Is COVID-19 impacting plant science, and is plant science impacting COVID-19?

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Abstract

COVID-19 changed 2020 massively after becoming a worldwide pandemic. Many countries affected by the disease witnessed disruptions in the agricultural, farming, industry, production and distribution sectors, causing a loss of crops due to reduced consumer demand. Sales of cut flowers, potted plants and seasonal crops that are sensitive to specific seasons or dates were affected, as were fertilizer and food security. Academics, including plant scientists, with limited work or research conditions during the pandemic, alleviated their work through alternative approaches, e.g., in silico research, or made more time to writing research papers, while student education has largely been placed on hold or held online by lecturers. Most COVID-19 research has focused primarily on medical and social aspects while some plant science-related research has been conducted on the use of traditional medicinal plants as possible alleviating agents, but not cures, to COVID-19 patients. The integrity of science and publishing, including research related to plants, is being tested as cases of superficial research, lax or superficial peer review, and misinformation abound. COVID-19 has thus had limited impact on plant science, and vice versa, thus far, even though it is likely that most plant scientists were affected.

Keywords: food security; herbal and medicinal plants; pandemic; plant-based medicine and vaccines; plant research; SARS-CoV-2; viruses

Introduction

In 2020, the world was radically transformed by the coronavirus disease (COVID-19) pandemic caused by the severe acute respiratory syndrome coronavirus type 2 (SARS-CoV-2) virus. Data from John Hopkins University states that, on July 16, 2020, COVID-19 had already infected 13,405,694 people and caused 580,552 mortalities around the world1. Countries have responded differently, including partial or total lockdowns, restricted travel, or physical social distancing, halting an estimated 81% of the global workforce2. In some countries, agriculture, farming, food, industrial, production and distribution sectors have come to a

1 https://coronavirus.jhu.edu/map.html (last accessed: July 16, 2020).
2 https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/briefingnote/wcms_740877.pdf (last accessed: July 16, 2020).
against other coronaviruses (e.g., SARS-CoV or Middle East respiratory syndrome coronavirus), most of the studies listed by Wu et al. (2020) remain theoretical, and those by Vellingiri et al. (2020) secondary metabolites or ethnomedicinal plants as possible treatments of COVID-19, e.g., Ul Qamar et al. (2020) on plant science, which has also been impacted, directly or indirectly. The most common is research on plant productivity to continue.

Without access to universities, research institutions, or agricultural testing fields in COVID-19 red zones, many researchers in plant science have restricted access to research material and data. Even if granted access to the workplace, stringent regulations may negatively impact the workload, working environment and working period, forcing some to spend their time at home writing papers to avoid psychosocial problems (Bouziri et al., 2020). Some online resources and classes for education in plant science were provided by some institutions during the pandemic (last accessed: July 16, 2020). The use of bioinformatics databases and in silico approaches to research, such as in silico PCR, or modelling (e.g., molecular docking analysis), can be conducted remotely, allowing some productivity to continue.

Research has focused primarily on medical and social aspects of SARS-CoV-2 or COVID-19, but little on plant science, which has also been impacted, directly or indirectly. The most common is research on plant secondary metabolites or ethnomedicinal plants as possible treatments of COVID-19, e.g., Ul Qamar et al. (2020). Wu et al. (2020) provided a list of about a dozen traditional Chinese herbal and plant-based medicines that have alleviated the progression of COVID-19 while Vellingiri et al. (2020) postulated that Indian medicinal plants, which have shown promising antiviral properties against other viruses, may also show promise against COVID-19. However, using only molecular docking studies or reliance on antiviral properties reported against other coronaviruses (e.g., SARS-CoV or Middle East respiratory syndrome coronavirus), most of the studies listed by Wu et al. (2020) remain theoretical, and those by Vellingiri et al. (2020) are hypothetical, so their efficacy against COVID-19 remains speculative until clinical human trials can be completed.

Some good plant-based research may have practical value to global health. In the field of plant biotechnology, plants can be used for molecular farming, allowing plants to be engineered to produce antigens for vaccines or diagnostic reagents (Capell et al., 2020), i.e., plant-based vaccines against COVID-19 (Rosales-Mendoza et al., 2020). Some studies used in silico testing and molecular docking software to assess the efficiency of plant secondary metabolites and other chemical compounds against SARS-CoV-2 proteins (Mpiana et al., 2020).

5 https://www.ncbi.nlm.nih.gov/pubmed/32628273 (last accessed: July 16, 2020).
6 https://www.ncbi.nlm.nih.gov/pubmed/32628273 (last accessed: July 16, 2020).
7 https://www.ncbi.nlm.nih.gov/pubmed/32628273 (last accessed: July 16, 2020).
8 http://www.oecd.org/coronavirus/policy-responses/food-supply-chains-and-covid-19-impacts-and-policy-lessons-71b57ae5/ (last accessed: July 16, 2020).
9 https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---sector/documents/briefingnote/wcms_742023.pdf (last accessed: July 16, 2020).
10 https://aec.ifas.ufl.edu/resources/ag-teachers/ (last accessed: July 16, 2020).
Plant-derived metabolites may in the future serve as effective disruptors of different components of SARS-CoV-2. For example, alkaloids might be used as an intracellular viral replication inhibitor DNA intercalating agent, phenolics bind with the membrane protein and spike protein, and essential oils (terpenes) can disrupt the viral lipid membrane due to their lipophilic nature (Jahan and Onay, 2020; Wink, 2020). Plant metabolites need to be clinically tested to support the findings of in silico modeling. The claims of ethnobotanical remedies serving as a cure or prophylaxis of COVID-19 are controversial, at best, since herbal medicine has both benefits and adverse effects (Vandebroek et al., 2020).

The integrity of the plant science literature is being put to the test by COVID-19. Excessive volumes, peer reviewer and editorial overload, resulting in editorial oversight (Chirico et al., 2020), and publishing too quickly invite the publication of erroneous research and the risk of bad science and predatory behavior (Teixeira da Silva, 2020) becoming part of the misinformation flow (Bell and Green 2020), issues that only post-publication peer review will be able to remedy over time.

Conclusions

Apart from direct impacts of COVID-19 on applied plant (agricultural crop) production, there is little evidence to suggest that plant science has been affected in any way as a field of study. The lives of plant scientists, as of other members of the public, has been disrupted, differently depending on the country, but there may be similarities in the lifestyle, social, psychological, educational and professional challenges that we have faced (Sofo and Sofo, 2020).

Authors' Contributions

Both authors wrote, read and approved the final manuscript.

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Conflict of Interests

The authors declare that there are no conflicts of interest related to this article.

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