

Editorial

Plantation Crops Diseases: Challenges and Future Thrust in Research

Plantation crops are a group of high-value commercial crops cultivated extensively in tropical and subtropical countries and contribute sustainably to the agricultural economy and export trade of many developing countries. In the African continent, tea, coffee, and cocoa contribute significantly to the economy of countries like Kenya and The Republic of Cameroon. In the Asian continent, oil palm contributes substantially to the economy of Malaysia and Indonesia. Rubber is a very valuable foreign exchange-earning crop in many Latin American countries. Being perennial, these crops are labour-intensive and need labour throughout the year and production of most of these crops are consumed after processing. Hence, the plantation sector provides livelihood security to millions of people by providing continuous employment. In India, the major plantation crops are coconut, arecanut, oil palm, cashew, rubber, coffee, cocoa and tea. The plantation crops namely coconut, arecanut, oil palm, cashew and cocoa which are grown by small and marginal farmers are mainly dealt with by the agriculture ministry whereas tea, coffee and rubber which are grown contiguous way in large estates are with the commerce ministry. Though plantation crops occupy less than 3 per cent of the total cultivated area, they contribute substantially to the national economy by way of export earnings. The gross value added by the sector annually amounts to 2,66,000 million, which is 6.7 per cent of the total value added by the horticultural sector in the year 2019. India is the largest producer of coconut, cashew nut and arecanut in the world. Tea and coffee are the main and oldest industries in the country, which provide ample employment opportunities to the people and hold immense export potential. Tea industry is one of the most important organized sectors in India and more than 70% of the population comes in contact with tea both directly and indirectly. Tea, with its large number of polyphenolic and other biochemical constituents and with specific flavour and aroma, is considered as a health drink now, in addition to its popular stimulating role. Health benefits of tea include prevention of diabetes, cancer, neurodegenerative diseases, reduction of body weight, as well as alleviation of metabolic syndrome and many others.

Plantation crops are always under a constant threat of biotic and abiotic stresses. On average, 15 % of annual loss occurs due to pests and diseases. In recent years, cyclones, frequent droughts and unseasonal floods caused severe damage to coconut plantations. Being perennial and cultivated mainly in humid tropics, most of these plantation crops are vulnerable to pests and diseases throughout their life span. Some of the diseases like bud rot of coconut, arecanut and oil palm are lethal and kill the palms of any age. The disease caused by the oomycete pathogen *Phytophthora* is a major problem in arecanut, coconut, cocoa, rubber and oil palm causing huge losses. Unlike annual crops, the microclimate in the plantation favours the buildup of inoculums and it is difficult to eradicate the inoculums from the infected garden. Early and accurate diagnosis of the disease through regular monitoring and surveillance will help in taking up control measures in the initial stage of the disease to reduce the loss. It is advised to follow integrated plant health management practices comprising host-plant resistance, cultural, biological and chemical control.

Though some of the plantation crops coconut and arecanut are mentioned in Indian epics and Puranas and are being used in many Indian rituals from ancient times, the modern scientific works of literature on diseases of these crops are available from the later part of 19th century. The bud rot caused by *Phytophthora* was first recorded and identified by imperial mycologist Sir Edwin J Butler in 1906. Thus systematic research on plantation crop diseases started 130 years back itself. The occurrence of the root wilt disease of coconut and research on its aetiology started as early as the 1930s. It is known that plantation crops like coconut are affected by several diseases from its germination to harvest, some are lethal and some causes economic loss by reducing the quality/quantity of nut yield. About 173 fungi, a few species of bacteria, viruses, viroids and phytoplasma are associated with coconut, however, only a few diseases are economically important. Among the pathogens, Phytoplasma, *Phytophthora* and *Ganoderma* are the major threat to coconut and arecanut production throughout the world including India. . The root (wilt) disease (RWD) caused by Candidatus *Phytoplasma oryzae*-related

strain is one of the oldest known diseases of coconut and a major reason for low productivity in the southern states of Kerala and Tamil Nadu. The crop loss due to the disease was estimated to be about 968 million nuts. It is a continuing threat to coconut cultivation in India. Apart from RWD, recently, the occurrence of another lethal wilt caused by phytoplasma belonging to Candidatus *Phytoplasma asteris* 16Sr group I is also noticed in certain small pockets of Tamil Nadu.. Bud rot caused by *Phytophthora palmivora* is another lethal disease with an average incidence of less than 1%, but in certain pockets, up to 20 % of the coconut palms succumb to disease depending upon climatic conditions, soil and nutritional factors and varieties. The increase in the incidence of *Phytophthora* diseases of palms in India is attributed to the non-adoption of scientific cultivation practices by farmers, erratic rainfall, non-adoption of prophylactic measures, and shortage of skilled labours coupled with high wages. Basal stem rot caused by *Ganoderma* spp. is prevalent in the coastal and dry tracts of Tamil Nadu, Karnataka and Andhra Pradesh. The average disease incidence in general ranges from 0.6 % to 4.9 %, but in certain badly managed groves the disease incidence of up to 31.4 % was noticed. Integrated disease management strategies evolved and are subject to refinement and modifications based on feedback from farmers. Newly available pesticide formulations are evaluated in search of better alternatives for the existing recommendations. The method of delivery and adoption is also being refined and validated. The technologies are evaluated in a farmer-participatory mode. Most of the palm protection technologies were found to be more effective and economic in area-wide/community-based adoption. Tea plant is cultivated as a bush by constant pruning and grows in a wide range of agro climatic zones. Being a perennial, it is subjected to attacks by various insect pests as well as fungal pathogens both on the leaves as well as roots and stems. Blister blight is the major threatening foliar disease, as it affects the apical young leaves which are used for beverage production. Other foliar fungal diseases include black rot, grey blight, brown blight and many more including algal red rust caused by *Cephaleuros virescens*. Among the root diseases are the different root rots (brown, red, black, violet), charcoal stump rot and stem cankers.

In addition to conventional method, serological and molecular methods for early detection of tea pathogens have been documented. PCR-based diagnostics have been developed for most of the major diseases of plantation crops. RT-PCR and LAMP assays have also been developed for diagnosis of coconut root wilt, *Ganoderma* wilt and *Phytophthora* bud rot. However, further refinement of these technologies to develop onsite reliable diagnostic kits is very much essential. Research needs to be focussed on understanding the host-pathogen interactions at a molecular level. To understand the pest/disease status on a wide scale, aerial surveillance using unmanned aerial vehicles can be utilized. The research on the use of the latest image processing technologies, artificial intelligence and IoT tools needs to be intensified to develop digital diagnostics tools. Developing drone-based target spraying for control of diseases in plantation crops is very much useful in reducing the usage of fungicides and the difficulty in climbing tall trees like coconut and arecanut.

Future thrust

Early detection and identification of pathogens is an important step for formulating effective management strategies. The development of robust diagnostics for major diseases is essential. Evolving biocontrol agents to cope with the changing climate is very crucial. The development of pest and disease surveillance systems by unmanned aerial vehicles (IoT and AI-based) aids in the area-wide and periodic surveillance of pests/diseases. Identification of molecular markers for the selection of resistant genotypes will give a new impetus to resistance breeding programmes. Strengthening of quarantine and establishment of a national diagnostic network for plantation crop diseases is suggested.

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