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COVID-19 and medicinal plants: A critical perspective

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ABSTRACT

On a global scale, the Coronavirus pandemic (COVID-19) is having a direct and indirect effect on human lives, socioeconomic conditions, and the natural environment. The measures are taken to prevent the spread of coronavirus and slowdown of economic activities could have major short and long term effects on the natural ecosystem and climate in the coming days. Based on the current scientific studies, the present perspective intends to examine the possible direct and indirect impacts of the COVID-19 pandemic on the ecosystem particularly on medicinal plants. The natural compounds obtained from medicinal plants and herbal formulations provide rich sources of novel effective measures to control viral infections. The unpredictable COVID situation has affected the environment based on several aspects which may play a key role in impact on plants. The positive perspectives of the world pandemic are a significant improvement in quality of air, reduced carbon emission, increased water purity and reduction in other types of pollution. But at the same time, the negative consequences are much more, which mainly includes increased consumption of preventive medical equipment and medical wastes due to treatment and human immortality, which is continuously endangering the medicinal plants. These wastes may affect the natural cycling process and the natural habitat of the medicinal plants which are a promising solution for the prevention of viral diseases in the years to come. Hence, this perspective will be beneficial for the possible research studies and proper implementation of the strategies that might be support the global climate sustainability.

1. Introduction

The appearance of the new SARS-CoV2 in December 2019, has caused an unprecedented impact globally. The World Health Organization (WHO) announced COVID-19 as a pandemic and global health emergency in March 2020. The direct and indirect impact of the COVID-19 pandemic is emerging in every aspect of life like public health, economy, the environment, social life and technology [1]. The current strategy for combating the pandemic spread is that most of the government and private sector policies are focused on public health and lack other perspectives, especially on environmental issues. As a result, the indirect impact of the coronavirus on the ecosystem, particularly on flora and fauna, has received less attention.

The pandemic disruption has brought about several consequences on the environment and climate as a result of significant lockdown of economic activities and slowdown of public and transport. The favorable aspects like significant improvement in the quality of air, clean

beaches, reduction in environmental noise level and wildlife animals were spotted back in cities which is very encouraging [2]. On the other hand, the adverse environmental impacts that have been increased and cannot be brushed off as these positive conditions last only for a short period. Therefore, the negative aspects such as the reduced recycling process in most of the countries, a very high increase in domestic and medical waste, further accelerate contamination of air, water and land which cannot be neglected [3]. Contamination of air, land and water due to disposal of corona prevention Medicare products such as disinfectants, mask, PPE kit, gloves and burden of untreated hospital wastes at the community level is an alarming situation for the growth and development of plants, especially for medicinal plants, which are considered to be a promising alternative solution to control viral infections in human beings.

Chloroquine, hydroxychloroquine, Ritonavir, Lopinavir, Camostat, Nafamostat, Famotidine, Nitazoxanide, Umifenovir, Ivermectin, Tocilizumab, Corticosteroids, Sarilumab, Fluvoxamine, Bevacizumab,

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Remdesivir, Doxycycline, Dexamethasone, Melatonin, Toremifene, Baricitinib, Casirivimab, imdevimab, Monoclonal antibodies, Bamlanivimab, Etesevimab, Paracetamol, Codeine, Dihydrocodeine, Non-steroidal anti-inflammatory drugs, many Immunity boosters, multivitamins, Vitamin-C, Zinc, a huge amount of medicines empty wrappers, boxes, syringes, Mask, Sanitizers, gloves and polymers wastes (packing materials) are used during the pandemic situation in uncountable amounts and still all are using by all countries [4–6]. These all complex chemical compound in the form of medicines or other waste products might enhance the pollution in natural sources drastically and may have an impact on plants or medicinal plants in the future which are one of the best alternatives for the production of novel therapeutic products for antiviral diseases and many other such ailments.

