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Management of Tobacco Mosaic Virus through Natural Metabolites

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Abstract: The viruses are one of the most threatening factors for plants resulting in gigantic economic losses. These utilize host internal machinery for reproduction and can spread through biological and non-biological means. Among the most hazardous plant viruses, Tobacco mosaic virus (TMV) is the most ancient virus which causes massive economic losses to tobacco, pepper, cucumber and ornamental crops globally. The problem can be reduced by minimizing the vector population through application of pesticides. Opposite to obtained success in virus control, rapid utilization of synthetic chemicals is disastrous for our ecosystem. Therefore, alternative approaches such as natural derivatives should be explored for eco-friendly management of TMV. So, here we have tried to take into account various natural metabolites which can be effectively and potentially used against TMV. We further explained about the derivatives from animals, fungi, bacteria and actinomycetes which are useful against TMV. The review imbibes the recent research findings regarding exploration of natural derivatives for management of TMV and concludes through highlighting the future prospects via hoping that future pesticides will be safer for human being and our planet.

Keywords: Alkaloids; tobacco mosaic virus; animals; microorganisms; plants.

1. Introduction

Approximately 15% of global yield of economically important crops is being reduced every year by different plant diseases [1]. Plant viruses account for approximately 30 % of plant diseases [2, 3]. These are nucleic acid based single stranded (ss) or double stranded (ds) DNA or RNA pathogens

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packed in proteins (capsids) which survive within the host via acquiring host internal machinery and further utilize it for the intracellular movements and transmission [3-5]. Viruses attacking plants are categorized as the second largest culprits causing huge losses to vegetables, house hold plants, ornamentals and various field crops worldwide i.e. approximately 60 billion USD in financial terms [6]. According to International committee of taxonomy of viruses (ICTV), there are 950 different types of plant viruses so far reported on our planet [7,8].

TMV is the positive sensed single stranded (ss) RNA virus (Tobamovirus; Virgaviridae) producing mosaic"-like mottling discoloration symptoms on leaves. It is considered as the most ancient virus in plant virology as it was discovered in 1898 [9]. The particular virus causes massive damage to various crops including 125 plant species such as tobacco, cucumber, pepper and ornamentals [10]. TMV is a rod shaped virus with a capsid composed by 2130 coat protein (CP) molecules along with one ssRNA genomic molecule (6.3-6.5 kb) [11](Figure 1). The CP is self-assembled into the rod-like helical structure constituting 16.3 proteins per helix turn tight around the RNA forming a hairpin loop structure [12] TMV genome encodes 4 open reading frames (ORFs) [13] and is considered as thermo-stable virus tolerating up to 1200°F (50°C) up to 30 minutes with a refractive index of 1.57 [14].

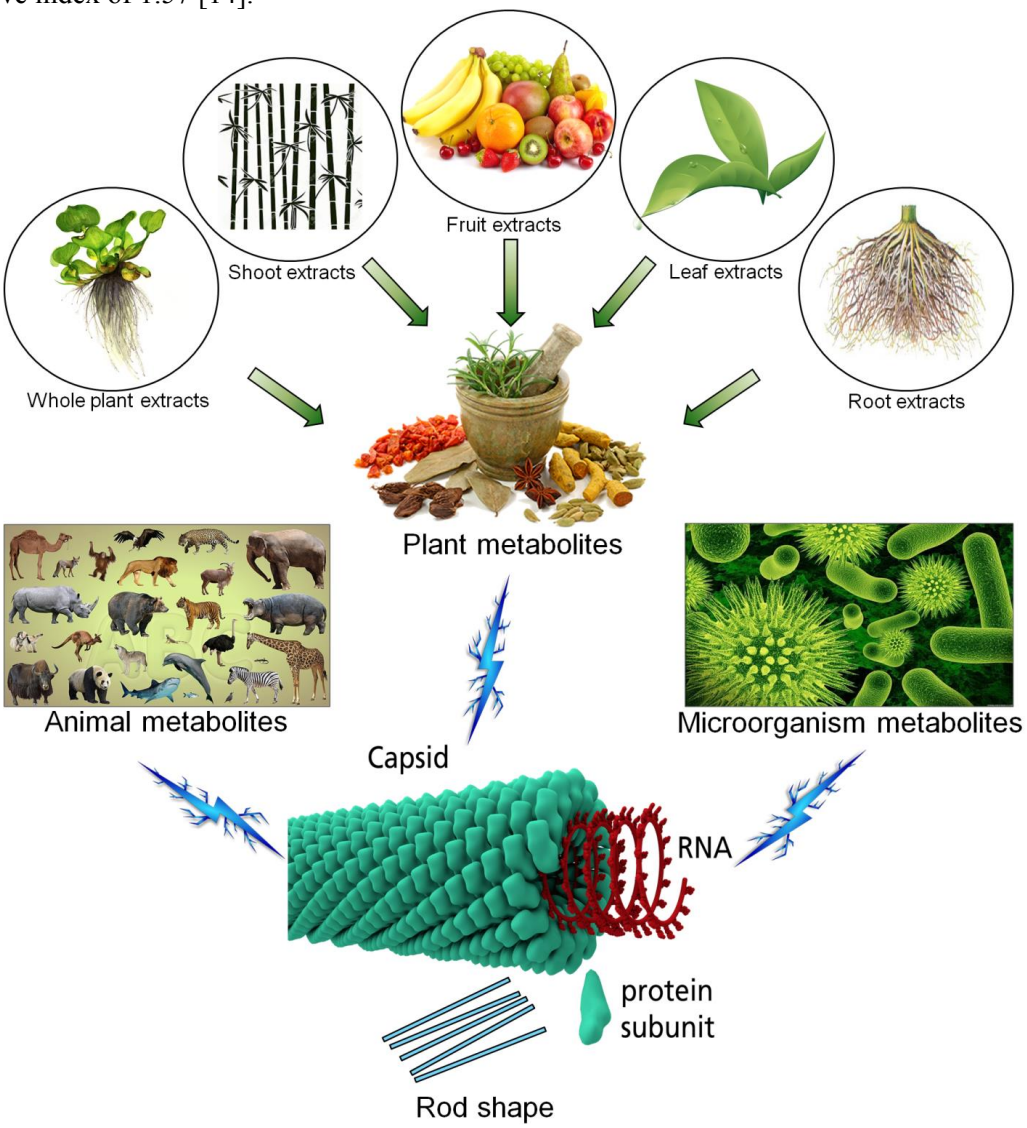

Figure 1. Structure of TMV and natural metabolites which have positive impacts against TMV