

Study addresses biological and evolutionary characteristics of

Researchers published the most extensive analysis on the attributes of domesticated plants and animals for food production

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A group of researchers from 18 institutions and 10 different countries analyzed and published biological and evolutionary characteristics of over one thousand domesticated species for food production. The work provides the scientific community with a very detailed global database that, in addition to contributing to future research, will allow a broader search for new species that can be used as human food. The study was published last October, 2018, in the journal *Nature Ecology & Evolution*.



Researchers compared body mass, basal metabolism rate and birth weight of domesticated and wild animals - Photo: Gustavo Diehl / UFRGS - Archive

The study sought to answer two questions: first, whether the domesticated species of plants and animals belong to few or many evolutionary lineages; and second, whether these species share biological characteristics with their wild counterparts. As explained by the professor of the Department of Ecology of the Federal University of Rio Grande do Sul (UFRGS) Valério Pillar, one of the authors of the research, plants and animals that we used for the provision of food, such as wheat or cattle, were formerly wild species, subjected to domestication from the end of the Paleolithic period on. And they represent only a small fraction of the global biodiversity. Of the approximately 370,000 existing flowering plants, only a number ranging from one thousand to two thousand have experienced some form of domestication directed to human food. Among the approximately 5,400 species of existing mammals, only a number ranging from 20 to 30 are raised for food.

Started in 2014, the project utilized global databases and relies on pre-existing information sharing. With the leadership of Professor Rubén Milla, from the Rey Juan Carlos University, in Spain, the data needed to answer the proposed questions were generated in several regions of the world by previous research projects. Researchers at UFRGS have contributed information on species found in southern Brazil.

Some phenotypic characteristics of the plants (height, leaf nitrogen content, and seed mass) and of the animals (body mass, basal metabolism rate, and birth weight) were analyzed. These traits were selected on account of their relevance to the life cycle of the species. The frequency of domesticated species in the different families and genera of plants and animals and their respective phylogenetic trees – diagrams that represent the evolutionary relationships between organisms – were also evaluated.

The researchers observed that, in general, domesticated plants have higher levels of nitrogen in the leaves (essential for photosynthesis and plant growth), as well as heavier seeds. In addition, domesticated herbs, or herbaceous plants, are taller than their wild counterparts. Domesticated mammals, on the other hand, have higher body mass and higher birth weight. They also have a lower basal metabolic rate, which means they spend less energy than wild animals to maintain the vital functions of the organism.

Despite the differences, however, the study demonstrates that the characteristics of domesticated species are a subset of those found in wild species. "What the article shows is that, even with these differences, domesticated

plants and mammals generally make up a subsample of the phenotypic variation observed in nature and that do not exceed the biological limits observed in wildlife,” says Pillar. “Even if the cultivated species produce large seeds, or if domesticated mammals are larger in size, these characteristics can also be found among wild species,” he exemplifies.

The professor also points out that these characteristics resulted mainly from a selection process that happened even before the actual domestication of these plants and animals, which had already been subject to harvesting and hunting by primitive human groups. “In the case of plants that were domesticated for grain production, they were annual plants that occurred naturally in disturbed environments and with good availability of nutrients in the soil, which coincide with the conditions that these plants usually have in crops. In the case of mammals, it was not the group of animals that grew faster which was not domesticated, but the group with a slower metabolism and with a longer life span, a situation which is associated with meekness, sociability, and adaptation to unproductive and unpredictable environments,” he adds.

It has also been observed that the differences between domesticated and wild species have no correlation to their geographical origins, the climate of the region of origin or the age of domestication. “There are rather striking differences between continents regarding the number of species that have been domesticated. But from what is known about the process of domestication, this limitation would reflect far more on evolutionary differences across continents than on the ability of human groups to tame species,” Pillar explains.

The study also found that domesticated plants for food production have very different evolutionary origins, while farmed animals belong to fewer groups. Only 22 genera of mammals, from ten different families, contain domesticated species. And 40% belong to the bovine family, which includes sheep, goat and cow, among others. In agriculture, the species are distributed in 120 families and 453 plant genera.

These results have important implications for the understanding of the potential of wild species for agriculture and livestock. “This study will provide the scientific community with a valuable database on domesticated species for food production and their wild counterparts, which has not been available so far, and will facilitate future research in this area,” Pillar emphasizes. According to him, this work will expand the search for new species that can be used as human food in the future. The results can be used to identify the relevant characteristics of the domesticated species for food production and, thus, to facilitate the search for wild species with similar attributes.

Scientific article

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Translated by Fernanda Cristina Cestari, under the supervision and translation revision of Professor Elizamari R. Becker (P.h.D.) – IL/UFRGS.

Universidade Federal do Rio Grande do Sul

Av. Paulo Gama, 110 - Bairro Farroupilha - Porto Alegre - Rio Grande do Sul
CEP: 90040-060 - Fone: +55 51 33086000

Directions

