



Potato Virus Epidemiology and the Emerging Role of Alternative Weed Hosts

Ahmad Iqbal^{1*}, Rana Binyamin¹, Akhtar Hameed¹, Talha Noor²

¹MNS-University of Agriculture, Institute of Plant Protection, Department of Plant Pathology, Multan, Pakistan

²Weihenstephan-Triesdorf University of Applied Sciences, Faculty of Agriculture Food, and Nutrition, Department of Agriculture and Food Management, Triesdorf, Germany

Abstract

Potato viruses remain a serious constraint to worldwide potato production. They cause a serious yield losses deterioration of tuber quality and seed degeneration of worldwide. Among the most economically important pathogens, potato leafroll virus (PLRV) and potato virus Y (PVY) continue to spreading geographically. The Expansion has been associated to increased monoculture system, changes in the ecology of aphid vectors due to climate change and the emergence of recombinant viral strains. Despite the progress made in disease management, current epidemiological frameworks still underestimate the main role of weed reservoirs in virus persistence, inoculum carryover and secondary transmission in potato agroecosystems. Recent molecular metagenomic, and landscape scale studies increasingly identify weed communities as active epidemiological studies rather than incidental alternative hosts. weed species such as *Chenopodium album* & *solanum nigrum* can harbor potato viruses, and preserve an asymptomatic infection, sometimes leading to the maintenance of potato viruses in the weed species for a season, and also support aphid vector survival. These reservoirs can carry viral inoculum between cropping cycles and intensify next season transmission in the potato crop. Emerging virome surveillance has also revealed hidden viral diversity within non crop vegetation including the identification of recombinant and undetected viral variants. Recent evidence indicate that weed mediated persistence is more central role in the initiation outbreak and seed degeneration dynamics than previously recognized. This review summarizes the most recent potato virus epidemiology and re evaluates the ecological significance of weed reservoirs under rapidly changing agroecosystems. Particular emphasis is placed on virus vector weed interactions, recombinant viral evolution, climate vector response migration and landscape connectivity influencing disease emergence. The review concludes that sustainable virus management are insufficient to depend solely on certified seed systems and vector suppression strategies. Instead, integrated surveillance system combining weed ecology, molecular epidemiology, and climate-based predication are essential for improving outbreak predication and strengthening long term potato health resilience.

Keywords: *Potato viruses, Weed hosts, Virus epidemiology, Vector ecology*

