

Role of Plant Quarantine in Preventing Entry of Exotic Pests

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Plant quarantine is a government endeavour enforced through legislative measures to regulate the introduction of planting material, plant products, soil and living organisms, etc. in order to prevent inadvertent introduction of pests (including fungi, bacteria, viruses, nematodes, insects and weeds) harmful to the agriculture of a country/state/region, and if introduced, prevent their establishment and further spread. ICAR-National Bureau of Plant Genetic Resources (ICAR-NBPGR) is authorized to issue import permit and undertake quarantine of plant germplasm including transgenics and for issue of Phytosanitary Certificate for material under export. Adopting a systematic workable strategy, using a combination of conventional and modern techniques, over the past forty-five years, a total of 78 exotic pests including fungi (6), viruses (19), insects/ mites (26), nematodes (9) and weeds (18) of great quarantine significance to India have been intercepted. All efforts are made to salvage the infested/ infected materials; however, if the material is unsalvageable, it was incinerated. The interceptions made signify the potential dangers in import of planting material if proper quarantine measures had not been followed. ICAR-NBPGR, also makes concerted efforts to develop and customize the modern detection and eco-friendly salvaging techniques to minimize the risk of escape in quarantine processing. Scientifically sound and transparent risk analysis prior to import is an important tool, so that, our agricultural production is not jeopardized. The Indian phytosanitary regulations provide a fragmented legislative system which needs to be harmonized and integrated to holistically deal with national biosecurity while complying with international norms. Also, there is a need to support research, training, capacity-building, networking and information sharing activities at both national and regional levels.

Plant Quarantine at ICAR-NBPGR

International exchange of plants/planting material carries an inadvertent risk of introduction of exotic pests or their new virulent races/strains into new areas. History has witnessed several examples of dangerous pests introduced along with plants/planting material/plant products that have led to serious socio-economic consequences. Plant quarantine is a mandatory requirement to regulate the entry of seed/planting material, plant products, living organisms and soil etc. so as to prevent unintended entry of pests across nations. International exchange of plant genetic resources (PGR) is important to broaden the genetic base of crops in order to develop improved crop varieties. The Government of India has legislated the Plant Quarantine (Regulation of Import into India) Order 2003, [hereafter referred to as PQ Order] to regulate the import of plant material. Under the PQ Order, ICAR-National Bureau of Plant Genetic Resources (ICAR-NBPGR) has been delegated powers to issue Import Permit and to carry out quarantine processing of imported PGR including transgenics and for issue of Phytosanitary Certificate for PGR meant for export.

The Division of Plant Quarantine at ICAR-NBPGR, New Delhi has developed an efficient and systematic methodology for quarantine processing for pest diagnostics, salvaging and containment to ensure biosecurity during exchange of PGR and to be transparent during exchange internationally. Stringent quarantine examination of 49,97,795 samples of PGR during 1976–2021 of which 1,78,507 samples were found infested/infected by insects (1,08,615); pathogens (42,123); Nematodes (23,952) and weeds (3,817). A systematic step-wise strategy is being followed for testing of each of the samples imported for presence of any unwanted pests Fig 1.

Over the years, during quarantine processing, a large number of pests have been intercepted in imported germplasm and other research material. The intercepted pests can be categorized as:

- (i) Pests not known to occur in India
- (ii) Pests with different races/biotypes/strains not known to occur in India

