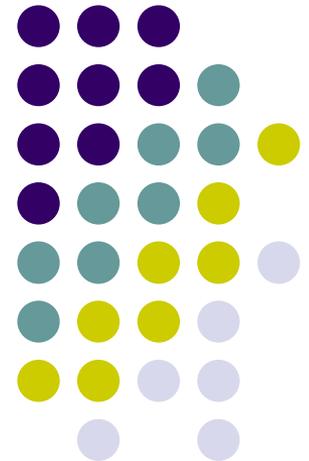


Diagnosis of Plant Pathogens and Quarantine Implications



Significance of risk assessment



- Risk assessment in plant health area in the frame of phytosanitary measures is to prevent the introduction and further spread of organisms harmful to plants.
- Proper diagnosis and detection are critical for the categorization and assessment of pests that are or may qualify as quarantine pests, and for appropriate application of phytosanitary measures.

The Plant Health Legislation

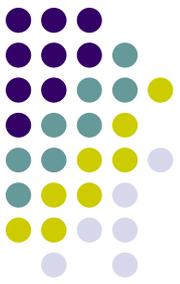


- ***The International Regulation Framework***
- The international plant health regulatory framework is set by the Sanitary and Phytosanitary (SPS) Agreement of the World Trade Organisation (WTO).
- Member countries have the right to take sanitary and phytosanitary measures based on scientific principles. Phytosanitary measures shall be based on international standards, guidelines or recommendations developed by the FAO Secretariat of the International Plant Protection Convention (IPPC)
- The “scientific principles” of phytosanitary measures are based on risk assessment, which includes the evaluation of the likelihood of entry, establishment or spread of a pest or disease within the territory of an importing country.

Diagnosis of Plant Pathogens and Plant Health Regulation



- ***Diagnostic Needs***
- Pest identification is key in the process of pest risk analysis. Pest risk analysis (PRA) consists of three stages:
 - initiating the process for analyzing risk;
 - assessing pest risk; and
 - managing pest risk.
- Initiating the process involves identification of pests that may qualify as quarantine pests or of pathways for which the risk analysis is needed; either of these two starting points can involve pests already present in the PRA area but not widely distributed and under official control, as well as pests absent from the PRA area, since both are covered by the quarantine pest definition.



- Pest risk assessment determines whether each pest identified or associated with a pathway is a quarantine pest. Pest risk management involves developing, evaluating, comparing and selecting options for reducing the risk.
- Proper detection and identification is critical for the appropriate application of phytosanitary measures
- In addition, diagnostic procedures are needed for
 - determination of pest status in an area,
 - pest reporting and
 - the diagnosis of pests in imported consignments

Problems for Risk Assessment Posed by Taxonomic Changes



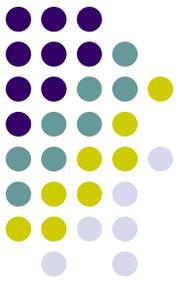
- Risk assessment in plant health is challenged by the changes in taxonomy and nomenclature that have taken place in the pathogen. This lead to a re-evaluation of pest records and doubts as to whether a regulated organism is actually the one of concern.
- Pathogens that were previously considered strains/varieties of a single species, have now in some cases been elevated to specific status.
- Further, pathogens recognised as species complexes have been partitioned into new species using molecular methods.

Case-Studies: Phytophthora Diseases

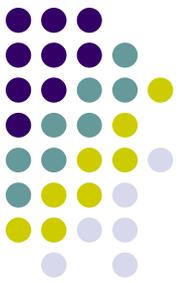


- ***Phytophthora ramorum***, the causal agent of sudden oak death (SOD) in North America and of a new *Phytophthora* species from European nurseries is considered exotic as:
 - the species had never previously been described in either continent,
 - the distribution was either geographically limited (California), or clearly associated with the nursery trade (Europe),
 - the high susceptibility of hosts in natural settings and
 - the presence of different mating types in the two continents.
- The California forest populations was distinct from European nursery isolates and three genetically distinct lineages in *P. ramorum* (NA1, NA2, EU1) were identified
- The evidence indicated that introduction in the nursery trade must have occurred multiple times, both in North America and in Europe

Bacterial Diseases



- *Erwinia chrysanthemi* first included in the genus *Erwinia* as a pathogen of chrysanthemum. Subsequently, it was found to infect a variety of plants.
- In 1984, the species was subdivided into six pathovars – *dianthicola*, *zeae*, *chrysanthemi*, *parthenii*, *paradisiaca* and *dieffenbachiae* – according to their host specificity.
- In 1998, *E. chrysanthemi* was moved to the genus *Pectobacterium* based on 16S analysis.
- In 2005, using 16S, DNA–DNA hybridisation and biochemistry, *P. chrysanthemi* was moved into a new genus called *Dickeya*, which comprises six species, namely *dianthicola*, *dadantii*, *zeae*, *chrysanthemi*, *paradisiaca* and *dieffenbachiae*.
- These species fall largely in line with the different *E. chrysanthemi* pathovars and show a degree of host specificity.
- In 2011, the species *D. dieffenbachiae* was moved within the species *D. dadantii*.



- Recent analyses revealed the presence of a number of potentially new *Dickeya* spp. (including '*D. solani*'), but to date none of these has been officially recognised.
- *Dickeya* spp. are soft rotting pathogens that cause disease primarily through production of various plant cell wall-degrading enzymes.
- Description of *Dickeya dianthicola* follows ' *Pectobacterium parthenii-dianthicola*, described on *Dianthus* sp. Strains belong to ex *Pectobacterium chrysanthemi* biovars 1, 7 and 9.
- According to several phylogenetic studies including 16S, recA and dnaX sequence analysis, DNA–DNA hybridisation and REP-PCR, *D. dianthicola* is most closely related to *D. dadantii* and exhibits little diversity between strains, with no obvious delineation between isolates from different host plants

Nematodes

- Potato cyst nematodes (PCN), *Globodera rostochiensis* and *G. pallida* are threats to world potato production (~ 75% loss)
- Diagnostics of *Globodera* spp. based on morphological characteristics of cysts and juveniles is time-consuming and requires specialized taxonomic expertise. Further, visual identification is not always unambiguous. Biochemical techniques were developed to separate *Globodera rostochiensis* and *G. pallida*.
- Investigation on differences between European and South American populations of PCN were based on biological and molecular studies.
- PCN present in Europe represent a minor subset of full biological diversity present in South America and that the range of virulence present in South America is far greater than that present in European PCN populations

