

Molecular Characterization of the Begomovirus Associated Satellites Infecting *Spinacia Oleracea* and *Capsicum Annum* Plants in Kohat, Pakistan

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ABSTRACT

Begomovirus is a major and economically important genus of the *Geminiviridae* family. It comprises a wide range of viruses that infect a number of dicot plants including the horticulture crops, cereal crops, aromatic plants, vegetable crops, medicinal plants and weeds in various regions of the world. This study aims to investigate and correlate the various symptoms of begomovirus / satellites in different plants grown in the vicinity of Kohat, Pakistan. Furthermore, the characterization of the selected virus-associated satellites at the molecular level is also studied. Samples of suspected plants showing begomoviral infection were collected from the Kohat District. Genomic DNA was extracted from the infected plants and subjected to PCR using DNA-1/DNA-2 and Beta01/Beta02 for alpha satellites and beta satellites, respectively. The amplified PCR products were cloned and sequenced commercially. After sequencing, in silico sequence and phylogenetic analysis was also performed. Our study discovered that many plants in the Kohat District display begomovirus and satellite disease symptoms with mild to extreme disease severity. Disease incidence is especially high in okra. Beta satellites were isolated and sequenced from *Spinacia oleracea* and *Capsicum annum* plants and they showed more than 90% sequence similarity with chilli leaf curl and tomato leaf curl beta satellites. The existence of betasatellites in

spinach and chilli plants was discovered for the first time in the Kohat region. Moreover, the distribution of these highly pathogenic variants of chilli leaf curl and tomato leaf curl betasatellites in the district Kohat has been reported previously.

Keywords: alphasatellites, begomovirus, betasatellites, geminiviridae, pathogenic variants