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Short Communication

QUARANTINE PROCESSING OF EXOTIC PLANTING MATERIAL IN INDIA

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One of the methods of crop protection is to prevent the pests/pathogens from entering into the areas in which the host plants are growing so that the chances of attack are eliminated. This method of exclusion is enforced through certain legal measures commonly known as *Quarantine*. Knowledge and methodology of exclusion are utilised and practised by a legally constituted authority to prevent the entry and spread of injurious crop pests/pathogens in public interest. Quarantine regulations are of comparatively recent origin. The adoption of such steps by different countries of the world has arisen out of the realisation that the crops have suffered extensive damages, often sudden in nature, not by the indigenous pests or pathogen but by exotic ones which gained entry along with introduced planting materials. Instances may be cited of the introduction of downy mildew of grapevine (*Plasmopara viticola*) into France from USA which was responsible for the destruction of grapevines. Blight disease of chestnut (*Endothia parasitica*) introduced into the USA from Europe completely wiped out chestnut plants. In India leaf rust of coffee (*Hemileia vastatrix*) introduced from Sri Lanka in 1776; flag smut of wheat (*Urocystis tritici*) introduced from Australia; bunchy top of banana introduced from Sri Lanka in 1940 causing serious damage to dwarf Cavendish varieties in different parts of India, wart of potato (*Synchytrium endobioticum*) introduced from Netherlands in 1952; onion smut (*Urocystis cepulae*) and sunflower downy mildew (*Plasmopara halstedii*) introduced recently are examples showing how many destructive diseases have entered into this country and have established themselves causing extensive damage.

Plant quarantine regulations in order to be effective have to be based on sound scientific principles. The biology and ecology of the organism against

which quarantine measure is proposed to be enforced should be known. Besides it has to be determined whether:

1. in the absence of any quarantine measure, the organism is likely to be introduced into the country;
2. in the event of its introduction whether the organism is likely to be established and cause damage of any consequence;
3. quarantine regulations can be framed on scientific lines and enforced satisfactorily and
4. it is economical to introduce the legislative measure in terms benefit likely to be derived.

National Bureau of Plant Genetic Resources (NBPGR), being the apex body for exchange of germplasm for research purposes, has greater responsibilities to avoid any introduction of exotic diseases. Plant materials imported from all over the world, once arrived, come to NBPGR- Joint Inspection Laboratory after accessioning of the seed samples (through Germplasm Exchange Division). The samples received in the laboratory are first entered in a register with pertinent informations *viz.*, IQ (import Quarantine) number, number of samples, host, source country, name and address of the person sending sample, name and address of the consignee and procedures adopted, dates, interceptions and remarks with regard to the seed health testing. Every effort is made to start testing samples on the day of receipt, so that the changes in the quality of seed are minimised. However, it is very important to note the presence of *Phytosanitary certificate*, a document necessary to be present along with the seed materials. Each contracting Government should make arrangements for the issue of Phytosanitary Certificate in accordance with the plant protection regulations of other contracting Governments, and in conformity with the provisions laid down.

Pests/pathogens are constantly associated with a plant disease which may be grouped in various ways. The diseases are soil-borne or seed-borne when they perpetuate and spread through the agency of soil or seed (or any propogating material). During the absence of an active host plant, pests/pathogens survive through one or more of the following means: soil, pests/pathogens; seed-borne pests/pathgens and alternate or weed hosts and off-season crops. Various procedures adopted/employed for the detection of different pests/pathogens are listed below:

Techniques for detection of pests and pathogens during quarantine processing

Fungal pathogens

1. Inspection of dry seed with unaided eye, hand lens or under low power stereoscopic microscope.

2. Miscroscopic examination of suspensions obtained by seed washings.
3. Incubation tests:
   a. Blotter method
   b. Agar plate method
4. Examination of symptoms developed on seedlings :
   a. Roll-Towel method
   b. Water agar seedling symptom method (Khare *et al.*, 1977)
   c. Sand/soil method
5. Growing on tests carried out in green house, environment controlled chambers or in field
6. Specific methods :
   a. Oxgall agar method (Mathur and Lee, 1978)
   b. Peptone-PCNB agar method
   c. Guaiacol-agar medium method
   d. Embryo count method
   e. NaOH soak method (Agarwal and Verma, 1983; Agarwal and Srivastava, 1981)
   f. Biochemical tests (Gordon and Webster, 1982)
   g. Serological tests

Bacterial pathogens

1. Visual examination
2. Plant inoculation (Thyr. 1969; Saettler, 1971)
3. Incubation tests
   a. Blotter tests
   b. Paper towel method
   c. Agar planting method (Lundsgaard, 1973)
   i. Direct plating (Randhawa and Schaad, 1984)
   ii. Plating with seed washing
   iii. Plating after seed maceration
4. Growing on test
   a. In water-agar
   b. In green house
5. Specific tests
   a. Phage plaque method or phage sensitivity test
   b. Serological techniques
   i. Agglutination test (Duveiller *et al.*, 1988)
   ii. Immunofluorescence test
   iii. Immunodiffusion (direct double diffusion; Ouchterlony double diffusion)
   iv. Enzyme Linked Immunosorbent Assay (ELISA)

Viruses

1. Visual examination of seeds
2. Grow-out test
3. Infectivity test
4. Staining of inclusion bodies
5. Electronmicroscopy

6. Serological tests
   a. Agglutination test
   b. Latex agglutination test
   c. Agar diffusion test
   d. ELISA.
7. Immuno Sorbent Electron Microscopy (ISEM)
8. Complementary DNA (cDNA) probes

Insect pests

1. Visual examination with unaided eye, hand lens or under low power stereoscopic microscope
2. X-ray radiography (Milner *et al.*, 1950; Wadhi *et al.*, 1967)
3. Transparency and staining technique (Kaura, 1959; Verma. 1986)
4. Acoustical method (Brain, 1924)
5. Chemical methods
6. Detention

Nematodes

1. Direct examination of plant materials
   a. Visual observations
   b. Microscopic observations
   c. Seed soaking and teasing and soaking of vegetative propagates in water
   d. Staining technique
   e. Examination of accompanying soil
2. Detection of nematodes in Post-Entry Quarantine Nursery

Salvaging of the infected germplasm

The principles of salvaging the infected germplasm are same as those of controlling the plant diseases except that the tolerance limit for any pathogen in quarantine is zero and efforts are made to eliminate the pathogen. Various physical and chemical methods which are adopted for disinfecting the germplasm are listed below.

Fungal pathogens

1. Mechanical seperation
2. Spirit wash
3. Acid wash
4. Hot water treatment
5. Chemical treatment
6. Post-entry quarantine growing

Bacterial pathogens

1. Roguing-out infected plants
2. Hot water treatment

3. Dry heat treatment
4. Chemical treatment

Viruses

1. Roguing-out infected plants showing viral symptoms in grow out test.

Insect pests

1. Fumigation
2. X-ray Radiography
3. Chemical dip/spray
4. Mechanical cleaning
5. Cold/heat treatments

Nematodes

1. Mechanical seed cleaning
2. Disinfection of planting material by heat
   a. Use of microwaves
   b. Hot water treatment
3. Nematicidal dip treatment

The planting material found free from insect pests and pathogens and or salvaged through various ways are then sent and made available to the respective indentors. However, the planting materials found to be infested/infected by pests/pathogens not know to occur in India are rejected and incinerated.

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