

TR4 and COVID-19 are two sides of the same coin

S. Sandilyan

Well-equipped interconnectedness of countries and continents facilitates not only the migration of humans but also the movement of microbes, plants and animals. Since ages humans deliberately introduced certain species across natural boundaries by considering their commercial and ornamental values. In parallel, several species are accidentally introduced into new provinces with the help of humans and nature (e.g. through hitchhikers, ballast water, cyclones, tsunamis). Commonly these are tagged as non-native, exotic, non-indigenous and alien species. Large proportions of such introduced species are highly beneficial to mankind. On the other hand, humanity also witnessed the deleterious impacts of some exotic species on biodiversity, global economy and nutritional security (e.g. epidemic outbreaks)¹⁻⁴. Coronavirus (COVID-19) is a recent example of how rapidly an alien species can invade across national boundaries and continents, and kill several million people and have a negative impact on the global economy.

Ironically humans are worried and react quickly whenever there is a direct life threat caused by a species in the form of an epidemic disease. Rest of the time they are least concerned about the future impacts of a crisis. For example, human understanding of invasive alien species and climate change issues explains how naive they are. According to Conor Seyle (One Earth Future Foundation, USA) humans are bad at understanding the statistical trends and long-term changes and how they are going to pose a serious threat for the existence of the future generation⁵.

Jeffrey Shaman (Columbia University, USA), explains that COVID-19 and climate change have almost similar consequences on human life, biodiversity and global economy, but unfortunately we react rapidly only to the former issue⁶. He adds that most of the people do not have any clue about how climate change is going to affect human health, biodiversity, agriculture, food security, economy, and regional and global political stability. Unfortunately people also have a poor understanding of invasive species issues⁶. For example, since the last 75 years, India practically does not have any benchmark studies on the im-

pacts of invasive alien species on its important habitats and how they affect human health, biodiversity and food security of the nation. In fact, Indian agriculture and aquaculture sectors regularly face huge economic losses due to the invasion and subsequent outbreaks of several exotic pests and pathogens (e.g. fall armyworm [FAW], coffee rust, potato wart of paddy, papaya mealy bug, coconut eriophyid mite, white spot syndrome virus in prawn)⁷.

It is worth mentioning here that our researchers, bureaucrats, stakeholders and policymakers, as well as the so-called activists on social media have not responded to the warning message issued by the Food and Agriculture Organization (FAO) and Centre for Agriculture and Bioscience International (CABI) on FAW, one of the worst invasive species on maize in recent times⁸. In 2016, FAO and CABI had sent a strong warning message about the chance for invasion of the FAW *Spodoptera frugiperda* in the Asian region. Unfortunately, most of the Asian countries, including India, did not pay attention to this. As a result, within two years FAW invaded several Asian countries, including Bangladesh, China, India, Myanmar, Sri Lanka, Thailand and Yemen. It has devastated maize, cotton, sugarcane and other cash crops cultivated in millions of hectares in the aforesaid countries^{8,9}. Pertaining to India, around June 2018, FAW was reported from Karnataka and subsequently other states were also affected mainly due to lack of understanding and coordination. Within two years, FAW has been reported in more than 20 Indian states⁹. In 2018, 2.2 lakh ha of maize-cultivated fields in Tamil Nadu were devastated by FAW and the State Government announced Rs 186.25 crores as compensation. In the forthcoming years, FAW could cause more damage than expected¹⁰. Thus, one can easily see the nonchalant attitude on the containment of FAW and COVID-19.

TR4 fungus

In recent times, banana species, especially the Cavendish variety, cultivated in India are being infected by the soil-

borne fungus *Fusarium oxysporum* f.sp. *cubense*, also known as Tropical race 4 (TR4) fungus. The disease caused by TR4 is popularly known as Fusarium wilt and Panama disease. TR4 has been identified as one of the worst invasive pathogens of this century. The infected plant is not able to produce bananas. Besides, once the fungus invades the field/habitat, it can survive in the soil for more than 40 years even in the absence of the host plant. Further, TR4 cannot be eradicated by fumigants and other chemical fungicides¹¹.

