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Mini Review

Medicinal Plants and Their Products for the Management of Poxviruses: A Mini Review

Sandhya Verma* and Niharika Sharma

Department of Life Science, Shri Vaishnav Institute of Science, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Madhya Pradesh, India

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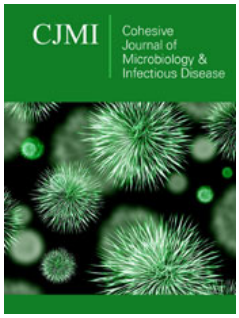

***Corresponding author:** Sandhya Verma, Department of Life Science, Shri Vaishnav Institute of Science, Shri Vaishnav Vidyapeeth Vishwavidyalaya, Madhya Pradesh, India

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Introduction

It is mysterious how viruses get inside host cells. Some viruses can grow and cause the host cell to lyse to infect more cells and propagate the infection, while others integrate into the host chromosome and can stay dormant for years at a time [1]. *Orthopox, yatapox, parapox*, and *molluscipox* virus are the four primary genera of poxviruses that may infect humans. Rodents are often the natural hosts of poxviruses, and infrequently people can catch the disease from them. When virus-containing material comes into interaction with the skin or respiratory tract, the poxvirus enters the organism (smallpox and monkeypox) [2]. Poxviruses, in contrast to many other viruses, enter host cells by attaching to receptors that are remarkably conserved across various animals. As a result, species-specific receptors have little impact on the spectrum of hosts that poxviruses may infect, and the effectiveness of an infection depends primarily on how successfully the host immune system can be antagonized [3]. The single linear double-stranded DNA molecule that makes up a poxvirus genome ranges in size from 130kbp (*parapoxviruses*) to 280kbp (*birdpox virus*) and up to 375kbp (*entomopoxviruses*). Skin lesions, which may be small-scale or broad, are common symptoms of all poxvirus infections [4]. Several other poxviruses remain serious dangers to public health despite the elimination of smallpox, especially for individuals who work with cattle [5].

Because viruses are continually changing, they have been creating new methods to get past the immune system. These factors make finding an effective antiviral treatment difficult [1]. The advent of novel viral agents and viral resistance mutation caused a widespread desire for antiviral characteristics. Plants were often the first viable medicinal option during viral illness pandemics that have changed human history. Plants and plant-based ingredients have been widely employed in the treatment and management of many viral and other disorders in the old Indian Ayurvedic medical system [6]. In the majority of the world's nations, traditional medicines are still frequently utilized, and their usage is growing. The World Health Organization reports that over 80% of the population in underdeveloped nations still uses herbal medicine as their primary source of treatment [7]. The use of natural medications has risen because of the depletion of synthetic drug effectiveness and the appearance of cases of contraindications [8]. In order to combat pox virus infections, this mini-review will look for plants and plant-based products that have antiviral properties worldwide.

The well-known Southeast Asian native fruit known as mangosteen (*Garcinia mangostana L.*) is valued for its therapeutic powers by the locals. Xanthones, a kind of polyphenol is produced by mangosteen, that often comprises a small portion of the average person's diet and has a significant impact on human health due to its antibacterial, antifungal, antiviral, antimalarial, anticarcinogenic, and antiatherogenic properties [9]. One spice with a high level of antioxidants and a long history of usage in traditional medicine is red ginger (*Zingiber officinale var. rubrum*). Red ginger contains chemical components (*Gingerol*, *zingeron*, and *shogaol*) with antioxidant, anti-inflammatory, antibacterial, analgesic, diuretic, antiviral,

antifungal, and anticancer activities, as per studies [10,11]. According to a study by Nur'aini, in ovo inoculation of 1.5% and 3% Mangosteen Rind (MR) and 5% and 10% gingerol in Red Ginger (RG) and the combination of 1.5% mangosteen rind plus 5% gingerol in red ginger ethanolic extracts at 0.1mL/egg inhibit avian pox virus by lowering the number of pock lesions on the chorio allantoic membrane of the embryonated chicken eggs [12]. A carnivorous plant belonging to the *Sarraceniaceae* family, *Sarracenia purpurea* (purple pitcher plant) is mostly found in the United States and Canada [1].

The first effective inhibitor of poxvirus replication at the level of early viral transcription was identified *in vitro* by research in *Sarracenia purpurea*. These findings suggested that *S. purpurea* may serve as another preventative tool against ortho poxvirus infections in light of the resurgence of poxvirus (vaccinia virus, monkeypox virus and variola virus) related diseases [6,13]. The prominent West African medicinal herb *Guiera senegalensis* produces galls (abnormal growth) that are utilized in ethnoveterinary medicine to cure FP in hens. These galls were once used to treat human cases of measles and smallpox [14]. Lamein et al. observed that a fowl pox virus-induced pock development and viral titre in developing chicken eggs were both inhibited by an aqueous acetone extract from the galls of *G. senegalensis*.

The stimulation of the alternative complement pathway and the suppression of fowl pox virus-induced cholesterol genesis in ovo by components of the gall extract are the proposed mechanisms of action [14]. *A Trifolium* species plant extract that was grown from plant stem cells in a bioreactor is known by the reference name *Secomet V*. *In vitro* studies using a 50^{th} of a milli liter of *Secomet V* showed significant antiviral activity against the vaccinia virus, rendering about 1 million particles noninfectious in 1 minute [15]. According to a study by Bhanuprakash et al. [16] goat pox virus replication *in vitro* is inhibited by the extract from leaves of Acacia arabica and Eugenia jambolana.

The maximal non-toxic amounts of extract from *A. arabica* (Babul) and *E. jambolana* (Jamun) leaves, 99.93±0.38 and 1999.73±0.50g/ml, respectively, inhibited the Cytopathic Effect (CPE) by 99.70 and 99.92 percent in all cytopathic inhibition tests [16]. Similar research by Bhanuprakash et al. [16] reported that extract of E. jambolana leaves of concentration 1999.73±0.50g/ml inhibits the buffalopox virus replication by 98.5% in all cytopathic inhibition tests [17]. Clinical tests on animal models against pox viruses (smallpox, vaccinia, buffalopox) have demonstrated that *Ocimum sanctum* (Tulsi), *Azadirachta indica* leaf extract and an ayurvedic mixture (*Triphala*) of dried fruits of the three plant species, *Emblica officinalis* (Amalaki), *Terminalia chebula* (Haritaki), & *Terminalia bellirica* (Bibhitaki), have viral inhibitory activity [6,16-18]. To establish the potency of these medicinal plants against the relevant viruses more preclinical studies are required. Nevertheless, the progress made so far in this field encourages further research into traditionally utilized plants to identify the antiviral chemicals against poxviruses.

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