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Research Team Led by NYBG Scientist Identifies the Likely Original Relative of Many Food Crops, a Resource That Could Make Them More Environmentally Resilient

Turnips, Broccoli Rabe, Bok Choy, and Others Might Benefit from the Genetic Diversity of Their Ancestor, Wild *Brassica rapa*, Probably First Domesticated More Than 3,000 Years Ago

Wild *Brassica rapa* has been domesticated into a wide variety of related food crops, including turnips, broccoli rabe, bok choy, and oilseeds such as turnip rape and sarson. Illustration by Alex McAlvay, Ph.D.

Bronx, NY—In a peer-reviewed article published online by the journal *Molecular Biology and Evolution*, a research team led by a New York Botanical Garden (NYBG) scientist identifies the likely wild, original relative of a group of important domesticated food plants, including turnips, broccoli rabe, bok choy, napa cabbage, and mizuna, a finding that could help improve the productivity and resilience of these crops and prioritize conservation efforts.

Alex McAlvay, Ph.D., the Kate E. Tode Assistant Curator in NYBG's Institute of Economic Botany, and his collaborators traced the ancestry of these plants, all of which are members of the same species, *Brassica rapa*, to the mountains of Central Asia, where they believe the species might have been originally domesticated more than 3,000 years ago.

"The wild relatives of crops harbor diversity that has been lost through generations of breeding and crop selection," Dr. McAlvay said. "Identifying the center of origin of the individual crop plant is important as it often indicates where most of the crop diversity is present."

Thousands of years of selective breeding by humans for various desirable traits have led to the diversification of *B. rapa* into multiple turnip, leafy, and oilseed crops, the latter of which include turnip rape and sarson, used for cooking or as fuel. Although the species is of worldwide economic importance, its domestication and diversification have proven difficult to untangle because many crop varieties appear to have escaped cultivation and grown wild, leading to uncertainty about the identify of the original *B. rapa* as opposed to its weedy relatives.

In the largest study of the species' origins and diversity to date, Dr. McAlvay and his colleagues analyzed DNA sequences from more than 400 plants representing a wide range of wild and domesticated *B. rapa* varieties and constructed ecological models to understand the potential distribution of the species thousands of years ago. They were able to distinguish truly wild samples of *B. rapa* from weedy escaped specimens and identify the Hindu Kush mountains in Central Asia as a possible location where the species was initially domesticated, as turnips, between 3,430 and 5,930 years ago. They were also able to disentangle the subsequent origins of other leafy vegetables from turnips in the Mediterranean and East Asia.

In their paper "*Brassica rapa* domestication: untangling wild and feral forms and convergence of crop morphotypes," the researchers say their findings highlight the importance of Central Asia for conserving the original genetic diversity of *B. rapa*, which "may prove important in the future to cope with changing environmental conditions." For example, that diversity could be cross-bred into important *B. rapa* food crops to make them more resilient to climate change. They warn that conservation measures are urgently needed because "potentially wild populations of *B. rapa* that are seen as weeds could be harmed by increased agricultural weed control in its native range."

The paper was posted on the *Molecular Biology and Evolution* website on April 30 and will be published in an upcoming print edition of the journal.

"*Brassica rapa* domestication: untangling wild and feral forms and convergence of crop morphotypes" is available at the following link: https://doi.org/10.1093/molbev/msab108

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The New York Botanical Garden, 2900 Southern Boulevard, Bronx, New York 10458

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