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RECOMBINANT DNA TECHNOLOGY, SYNTHETIC DOMESTICATION AND BIODIVERSITY

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ABSTRACT: Discovery of the structure of DNA and the capacity to manipulate specific sequences have formed the foundation for a current proposal of synthetic domestication as an expanded concept of domestication. Currently, the manipulation and effective evaluation of countless organisms, metabolic pathways and molecules that exist as potential products of a large, biodiverse ecosystem can be achieved using a broad spectrum of technologies from genomics to synthetic biology. This, in turn, will allow prospecting, characterisation, gene expression, new pathways and gene arrangements and the necessary proof-of-concept studies (research to demonstrate the functional efficacy of a trait or technology in the target organism, to reduce the risk of product failure), aiming for the sustainable use of biodiversity. Here, I will comment on two current studies which may contribute as examples of synthetic domestication traits of biodiversity organisms. First, spider silk fibre has been noted for its unique physical and mechanical properties and has been recognised as a protein-based nanomaterial. Drawing on genome and transcriptome data, It has become possible to design de novo proteins and produce synthetic spider-like fibres in transgenic metabolic engineered bacteria. Currently, different expression systems for producing synthetic spider-like proteins on a large scale at a lower cost. As a second example, studies of oleaginous plants towards development of additional viable options for bioenergy supply are a current worldwide demand. Using genome edition of seed-specific regulatory sequences allowed to generate soybean matabolic engineering. In contrast to native soybean fatty acid composition, which provides an average of 25% oleic acid and 13% palmitic acid, engineered soybean seed lines have been generated with a composition of oleic acid above 90% and palmitic acid below 5%. Based on our present knowledge, one can expect that our civilization, in future decades, will be able to domesticate a number of so far unused biological functions by genetic engineering/synthetic biology, and this may serve to benefit mankind and environment.

Keywords: synthetic domestication; biodiversity traits; recombinant DNA; synthetic spider-like fiber; soybean fatty acids

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