

The importance of effective implementation of plant quarantine is clearly indicated by the interception of several economically important pests not yet reported from India. Quarantine risk is much higher due to the hidden nature of infestation and their being repeatedly intercepted.

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Pathogenic Fungi and Bacteria in Phytosanitary Issues-Current Trends and Future Directions

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The latest Global Agreement on "Sanitary and Phytosanitary Measures" (SPS Agreement) deals with phytosanitary issues among the member countries of World Trade Organisation (WTO). SPS has the major implication on food safety, animal and plant health in relation to trade. As the main purpose of WTO is trade flow with equal treatment, there is an increase in the dissemination of dangerous fungi, bacteria, viruses, nematodes and insects. To combat such threat, Government of India enforced plant Quarantine (Regulation of Import into India) Order, 2003 to regulate exchange of plant/plant material for sowing, planting, propagation with general and specific conditions for import. Regulation of import to prevent introduction of destructive fungi and bacteria is highlighted in three schedules in the order. Importation of banana, rubber, and date palm is prohibited due to *Ralstonia solanacearum*, *Microcyclus ulei* and *Fusarium oxysporum* f. sp. *albedinis*, respectively (Schedule IV). Several plant species like cassava, citrus, cocoa, cotton, groundnut, rice and tobacco can be imported with additional declarations (Schedule V). Specific post-entry quarantine measures and treatments are imposed to prevent exotic fungi and bacteria in *Allium* spp., barley, beans, carrot, chickpea, grape, maize, peas, sorghum and soybean. (Schedule VI).

NBPGR Regional station, Hyderabad is discharging quarantine requirements of ICAR institutes, State

Agricultural Universities, Private Companies and International institute (ICRISAT) located in South India. Suitable detection techniques are used to detect plant pathogens like fungi and bacteria on exotic germplasm. Few of the quarantine significant pathogens intercepted at this Regional Station were *Peronospora manshurica* on soybean from USA; *Ralstonia solanacearum* on groundnut from Australia, Brazil, Cyprus, Malawi, Niger, Sudan, USA and Zimbabwe; *Xanthomonas campestris* pv. *holcicola* and *Ralstonia andropogoni* on sorghum from PDR Yemen.

Soybean downy mildew caused by *P. manshurica* is not known to occur in India. This pathogen was intercepted on soybean from USA. Oospores of the pathogen were detected by visual examination and sedimentation test. However, at NBPGR, New Delhi, the pathogen was intercepted in 1535 samples from 15 countries (Agarwal and Singh, 1998). Thirty physiological races were reported from USA alone (Dunleavy, 1997). The oospore can retain viability upto eight years (Pathak *et al.*, 1978). Bacterial leaf streak (*X. campestris* pv. *holcicola*) and leaf stripe (*R. andropogoni*) were identified during the rainy season of 1987 on sorghum. Dot-immunobinding assay was used to identify both these bacteria (Prasada Rao *et al.*, 1990). There is no authentic evidence on the detection of these two pathogens in India, hence they are categorised

as quarantine pests (Anonymous, 2003). Bacterial wilt (*R. solanacearum*) was intercepted in groundnut accessions from eight countries. The disease expression took place only at higher temperatures (30°C and above). A diagnostic schedule involving grow-out of imported groundnut seeds for four weeks and plating the leaf bits and twig pieces on Tetrazolium Chloride Agar medium was found effective for the detection of infection (Anitha *et al.*, 2004).

Several serological tests are available for detection and identification of plant viruses for the past four decades. Relatively, little work is done on serological detection of fungi and bacteria prior to development of Enzyme linked immunosorbent assay (ELISA) and monoclonal antibody techniques. At present there are many examples where fungal and bacterial pathogens can be detected routinely by ELISA. With the advent of molecular biology and the ability to compare regions of genomic DNA representing conserved sequences, the development of diagnostic techniques increased at an amazing rate. The major condition associated with pathogen detection techniques applied for the enforcement of plant quarantine regulations and policies includes cost, duration of testing, sensitivity, reproducibility and suitability to screen a large number of samples. Although molecular diagnostic techniques satisfy most of the needs, few barriers prevent their wider adaptability.

Pest risk analysis (PRA) has gained importance due to liberalization of world trade. Moreover, it has become obligatory to member countries of WTO to base their phytosanitary measures on scientific evidence of pest risk. Capacity for pest risk analysis is an area of concern, which needs immediate attention. PRA needs to be worked out for important crops having fungal and bacterial disease problems. For example, sunflower

germplasm is mostly available in European countries. Hence PRA on sunflower with special reference to quarantine significant pathogen like downy mildew (*Plasmopara halstedii*) is essential for the exchange of germplasm. Identification of pest free areas based on surveys and surveillance is important. Pathogens like *Fusarium poae* in wheat, downy mildews of sorghum (*Peronosclerospora sorghi*) and pearl millet (*Sclerospora graminicola*), where many races and biotypes are reported all over the world, should be included in different schedules of Plant Quarantine Order, 2003. Establishment of National Referral laboratories, electronic linking of all quarantine laboratories, development of National database, identifying research on detection techniques and treatment schedules for fungi and bacteria of quarantine importance are the steps suggested in the context of phytosanitary measures.

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***Colletotrichum* spp. Intercepted in Exotic Germplasm during 1976-2004**

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The international exchange of the Plant Genetic Resources (PGR) has contributed towards increase in crop productivity in India. Since several pathogens have been reported as seed-borne, there is always a risk of inadvertent

introduction of seed-borne pathogens along with such imports. Therefore, a thorough and critical examination of introduced material for associated pests is essential for plant quarantine clearance. National Bureau of Plant