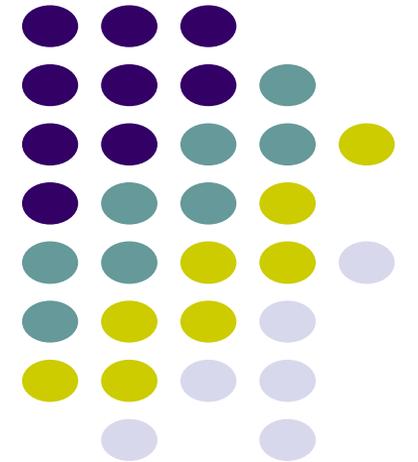
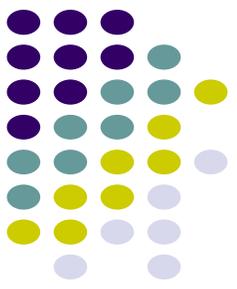


# DNA Barcoding of pathogens of quarantine

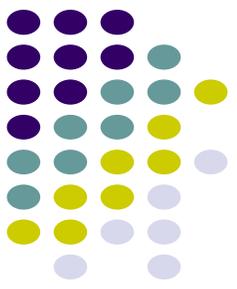
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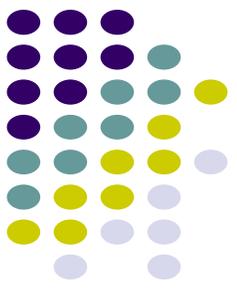
# DNA barcoding- the necessity

- Development of accurate identification tools for plant pathogens and pests is vital to support Plant Health Policies to manage plant diseases in a broader way.
- Challenges:
  - Increase number of plants being traded worldwide
  - Chance of harmful organisms spreading is enhanced
  - Taxonomic knowledge on harmful quarantine organisms is not adequate
- The economic damage is significant:
  - Both when a harmful quarantine organism is not identified and
  - when an organism is incorrectly diagnosed as a quarantine organism
- In the EU alone there are some 275 quarantine organisms for which protective measures against introduction into and their spread within the Community needs to be taken.



# Barcoding for diagnostics

- DNA barcoding is a taxonomic method that uses a short genetic marker (DNA sequence signature) in an organism's DNA to identify it as belonging to a particular species.
- Although the DNA sequences of related species are generally very similar, there are differences to be found. The part of the DNA sequence that is different is specific to that particular organism and forms a unique and specific molecular DNA barcode.
- One or several specific DNA barcodes are made for each quarantine organism.

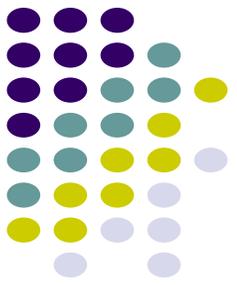


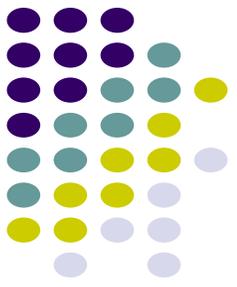
# Plant Pathogen Barcode (PPB)

- To facilitate the rapid and accurate identification of plant pathogens, a new database is developed to firmly link names and associated meta-data to a rapidly developing new standard in biology.
- DNA barcoding is an emerging gold-standard for species recognition. This development has already shown itself to have unprecedented power for clarifying species identities and limits, uncovering new and often cryptic species.
- In response to the growing number of researchers who are using barcoding, data standards for barcode records have been developed, and an open access database has been created. The Consortium for the Barcode of Life (CBOL) has engaged more than 125 Member Organizations in 40 countries.