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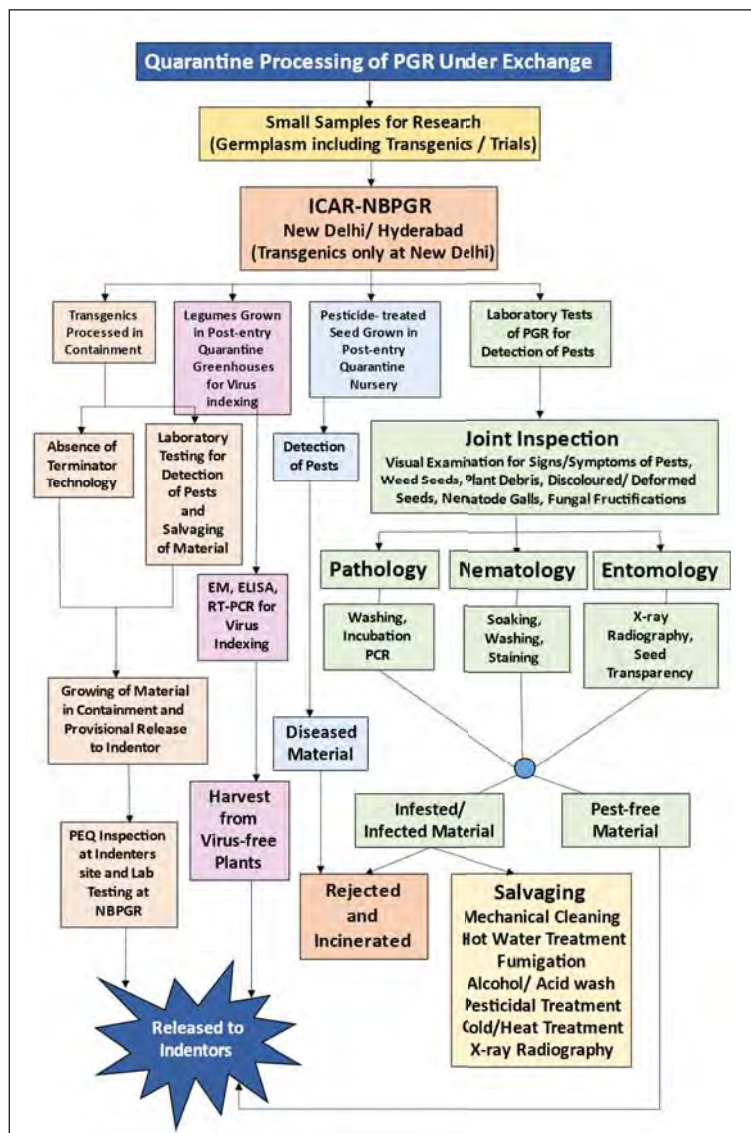


Fig. 1. Schematic presentation of Quarantine Processing

- (iii) Pests intercepted on a new host or are from a country from where they have never been reported before
- (iv) New pest species hitherto unreported in science
- (v) Pests reported to be present in India

These interceptions, especially of pests and their variability not yet reported from India [Category (i) and (ii)] signify the importance of quarantine in preventing the introduction of destructive exotic pests. The categories (iii) and (iv) pests are not expected in the sample as per the PRA which is literature-based and since no records are available on the pest/ host their presence is unexpected and hence, important from quarantine view point. The last category (v) – pests reported to be

present in India are also important as they could have a wide host range and become invasive in case they find suitable biotic and abiotic environment (Khetarpal and Gupta, 2008). A total of 78 exotic pests belonging to Category (i) including insects/ mites (26), fungi (6), viruses (19), nematodes (9) and weeds (18) that are not yet reported from India have been intercepted so far.

The samples found infested/ infected with pests viz., were salvaged using suitable methods and if they could not be salvaged, they were rejected and destroyed by appropriate means (Fig. 2). Had any of these exotic pests not been intercepted and had escaped, they could have entered and established in India and subsequently caused devastation to Indian agriculture.

