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All South Indian elephants are cousins

Keya Acharya

A recent study has thrown up the unexpected result that all elephants in the Nilgiris area descended from a single maternal line.

 India's first-ever study of the evolutionary genetics of the Asian elephant, done through isolating DNA from dung samples, has thrown up significant management implications for Project Elephant, the conservation programme of the Indian government. Previous genetic studies were inaccurate, as they have looked at only four small populations in Sri Lanka, excluding India, which holds the world's largest concentration of Asian elephants.

This study, which earned scientist TN Vidya her doctorate from the Indian Institute of Science's Centre for Ecological Sciences, followed elephant groups, in the three main blocks of the Nilgiri, Annamalai and Periyar hills of southern India. The Nilgiris are geographically separated from Periyar and Annamalai hills by the 40-km wide Palghat gap. The region is home to 11-13,000 of India's total 25-28,000 elephants.

DNA markers

Surface dung, rich in endothelial cells from the gut, offer the next best source of DNA to blood or tissue samples which are logistically difficult to collect. Since it is not feasible to examine the entire DNA of each individual, population geneticists sample only a few segments of the total DNA, called molecular markers. The greater the number of markers one uses, the better, but this is limited by expense and time. It costs anywhere from Rs.1000-2200 to be able to decipher without ambiguity the DNA

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sequence at one molecular marker for one individual.

The two types of DNA in a mammalian cell, are mitochondrial DNA which can be inherited only from the mother and hence used to trace maternal lineage, and nuclear DNA which is found in the nucleus and forms the bulk of the DNA. Nuclear DNA is inherited from both parents, (except for Y chromosomal DNA) and can be used to examine relatedness between individuals as well as gene flow between populations.

Colonisation patterns

Depending on the extent to which individuals vary in mitochondrial and nuclear DNA, one can infer patterns of colonisation of a geographic area , the relatedness between individuals, and whether there was past gene flow between populations. If individuals moved across populations in the past and bred there, they would have contributed genes from one population to the other.

This signature can be picked up by examining the frequencies of different variants of a particular segment of DNA (these different variants are called 'alleles'; or 'haplotypes' in case of mitochondrial DNA) in the populations examined.

"If we find such evidence of past gene flow between populations, it means that these populations were historically connected or exchanging individuals" , says Vidya.

The study used the phenol-chloroform method followed by purification of DNA using silica columns to extract DNA. The results examined population structure, genetic diversity, identifying whether genes were shared in these populations, historical trends of migration and came up with the singularly unusual finding that all the Nilgiri populations had only one single mitochondrial 'haplotype' or genetic sequence, proving a single maternal line in descendance.

Social organisation

Possible answers to these surprising results could be due to social organisation. Adult female elephants of a close lineage tend to cluster together in groups of 8-10. If the group gets too big, they break apart again, but maintain close contact.

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The Annamalai and Periyar populations showed a more normal variability at 2 or 3 different haplotypes, inspite of the geographic discontinuity from the Nilgiri area being a mere 40 km wide. "Even though this is also unusual, we think maternal social dominance has been keeping these clusters apart through the Palghat gap", says Vidya.

"With a view to maintaining historical patterns of gene flow, it is usually recommended that these populations are treated as a single management unit. Any corridors that exist between these populations should also be preserved. Using molecular data is thus an objective method of designating management units for conservation", says Vidya.

Project Elephant

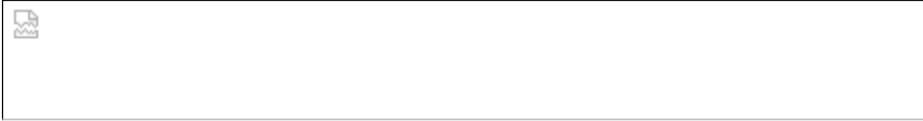
In other words, Project Elephant, which has four reserves in southern India, 2 in the Nilgiris and one each in Annamalai and Periyar all working separately, needs to treat all these reserves as a single contiguous management unit, ensuring corridors where needed. Translocating elephants from Nilgiris to Palghat also should stop due to their proven genetic diversity. Conservation science has shown translocation is poor in areas with varying genetic pools.

But current realities of shrinking habitat, man-elephant conflicts, besides poaching make the IISc's recommendations a tough task. Political implications of elephants migrating into other States is also increasing yearly. "We're not translocating, they're going into neighbouring State territories on their own", says Principal Chief Conservator of Forests in KN, Rammohan Ray..

"The most I can say for co-ordinating as a single contiguous unit is that at least we don't quarrel with our neighbours when the elephants move to their territories."

The KN forest department is now in consultation with Dr. Raman Sukumar of IISc in suggesting elephant corridors, which will then have to be acquired.

" It's a huge process requiring money and time. It's not that simple," says Ray phevatically.



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