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BEGOMOVIRUSES REPORTED ON MEDICINAL PLANTS – AN OVERVIEW

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ABSTRACT

Begomoviruses (the Geminiviridae family) is observed to infect valuable economic yield including medicinal plants. In the last two decades, the issue of begomoviruses has been compounded by the proliferation of various variants of viruses due to recombination and genome mutations, the introduction of susceptible plant varieties, as well as changes in climatic conditions. The latest research work on Begomoviruses impacting medicinal plants has been focused in this study.

Keywords: Begomoviruses, Medicinal Plants, Recombinations, Genome Mutations and Climatic Conditions

INTRODUCTION

In the field of pharmaceutical and related disciplines, market as well as research on medicinal plants is emerging globally in an exponential manner. In fact, between fifty thousand and seventy thousand plant species are globally recognized for their medicinal properties, and four thousand to ten thousand of them are threatened (Canter *et al.*, 2005 and Taylor, 2008). More than four lakh tonnes of medicinal plants are globally exchanged for approximately 3000 species. India is one of the largest medicinal plant producers and exporters (Taylor, 2008). Instead of their synthetic analogues, natural products from medicinal plants have less adverse effects on human systems. The global market for medicinal plants is expected to reach five trillion dollars by 2050, with an annual rise of 10 to 20 percent (Singh and Jha, 2008). In a bid to explore new ways to meet the ever increasing demand of herbal preparation without depleting existing capital for improving regional growth, the scientific fraternity is indulged in the pursuit. Medical plants grown in India and globally are subjected to a large number of threats.

Quite a large number of pests are harmful to medicinal crops and hinder the yield of production (Kataria and Kumar, 2012). There are also other microscopic species other than these that cause a significant annual loss. One of the species that are microscopic is viruses. The crop plants are infected by many viruses, but the principal contribution is from the begomovirus. Begomovirus is the largest genus of plant virus in the Geminiviridae family that also infects a wide range of plants, monocots and dicots, causing catastrophic losses. Contingent upon the factors like the strains of the host, atmosphere and viruses (Gadani *et al.*, 1990), reduction contributed by Geminiviruses and it was estimated to be 18 to 100 percent. During 1950s Begomovirus reported losses ranging from

20 to 100 percent. (Leke *et al.*, 2015). In recent years the research over Begomoviruses and its threats to medicinal have taken a serious turn.

The Begomoviruses is known to have an adverse effect on the agricultural crops, medicinal crops, weeds etc., affecting the economy of the society. Combined with white flies polyphagous feeding behavior, the fast evolutionary ability of these single standard DNA viruses has led to the emergence of many destructive viral strains. This analysis accentuates particularly one effects of begomovirus on medicinal plants (Table 1, description of medicinal plants infected with begomovirus).

Andrographis paniculata, commonly referred to as the creator of green chiretta, is an annual herbaceous plant native to India and Sri Lanka in the Acanthaceae family. This herb is known to have anti-hepatotoxic, anti-carminative and many other therapeutic properties because of its pharmaceutical properties. Khan and Samad (2014), in Kalmegh fields and nearby Lucknow area, discovered the symptoms of upward leaf curling and yellow veins. Sequences of *Ageratum* yellow vein betasatellite showing 83-89 percent identification, were also correlated with a betasatellite. Khan *et al* (2015) identified *Catharanthus* yellow mosaic virus from Barabanki district, Uttar Pradesh in Kalmegh, showing similar symptoms the disease occurrence was between 15 - 20 percent.

Catharanthus roseus is renowned for its ornamental properties and known as Madagascar periwinkle. It also possess some important medical properties that are vital for treatment of cancer and plant virus. A BLAST analysis was performed by Punjab University, Pakistan, exhibiting excessive yellow mosaic. It further showed that the clone KN4 sequence has less than 89 percent identity with the *Chilli leaf curl India* virus, and the clone KN6 sequence shows a new Papaya leaf crumple virus identity of 95 and

Table 1: Medicinal plants infected with begomovirus.

