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Abstract

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The advent of the mite omics era and integration of multiple technological approaches to mite control*

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FIGURE 1. Healthy and nutritious tomato crop growing in a protected environment. Mite pests can impact yield and cosmetic quality standards in the sustainable production of tomato crops.

Current food production involves not just the fundamental need to provide calories and proteins but full nutrition status under specific safety standards. Vegetable production, especially tomatoes, grown under highly intensive conditions and with cosmetic quality standards are exceedingly targeted by and susceptible to pests. Mites are mostly diminutive in size. Their widespread distribution and invasiveness (as new species) are often neglected, and they are commonly mistaken for similar known species, compounded by a limited understanding of their diverse biology and multitrophic interactions, resulting in pronounced crop losses due to late action. Advances generated by mite-omics opened a new stage in research and development with the publication of the first mite genome, the two-spotted spider mite (Grbić *et al.* 2011), a major tomato pest. A rising number of diagnostic methods and Artificial Intelligence (AI) monitoring and automation systems are increasing the understanding of the widespread occurrence of mites and their association with plant hosts and microbial communities (Rodrigues *et al.* 2019). Improving control strategies using nano-production, automation and AI-designed or delivery systems will increase the specificity of new acaricides and control methods. Substantial efforts will still be needed to determine potential damage or benefit to crop production using newly available tools for early detection, population monitoring and pest management. This new era is not without challenges as some of these developments may represent dual-use research of concern (DURC—a research that is planned to provide benefit but could be misapplied causing harm) and a revised framework for responsible use of the technologies must be in place. The recent rapid expansion of genetic/genomic and life science applications on arthropods and the expansion to mite-microbial systems will positively impact work on invasive mites and the tactics to manage those pests, resulting in more resilient and sustainable crop production.

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