Many scientific reviews show that positive results are obtained by using herbal medicines when used alone or combined with standard medicines for treating COVID-19 infected patients. Luo CH and his team reports that certain herbal and Chinese traditional medicine can substantially improve mild to serious symptoms, as well as reduce mortality. These medicines reveal antiviral, antioxidant, anti-inflammatory and immunity-boosting effects, making them a promising treatment option for COVID-19 patients [7]. According to Benarba and Pandiella, recent studies reveal that application of naturally available bioactive products, various herbal extracts and extracted components can produce anti-COVID actions by directly inhibiting virus replication or entry. Some components have been found to inhibit the ACE-2 receptor or the serine protease TMPRSS2, both of which are necessary for SARS-CoV-2 to infect human cells. The reports show these products can inhibit certain proteins such as papain-like and chymotrypsin-like proteases involved in the life cycle of the SARS-CoV-2 virus [8].

Studies show that Coronaviruses (CoVs) belonging to the virus family cause infections in respiratory and gastrointestinal organs in human beings and animals. The virus is communicated from person to person by respiratory droplets [9]. The COVID-19 virus has been detected in the stool of COVID patients in multiple cases, according to various reports, and it has been observed that it remains positive in stool even when the infection in the respiratory tract is found to be negative. As a result, the viral transmission in the gastrointestinal organs raises concerns about potential faecal-viral transmission in wastewater [10,11].

Haramoto and his team from Japan conducted the first monitoring of SARS-CoV-2 RNA on the environment and reported the identification of SARS-CoV-2 RNA in secondary-treated wastewater (2.4×10^3 copies/L) [12]. According to Paola Foladori's report on SARS-CoV-2 viral transmission from infected person faeces to wastewater and water treatment plants, the virus in the faeces of SARS-CoV-2 infected people is found to be 5.10^3 – $10^7.6$ copies/mL. But it drops from 2 copies per 100 mL to 3.10^3 copies per mL after entering a WWTP [13]. Similarly, Kitajima et al. also confirmed that the presence of SARS-CoV-2 RNA in wastewater collected from virally infected areas [14].

The ability of plants to recognize evolutionary forces and diversity within populations, as well as their intrinsic mechanisms for detecting these changes and how biodiversity is preserved or propagated, are essential features for plants to thrive in a changing climate. Several Scientific research studies have been done on the effect of how an environmental factor affects the physiology and metabolic activities in plants. The literature review presents information on plant-produced chemical compounds with medicinal properties, as well as how their development is influenced qualitatively and quantitatively by various environmental factors. Any factor in the environment that deviates from the optimum levels harms the rate of physiological processes, causing stress in the plant. The way plants react to stress is determined by the length and severity of the stress, as well as the plant's physiological state. The fertilisation with growth-limiting nutrients in the soil due to land pollution results in the synthesis of limited concentrations of carbon-based phytochemicals and reduction of Nitrogen components such as alkaloids and cyanogenic glycosides in plants [15].

Banerjee and Roychoudhury investigated the stress on the growth

and physiology of medicinal plants due to the salinity effect, finds that salinity stress is a major inhibiting factor for the growth and development of medicinal plants such as *Majorana hortensis*, pennyroyal, peppermint, Aloe vera, Apple mint, Geranium, *Thymus maroccanus*, *Matricaria recutita* and *Thymus vulgaris* [16]. Changes in saline water may arise due to increased load such as harmful pollutants like disinfectants, masks, PPE kit and gloves and the burden of untreated hospital wastes in the current situation.

Under the current scenario, the emerging situations of environmental pollution such as highly infected wastewater due to COVID-19 infection is a non-invasive early warning for the natural ecosystem, particularly the growth and development of plants in the coming days. The main objective of this perspective is to focus on how to control such a situation or ensure the future sustainability of the human race as we depend on natural sources such as air, water, soil and plants for life essentials such as food for nutrients and medicines. Therefore, urgent research investigations are required to know and understand how the duration and intensity of these environmental factors impact plant species in the future. Furthermore, besides social and economic impacts and loss of human life, the virus crisis may bring an environmental crisis that may last longer and may pose more challenges for the countries to manage if they neglect the impact of the covid-19 pandemic on the environment. Accordingly, the need of the hour is to give extra attention and make possible strategies to attain environmental sustainability as well as sustainable development themes and goals.

Declaration

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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