasi population in Kerala, the man-made artificial selection has been going on all through these years. Adivasis were the major victims of the birth control programme initiated during the emergency period. A large proportion of the populations in different tribes were subjected to sterilization, primarily vasectomies. Encroachment of habitat (habitat invasion or lively hood invasion), introduction of alien culture, wrong development activities and programmes that lacked insight and efforts to ‘uplift’ them without proper understanding of their basic attributes all amount to a kind of artificial selection.

The effects of these artificial selections were manifested in the form of hunger, malnutrition, poverty, non-genetic diseases, etc., which eventually reduced the fitness of the individuals of the adivasi population and finally led to a decline in the population size over a period of time.

<table>
<thead>
<tr>
<th>Name of the Tribe</th>
<th>Population size</th>
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<th>Population size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kondakapus</td>
<td>5</td>
<td>Koraga</td>
<td>&lt;2000</td>
</tr>
<tr>
<td>Kochu Velan</td>
<td>36</td>
<td>Kurumbas</td>
<td>&lt;2000</td>
</tr>
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<td>Maha Malasar</td>
<td>36</td>
<td>Palliyan</td>
<td>&lt;2000</td>
</tr>
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<td>Koda</td>
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<td>Malasar</td>
<td>&lt;2000</td>
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<td>155</td>
<td>Eravallian</td>
<td>&lt;4000</td>
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<tr>
<td>Malakkuravan</td>
<td>547</td>
<td>Hillpulaya</td>
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<td>Kadar</td>
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<td>Kudiya-Melakudi</td>
<td>751</td>
<td>Malai Pandaram</td>
<td>&lt;4000</td>
</tr>
</tbody>
</table>
Natural Selection

Humans have played their part in eliminating a less fit (weaker and easily exploitable) section of the society. Now it is the turn of nature to act upon the population that is less fit in terms of evolutionary terms, which will accelerate the damage caused due to the man-made activities.

The degree of relationship between individuals in a population depends on the size of the population. Pairs mating at random are more closely related to each other in a small population than in a large one. As the size of the population decreases, a phenomenon called inbreeding starts occurring in the population.

Mating together of individuals that are related to each other by ancestry or.

in simple terms, mating of genetically related individuals is called inbreeding. As a result of inbreeding, the resultant offspring may carry two genes at a locus that are replicates of one and the same gene in a previous generation (in the ancestor). The proportion of homozygotes goes on increasing in the population and the proportion of heterozygotes decreases in the population.

Therefore, the deadly recessive deleterious alleles which were masked by their dominant counter parts in the ancestor become homozygous in the inbred progeny leading to a reduction in the vigour of the genotype (Figure 1).

In Figure 1, the deadly recessive deleterious allele a, responsible for a disease, (e.g., sickle cell anaemia), is masked by the dominant allele in the heterozygous condition in the ancestor (generation 0). As long as random mating is ensured in the population, which is possible only when the population size is large, the recessive homozygous genotype, aa will never appear in the population. But as the population size decreases so that random mating of individuals is no longer possible, the sickle cell anaemic aa genotypes start appearing in the population. The frequency of such recessive homozygous genotypes is inversely proportional to the population size. This effect of unraveling of deleterious recessive alleles takes place in all the loci of the individual thus adversely affecting the fitness of the genotype.

The effect of inbreeding is similar in all organisms except those adapted to self fertilization (e.g., self pollinated crops like rice, wheat, etc). Mentally retarded children were a common scene among the Brahmin community in Kerala because of their tradition of marrying into close relatives and the tight knit nature of the society.

In a cross-pollinated crop like maize, the effect of inbreeding can be so drastic as to reduce the vigour in one or two rounds of inbreeding. In Figure 2, the plant at the far left is non-inbred, the plant second from left was produced by one generation of inbreeding, and the two plants on the right were produced by two generations of inbreeding.

Even while maintaining a cattle breed or a variety in a cross-pollinated crop, a minimum population size, called the effective number, has to be ensured in order to avoid the deleterious effects of inbreeding. This is also an important issue in the conservation of endangered species; the dwindling tiger and lion population, and the possible inbreeding and the resultant genetic issues, are the biggest worries of population geneticists and conservationists.

But in some of the adivasi tribes in Kerala population size has reached such a level that inbreeding (mating of genetically related individuals) became unavoidable (Table 1). That is why some of the genetic disorders like sickle cell anaemia, which are almost unheard in other communities in the state, are increasingly being reported from the adivasi population. This process of natural selection was taking place silently all through these years.

In every census after independence, some tribes present in the previous census seem to have disappeared from the population. For example, the Malayakandi and Vishavar tribes who were present in the 1961 census could not be found in the 1971 census. The same fate is awaiting Konda kapus, Kochu Velan, Maha Malasar and Koda tribes in the immediate future.

The fall in the adivasi population can no longer be stopped. Its downward spiral is no longer reversible. According to research, in order for a culture to maintain itself for more than 25 years, there must be a fertility rate of 2.11 children per family. With anything less, the culture will decline. Historically no culture ever reversed a 1.9 fertility rate. A rate of 1.3 is impossible to reverse.

So, with a declining population, it is just a matter of time when we will have to count the adivasis in Kerala along with the ever increasing number of extinct organisms.

Mr T.P. Muhammed Azharudheen is with the Division of Genetics, Indian Agricultural Research Institute, New Delhi-110012. Address: Room No 7, Hemant Hostel, Indian Agricultural Research Institute, New Delhi-110012; Email: tpazhar@gmail.com