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CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS



Estación
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Doñana

PRESS RELEASE

The Iberian lynx hybridized in the recent past with the Eurasian lynx

- A study led by the Doñana Biological Station has concluded that the Iberian lynx would have more genetic diversity now than 4000 thousand years ago thanks to the genetic exchange with the Eurasian lynx.
- This study is essential in the current scenario in which the genetic viability of the Iberian lynx is still not guaranteed



Left: Iberian lynx. Foto: Antonio Rivas /EBD-CSIC. Right: Eurasian lynx. Foto: Martin Mecnarowski



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Seville, 15th December 2023. Cross-species hybridization is a more frequent phenomenon than previously thought. In the past, it happened with modern humans. It is estimated that our genome contains about 2% of Neanderthal DNA. We now know that the Iberian lynx (*Lynx pardinus*) has also hybridized with closely-related species in the recent past. A study led by the Doñana Biological Station – CSIC showed that the Iberian lynx interbred with the Eurasian lynx (*Lynx lynx*) over the last few thousand years, which would have helped to increase its genetic diversity. These results are important in the current scenario, in which the survival of the Iberian lynx is not guaranteed in the long term.

To carry out this study, the scientific team analyzed the DNA of the three ancient Iberian lynx specimens: one from Andújar dated around 4300 years ago, another from Alcanar in Catalonia dated 2500 years ago, and another from Algarve in Portugal, dated approximately 2100 years ago. Then they compared this information with genetic data from present-day individuals. What they observed was totally unexpected: the genetic diversity of ancient lynxes was lower than that of contemporary lynxes.

This increase in genetic diversity throughout history could not be explained by the historical population drift of the Iberian lynx. As its population declined over time, genetic diversity should be lower, not higher. Nor was it possible that the ancient individuals belonged to completely isolated populations, since genetic analyses showed they intermixed with each other and the ancestors of contemporary lynx. So, what could have happened in the last three or two thousand years?

The scientific team found a possible answer in hybridization. “The analyses revealed that modern lynxes shared more genetic material with their sister species, the Eurasian lynx, than the older lynxes”. This suggests that a genetic exchange has occurred between the two species during the last two thousand years”, explains researcher María Lucena, first author of the study who developed this work during her doctoral thesis in the Doñana Biological Station – CSIC. Precisely, the results indicate that the most recent ancient specimens of Iberian lynx, the ones from Catalonia and Algarve, have more genetic variants from the Eurasian lynx than the one from Andújar. Thousands of years ago, the distribution of the Eurasian lynx may have reached as far as the south of France and Italy. This species inhabited the north of the Iberian Peninsula until recent years, creating opportunities for the gene exchange between the two species. The gene flow of the Eurasian lynx to the Iberian lynx would have subsequently spread to all modern populations.

Genetic rescue

The genetic diversity of species is essential for their adaptation to changes in their environment. However, the genetic diversity of the Iberian lynx became one of the lowest in the world. The species experienced a major decline during the 20th century that left only about 100 individuals divided in two isolated, small populations in Doñana and Andújar. In response to this situation, it was decided to mix the two genetically distinct populations. “Allowing crosses between individuals that are not at all related to each other, we avoided the inbreeding that had accumulated in the two small populations”, explains José Antonio Godoy, a researcher at the Doñana Biological Station – CSIC. “According to our data, it seems that the “hybrids” of the two populations have greater reproductive success and possibly greater survival. At the same time, it also increases the genetic diversity available for adaptation to environmental changes”.

Despite its successful recovery during the first decades of the 21st century, the Iberian lynx does not have yet a minimum population size to ensure acceptable genetic diversity in the future. In another recent study, the research group calculated that at least 1100 reproductive females were needed, while only 326 were registered in the 2022 census. In addition, it was imperative to increase the number of subpopulations and improve connectivity between them for the genetic exchange. The LIFE-Lynxconnect project, funded by the

European Commission, aims precisely to achieve a self-sustainable and genetically viable population of Iberian lynx in the long term, by connecting the different subpopulations and creating two new ones.

Could hybridization with other species be a solution to the low genetic diversity of endangered species, as the Iberian lynx? This option is often dismissed on the understanding that the offspring would have a lower probability of survival and reproduction, reducing the viability of the population rather than increasing it. "In general, we expect that most of the genes that enter a species from another one will have negative consequences and will be eliminated over time by natural selection, but some may restore functional variants or even allow the adaptation to new environmental conditions", explains José Antonio Godoy. "However, we do not yet know what consequences had the past introgression we have detected in the Iberian lynx, and we can much less predict the consequences of future natural or intentional hybridization", he concludes. Further research in these lines will be necessary.

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