Name of medicinal plant	Medicinal properties	Name of virus/ species	Nature of genome	Symptom	Reference
<i>Capsicum annum</i>	It is used for treatment of cancer cells, sinusitis, bronchitis and pain reliever in case of arthritis,	“Chilli leaf curl” virus	Monopartite	upward leaf curling symptom	“Dhanraj & Seth, 1968; Khan <i>et al.</i> , 2006; Vinoth Kumar <i>et al.</i> , 2012; Saunders <i>et al.</i> , 1992”
<i>Capsicum frutescens-grossum</i>	used for sore back, sore muscles and rheumatism	“tomato yellow leaf curl” virus	-	leaf curling and growth stunting	Khan <i>et al.</i> , 2007
<i>Carica papaya</i>	anti-hypertensive, antioxidant, wound healing, effect on smooth muscles, antimalarial, hypoglycemic activity	papaya leaf curl virus	-	leaf curl diseases	Mishra <i>et al.</i> , 2021
<i>Emilia sonchifolia</i>	use to treat inflammation, rheumatism, wounds, coughs, and tumors.	“ageratum yellow vein China virus and tobacco leaf curl Thailand virus”	-	Yellow vein symptoms	Zhao <i>et al.</i> , 2018
<i>Momordica charantia</i>	It is used as antiviral antimicrobial, antihelminthic and for regulating blood cholesterol	“Tomato leaf curl New Delhi virus and Pepper leaf curl Bangladesh virus”	Monopartite	Yellow mosaic	Tiwari <i>et al.</i> 2010
<i>Moringa oleifera</i>	antifungal, antiviral, antidepressant, and anti-inflammatory activity	Multiple Begomoviruses	-	Plant dwarfism and mosaic chlorosis,	Séka <i>et al.</i> , 2018
<i>Mucuna pruriens</i>	antioxidant, enhance sexual health, anticholesterolemic, antivenom activities	Velvet bean severe mosaic virus	Bipartite	Mosaic and yellowing	Zaim <i>et al.</i> 2011
<i>Ocimum spp</i>	antibiotic, anticancerous, antiageing, antistress, antipyretic, diaphoretic, diuretic activities and also used in stomach pain, cough and cold, diarrhea and indigestion	“Tomato leaf curl virus, Chili leaf curl virus and Tomato leaf curl Albatinah virus”	Monopartite	leaf curling, and yellowing	Ammara <i>et al.</i> 2015
<i>Sida cordifolia</i>	used to treat inflammation of the oral mucosa, and nasal congestion	“Sida leaf curl virus”	“Monopartite”	“Mild upward leaf curling”	Guo and Xhao, 2006
<i>Salvia hispanica</i>	antioxidant, control high blood pressure	“Sida mosaic Bolivia virus and Tomato yellow spot virus”	Bipartite	Yellowing and Mosaic	Celli <i>et al.</i> (2014)

99 percent. In the Begomovirus genus, KN4 is a newly discovered isolate and is thus called the *Catharanthus yellow mosaic virus* (Ilyaset *et al.*, 2013).

Clitoria ternatea, commonly known as butterfly pea, belongs to the Fabaceae family. These Plant extracts exhibit a wide range of pharmacological benefits, including antipyretic, antimicrobial, and are able to smoothen the muscles (Mukherjee *et al.*, 2008).

Euphorbia heterophylla initially originated in South and Central America, and much of the tropics and subtropics are now commonly naturalised. This plant is commonly used to treat stomach pain, constipation, gonorrhoea, and fungal diseases. *E. heterophylla* showed signs of yellow mosaic and leaf curling. The BLAST study depicted 86

percent similarity with the *Euphorbia mosaic virus*, thus identified as *Euphorbia mosaic Venezuela virus*. Further, the DNA-B clone indicated a 77 percent similarity with Cuba's *Euphorbia mosaic virus* (Zambrano *et al.* 2012). *Mentha spp* is commonly known as mint belongs to the Lamiaceae family. It is used as a carminative, antifatulence, diarrhoea treatment, pain relief, relaxant and antibacterial action, etc. viral infestation has been shown in infected mint plants, including mosaic, curling and leaf deformation, yellowing and poor stunted growth, which in turn results in biomass loss. The sequence showed 93 percent identification with isolate *Tomato leaf curl Pakistan virus* (Borah and Dasgupta, 2012). A full DNA-A monopartite begomovirus was subsequently developed in 2008 in Punjab, Ludhiana, along with a betasatellite molecule in the *Mentha* crop.

Owing to themedicinally important components such as morphine, codeine, the baine, etc., the *Papaver somniferum* (Opium) is highly regarded. The sequence shows the highest identity of isolates with the DNA-A genome of *Tomato leaf curl New Delhi virus* from bottle guard, muskmelon and tomato etc. found in India (Srivastava *et al.*, 2016). Here, the result indicates 100 percent incidence on opium poppy plants and tomatoes, although it also threatens other important medicinal crops.

Solanum nigrum, a weed plant commonly referred to as “Black Night Shade” or “Makoy”, is known for its medicinal properties in the treatment of inflammation, edoema and hepatic cancer. A study conducted on *nigrum* in Rajasthan during 2010 revealed certain related symptoms of the virus coaxing and stunting, thereby causing enormous loss. This is the first evidence of infection with begomovirus in *S. nigrum* (Gaur *et al.*, 2013). It plays a major role in the transmission of disease to other economically important crops as an alternate/reservoir host.

Withaniasomnifera, also known as Ashwagandha. Medicinal preparations for arthritis, insomnia, liver disorders, anticancer, etc. are extracted from its root and berry. The yellow mosaic disease association of a begomovirus was identified but not at the molecular level (Baghel *et al.*, 2012). A survey in conducted in Aligarh, Lucknow and Rajasthan, indicated the incidence of illness to be around 15 and 20 percent. These isolates shared a maximum identity of 91 percent with *Lucknow's Jatropha mosaic India virus* (Baghel *et al.*, 2012). As shown in Table 1, various other medicinal plants that are infected with begomovirus are also present.

CONCLUSION

India along with rest of the world has registered an increased rate of number of begomovirus infections, therefore has received worldwide attention from the researchers. This analysis accentuates on the current aspects of begomoviruses infecting the medicinal plants in particular.

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