TR4 was first reported around the 1990s in the commercial Cavendish cultivation fields of Malaysia and Indonesia. Subsequently, it effortlessly invaded several nations mainly because of the fragile quarantine policies and lack of awareness. Phenomenal spread was reported during the 20th century and around 2000 it was reported from several countries, including Philippines, Oman, Jordan, Laos, Mozambique, Lebanon, Pakistan, Vietnam, China, Australia, Papua New Guinea and India. Also, 1 lakh ha of commercial cultivated banana plantation was damaged by TR4 in Australia¹¹.

India confirmed the infection of TR4 in Uttar Pradesh in 2018; however, it was reported from Bihar in 2015, but was officially confirmed only in 2019. Now TR4 has been reported from Madhya Pradesh, Maharashtra and Gujarat. ICAR-National Research Centre for Banana, Tiruchirappalli has reported that West Bengal, Odisha, Karnataka, Tamil Nadu and the North East states are highly prone to invasion¹¹. On the other hand, farmers in the infected areas have begun to cultivate less profitable crops like maize and millets, which gives them a profit of only around Rs 25,000/acre. However, before TR4 infestation, they had earned more than Rs 2 lakhs/acre from banana cultivation. According to Indian Council of Agricultural Research (ICAR), India will face a loss of Rs 50,000 crores in the forthcoming years due to TR4. It also predicts that this will create large unemployment among the farm labourers¹¹. Already reports have confirmed that a large number of farm labourers from Bihar are moving

towards Punjab and Haryana for their livelihood¹¹.

Containment of TR4

ICAR has mentioned that TR4 is mainly spread through soil and soil particles adhering to agricultural tools, labourers' belongings, including their clothes, planting and plant materials, all types of water movement (irrigation water, surface drainage water, floods), strong wind and bunch stalks¹¹. Besides, movement of vehicles, livestock, insects such as banana weevils and transport of saplings could also facilitate the spread of TR4 to new areas. Based on this, ICAR has issued guidelines on how to prevent the spread of TR4. It has asked the farmers to demarcate infected plants and fields with coloured ribbons and place a warning board in order to prevent human movement. It has also insisted that farmers do not pull out the infested plants but burn them in their fields. Vehicles used need to be disinfected immediately before they exit from the field. ICAR has also requested the owners and labourers to adopt the 'come clean and go clean' policy, and has advised farmers not to drain water from the infested fields¹¹.

WHO, UNICEF and the respective countries such as India, USA, UK, Malaysia circulated a set of guidelines/instructions for containment of COVID-19. It is worth recalling how quickly individuals, media and governments have reacted to COVID-19. Within a short period of time the global community developed several guidelines and circulated them with help from the concerned authorities. As a master move, all the countries closed their international and national boundaries by curtailing all sorts of transportation and maintaining social distancing. Several countries issued a 21-day lockdown and even extended it based on the recorded numbers of infected people. The entire social media was flooded with COVID-19 messages. For

the past few months, a large number of R&D laboratories are actively involved in finding new drugs for COVID-19.

On the other hand, TR4 and FAW are going to endanger banana and maize plantations of several countries and will affect the economy and nutritional security. The ongoing climate change events are also going to have a negative impact on the global economy and human well-being⁶. Unfortunately, the bitter fact is that enough awareness has not been created among different stakeholders, farmers and the common public by the concerned authorities on the deleterious impacts of TR4, FAW and climate change events. If we compare the actions taken by the governments on the COVID-19 pandemic, as well as TR4, FAW and climate change issues, one can easily see several differences.

Boiling frog syndrome

The UN has clearly stated that the threat from climate change is as real as that from COVID-19, although it seems far away⁶. Interestingly, the UN statement is also applicable to invasive alien species. It is high time that we revamp our old notions and ideology on the issues of climate change and invasive species. Undoubtedly, the TR4 and FAW crises should also be considered as important as that of COVID-19, because they can also have a negative impact on food security, biodiversity, livelihood and global economy. In fact, the consequences of climate change and bio-invasion are several folds higher than those of COVID-19. Indeed, mankind needs to take a quantum leap from the current boiling frog state on issues regarding climate change and invasive species.

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S. Sandilyan was fellow on Invasive Alien Species, Centre for Biodiversity Policy and Law, National Biodiversity Authority, Taramani, Chennai 600 113, India.
e-mail: ssandilyan@gmail.com