

## Plant Biology

# A tale of morning glories. New discoveries about the origin of the sweet potato

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### ABSTRACT

*A recent molecular study of the sweet potato and its wild relatives, the most comprehensive study of this group of plants to date, provides important information to understand the origin and early history of this important crop.*



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Morning glories, so called because of their characteristic full bloom in the early morning, are common garden plants that belong to the family [Convolvulaceae](#). Perhaps surprisingly, the most famous morning glory species is not famous for its flowers, but instead for its underground, tasty structures: its edible roots. The scientific name of this species is *Ipomoea batatas* (L.) Lam., but it is much better known as [sweet potato](#) (read also the [break](#): "[GMOs are not a human invention: sweet potato is a naturally transgenic food crop](#)"). This plant, of American origin and only distantly related to the potato, is among the most important crops in the world and is a staple in many countries, with billions of tonnes cultivated every year. Further, the orange-fleshed varieties are particularly important because they are rich in [vitamin A](#) and are helping to

address problems related to deficiencies in this vitamin that affect millions of children worldwide.

Despite being such an important food crop, the origin of the sweet potato has always been shrouded in mystery, and most aspects of its evolution were poorly understood. Some unanswered questions were: 1) did sweet potato evolve from a single ancestor or is it a hybrid of several species? 2) Did it evolve once or multiple times and where did it originate? 3) When did its edible root originate and is it a result of human domestication? To answer these questions we need to understand the evolutionary relationship between the crop and its most closely related wild species, what we call the Crop Wild Relatives (CWRs). These species share a recent evolutionary history with the crop and

provide valuable information about its evolution. Furthermore, understanding this relationship is essential for food security, as CWRs act as potential sources of genetic variation that can be used for crop improvement.

In the last decades, multiple studies unsuccessfully tried to clarify the origin of the sweet potato through morphological, cytological and molecular studies. These studies had different limitations and provided only incomplete and often contradictory results. Ultimately, the lack of knowledge hinders the use of CWRs in breeding programmes, meaning that sweet potato improvement is restricted to using the genetic diversity held within the crop.

We, a group of researchers from the University of Oxford (United Kingdom), the International Potato Center (Peru) and the Oregon State and Duke Universities (United States), have recently presented a study that overcame the limitations from previous studies and provided answers to the questions outlined above. First, we identified the species in the group most closely related to the sweet potato, its CWRs. This group contains fifteen species, each with variable morphologies and with extensive and overlapping distribution areas in the Americas and the Old World. Secondly, we obtained enough plant material to represent the diversity existing within this group of plants by collecting samples from the field, from herbarium specimens and from plants cultivated in the greenhouse. Finally, we obtained a large amount of DNA from all these samples. This dataset, the most comprehensive in sweet potato research to date, allowed us to investigate thoroughly the origin and evolution of the crop.

We found that the sweet potato's closest relative is [\*Ipomoea trifida\*](#), a Central American species, and that the sweet potato had a single origin from a common ancestor with *Ipomoea trifida* at least 800,000 years ago. This is a long time before humans appeared on Earth, indicating that the edible root was most probably already present when humans first found the plant and thus is not a consequence of domestication.

In addition, we addressed one additional question that has been a source of controversy for centuries: how did the sweet potato, a plant of American origin, come to be widespread in Polynesia by the time Europeans first arrived? The predominant hypothesis is that humans domesticated sweet potato and subsequently transported it, which implies the existence of human contacts across the Pacific before the European Age of Exploration. Importantly, the sweet potato was the only standing biological evidence of these alleged contacts. The large amount of data generated in our molecular studies also allowed us to challenge this hypothesis by showing that the timeframe of sweet potato evolution was much older than previously thought and that morning glories naturally disperse very long distances. Thus, our results suggest that the sweet potato arrived in Polynesia by natural dispersal thousands of years before human colonisation. There is therefore no need to invoke human-mediated transport.

In conclusion, the results of our study have important implications for our understanding of sweet potato evolution and domestication, open the door to the use of wild species in sweet potato breeding and question the existence of human contacts across the Pacific in pre-Columbian times.