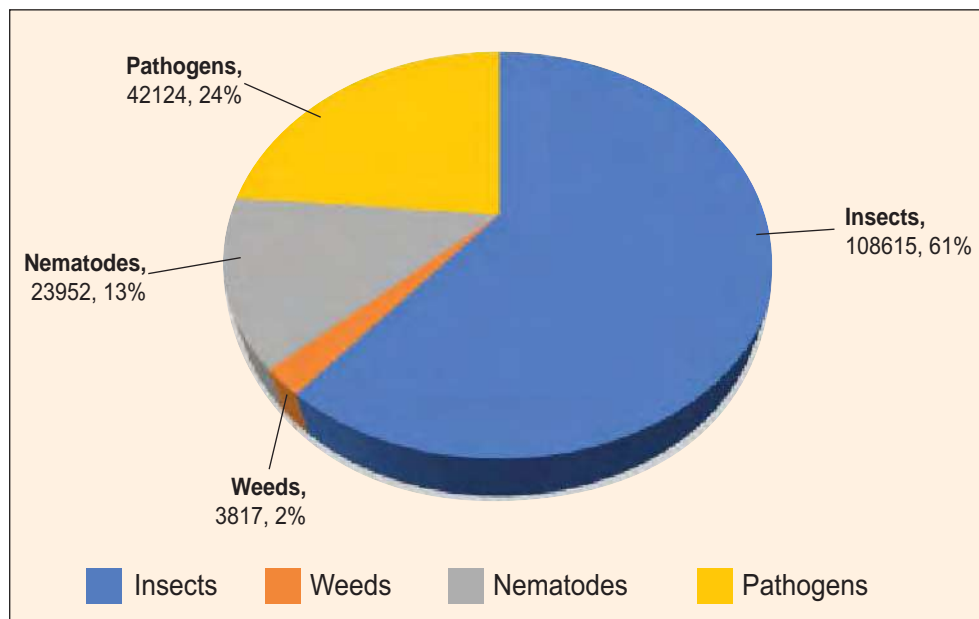


Fig. 2. Samples Infested/Infected (1976-2021)

Presently, exchange of PGR has become more difficult under the Convention on Biological Diversity, hence, all attempts were made to salvage the germplasm and over 99 % of samples were salvaged and less than 1% samples were rejected. ICAR-NBPGR has *state-of-the-art* facilities to properly undertake quarantine. However, more wide-ranging efforts are needed in the national plant quarantine system to develop adapt and adopt the latest detection and eco-friendly disinfestation/disinfection techniques to minimize the risk of pest escape in quarantine.

Issues in Quarantine of Germplasm and Action Points

There are issues related to quarantine in exchange of PGR both legislative and related to quarantine processing and methodology (Khetarpal *et al.*, 2006; Chalam and Khetarpal, 2008). The legislative issues pertaining to India are as follows:

The national quarantine legislation needs to be in harmony with the international norms laid down by International Plant Protection Convention (IPPC) and the countries in the region are trying to gear up their activities to comply with it. India has done so by bringing out the PQ Order 2003 and through its various amendments. Under this the imports have been classified as:

(a) Prohibited plant species (Schedule IV);

(b) Restricted species where import is permitted only by authorized institutions (Schedule V);

(c) Restricted species permitted only with additional declarations of freedom from quarantine/ regulated pests and subject to specified treatment certifications (Schedule VI) and;

(d) Plant material imported for consumption/ industrial processing permitted with normal Phytosanitary Certificate (Schedule VII).

Under the PQ order, a pest risk analysis (PRA) has been made mandatory for all material being imported into the country other than those present in Schedules V, VI and VII. The various schedules V, VI and VII of the PQ Order give lists of crops for which a generic PRA is given and detailed PRA is not required. In case of germplasm, a large number of species of cultivated crops (and their wild relatives/land races) with useful traits are imported. Such wild relatives, land races of germplasm whose pest profile is not adequately recorded hampers PRA preparation and consequently their import. However, in 2007 the legislation has been amended whereby ICAR-NBPGR is empowered to undertake PRA for germplasm material for pest-free import. This is more relevant in the present context when access to germplasm is becoming more and more difficult under the Convention on Biological Diversity, 1992.

Another difficulty, which is faced during import of certain material, is the additional declarations being sought under the Schedule VI (Species permitted only with additional declarations of freedom from quarantine/regulating pests and subjected to specified treatment certifications). Many countries from where a pest is not reported find it difficult to certify in the phytosanitary certificate the freedom from those pests. To solve this problem, the recent amendments of the PQ Order with more number of crops give country-specific requirements under additional declarations and special conditions for import. This would greatly help the indentors in procuring germplasm of their interest from varied sources (Dubey *et al.*, 2021).

The technical issues include issues pertaining to quarantine processing i.e. methodology for detection and salvaging of pests are enumerated follows:

- The amount/size of the germplasm sample is very crucial from quarantine processing point of view, as sampling procedures meant for bulk material cannot be adopted. Also, the technique applied should enable detection of miniscule amounts of pest in the samples drawn and also be non-destructive. The sample size may not be enough for direct testing of seed and post-entry quarantine testing and release from virus-free plants after testing may take one crop season.
- Diagnostic reagents such as antisera for viruses/bacteria and the reference collection for insect pests are often not available for exotic pests. A repository of antisera needs to be established as one has to deal with exotic pests in quarantine (Chalam, 2020). Expertise is also required in the field of taxonomy and biosystematics as there is a continuous need to identify unknown/new pathogens or strains.
- There is an urgent need to have National Plant Pests Diagnostic Network (NPPDN) linking the research laboratories with seed/vegetative planting material testing laboratories and quarantine stations, which would be the backbone for strengthening the programme on biosecurity from plant pests (Chalam and Maurya, 2018).
- Strengthening research on the development of sensitive and non-destructive detection and salvaging techniques as well as on:
 - Increased use of radiation and other eco-friendly non-chemical frontier techniques as effective mitigation treatment as alternatives to methyl bromide fumigation
 - Development of user-friendly serological/molecular diagnostic protocols/kits for prognostic detection of exotic pests and their variants and also low levels of pest infections.
 - Development of digitized biosystematic keys for pest identification.
 - Epidemiological studies including survey and surveillance of diseases/pests to prepare database on endemic pests, identify pest free areas and target IPM for reducing threats.
 - Developing models for risk analysis for exotic pests, diseases, invasive weeds and genes.
 - Developing standard operating procedures through relevant Handbooks/Manuals for survey and surveillance and checking major diseases/pests including invasive weedy species.
 - Studies on factors influencing climate change and pest diversity and virulence.
 - Studies on factors affecting potential of pest survival under different transport conditions of, modes of dispersal, availability of hosts/alternate hosts at port of entry, establishment potential, strategy for reproduction and mode of pest survival, vectors and natural enemies of the concerned pest in the new area.
 - Simulated evaluation of mitigation options to deal with epidemics/pandemics.
 - Need for special focus on management of indigenous diseases, pests and invasive weeds with a potential to impact food security, environment including biodiversity, and trade.
 - Development of national dynamic biosecurity database of insect pest, diseases, invasive weeds and their management.

National Plant Quarantine System: Way Forward

The liberalized trade under WTO has made quarantine personnel highly accountable on accurately achieving the objectives of eliminating alien pests or to take up eradication actions. The threat of pest introduction and the ways to stop the establishment of such pests into India continues to be a major fear. Unless proper phytosanitary procedures are adopted, pests could be transferred all over the world, get established into new

areas and impact agricultural production (Khetarpal and Gupta, 2008). On the other hand, this also presents a tremendous opportunity for farmers to export agricultural products/produce to boost our economy if they meet the quality standards and overcome phytosanitary restrictions at international level. Active participation in meetings of IPPC and Codex Alimentarius by India to negotiate for realistic standards would also give a necessary push to trade in agriculture. All this is feasible only if the government and the organizations working on SPS issues work hand-in-hand with each other, to accomplish international standard of agricultural produce that would eventually boost Indian exports at the same time safeguarding our crops and environment from ingress of exotic pests (Khetarpal and Gupta, 2007).

Also, awareness about the biosecurity among general public and scientific community is greatly required for generating respect for quarantine/ biosecurity regulations. Besides, the domestic quarantine regulations already promulgated for nine destructive pests (fluted scale, San José scale, coffee berry borer, codling moth, banana bunchy top and mosaic viruses, potato cyst nematode, potato wart and apple scab) seem to be a complete failure as there are reports of spread of some of these pests to neighbouring states and also to different parts of the country. Extensive eradication measures and surveys are needed in different regions of the country that would finally contribute in identifying the pest free areas, a task that is also required to be accomplished as per the international norms for fulfilling the commitments made under the SPS Agreement. There is also an urgent requirement to prevent not only spread of the pests above but also to develop domestic quarantine regulations against certain recently introduced/ detected pests in the country and which might spread fast (Gupta and Dubey, 2017). More resources need to be diverted towards developing appropriate legal and protection measures against such pests to save the country.

Unlike in USA and Australia, there is a total absence of organized plant quarantine services at state borders in India. It is essential to set-up plant quarantine checkpoints at inter-state border roads/inland container depots/ rail roads manned by trained personnel to control the movement of planting material, transport carriers and containers so as to have effective check of the pests especially those covered under domestic quarantine regulations.

Indian plant quarantine system has certainly come a long way starting with the legislation viz., Destructive Insects and Pests Act way back in 1914. However, modernizing quarantine mechanism is much more crucial today in the light of globalization not only to protect the crops from invasive foreign pest species but to safeguard the economy by ensuring enhanced productivity and farm incomes. The Agricultural Biosecurity Bill (2013) which provided for instituting of a mechanism for holistic prevention, eradication and management of pests of plants and, pests and diseases of animals and undesirable organisms for ensuring biosecurity in agriculture and to comply with our international commitments, for enabling exports and imports of plants and their products, animals and their products, aquatic beings and regulation of microorganisms of agricultural importance and for matters connected therewith or incidental thereto needs to be revived and put in place.

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