Abstract

Bemisia tabaci (Gennadius) (Hemiptera: Aleyrodidae) is a globally destructive pest that is particularly damaging to tropical and subtropical agricultural systems. The sap-feeding behavior, coupled with its rapid reproduction, causes substantial direct crop damage and facilitates the transmission of over 350 plant viruses, leading to significant yield losses in crops such as tomato, potato, cabbage, cotton and soybean among others. Conventional control strategies rely heavily on synthetic insecticides; however, their intensive use has led to the emergence of insecticide resistance in B. tabaci biotypes, environmental degradation, and detrimental effects on non-target organisms. Biological control using natural enemies, including predators, parasitoids, and entomopathogens, serves as a sustainable option within several integrated pest management (IPM) frameworks. In this review, the effectiveness of key biocontrol agents such as predatory beetles (Delphastus catalinae), mirid bugs (Macrolophus pygmaeus), parasitoid wasps (Encarsia formosa), and entomopathogens in controlling B. tabaci populations is evaluated. It highlights implementation challenges, including environmental sensitivity, host specificity, cost, scalability, and insecticide compatibility. Further, future directions are discussed with a focus on genetic and ecological innovations, improved delivery mechanisms for entomopathogens, climate-resilient biocontrol agents, and farmer-centric training and policy support. Promoting these multidisciplinary strategies is crucial for enhancing long-term pest suppression while preserving ecological communities and the integrity of agricultural landscapes by reducing reliance on synthetic insecticides.