# QBOL ([www.qbol.org](http://www.qbol.org))

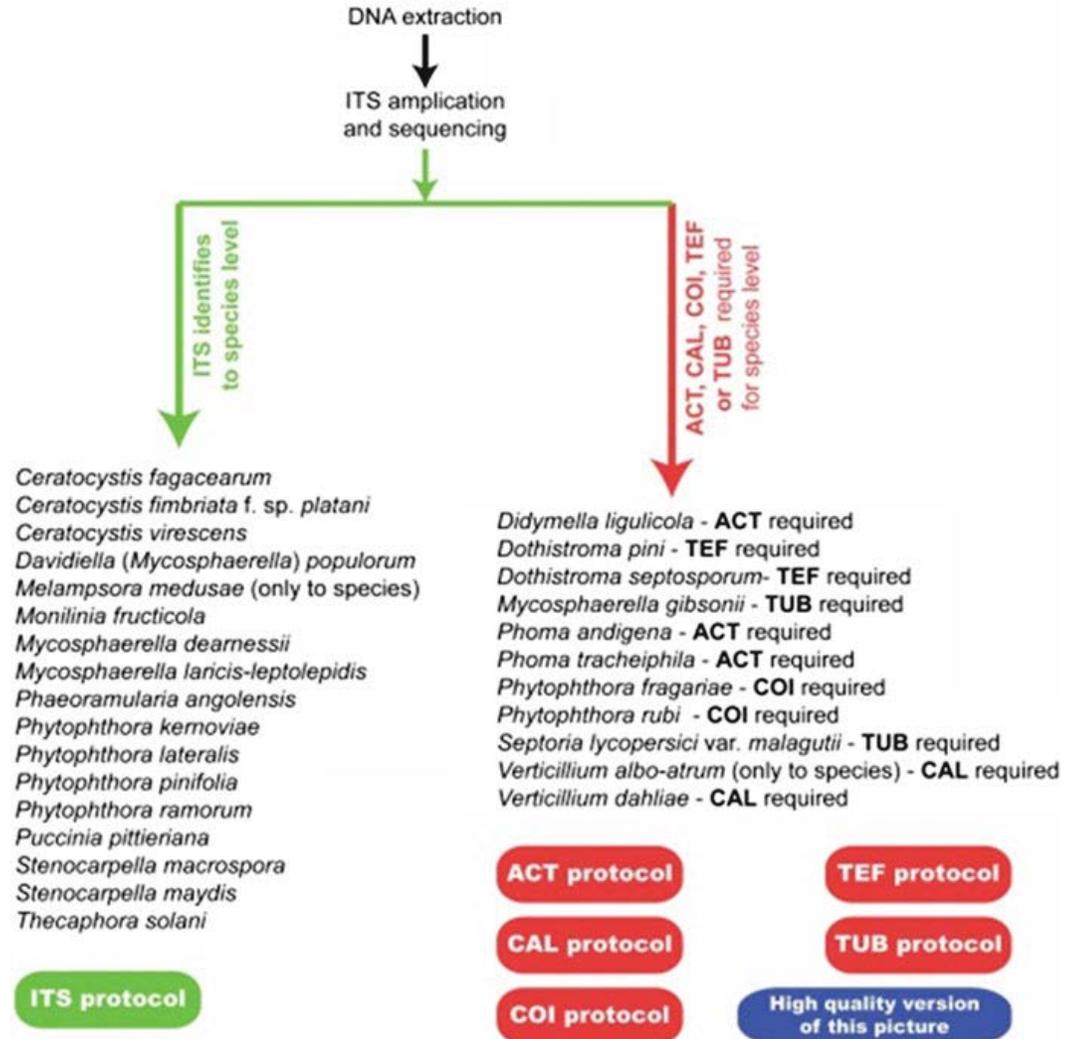
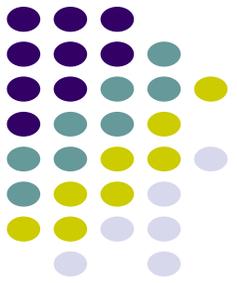
- QBOL is an EU project on DNA barcoding, started in 2009 to generate DNA barcoding data of quarantine organisms and their taxonomically relatives to support plant health diagnostics.
- The data are included in a database, called Q-bank ([www.Q-bank.eu](http://www.Q-bank.eu)), which now consists of a dynamic open-access database of quarantine plant pests and look-alikes, linked to curated and publicly accessible reference collections.
- It contains sequence and morphological data including photographs, nomenclatural and diagnostic data of specimens available in reference collections.



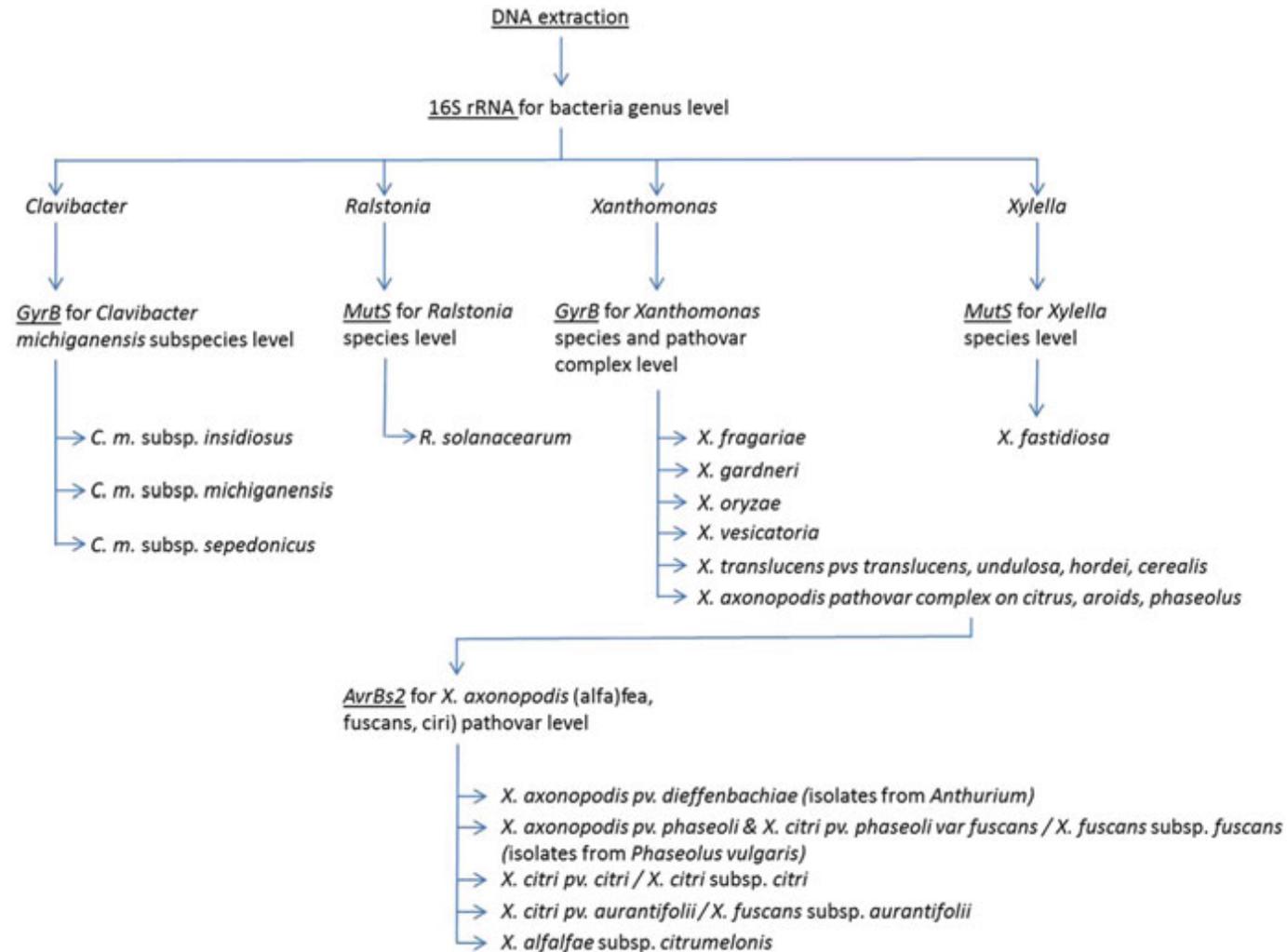
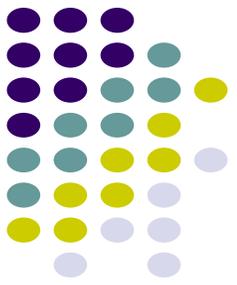


- QBOL made DNA barcoding available for plant health diagnostics and focused on strengthening the link between traditional and molecular taxonomy as a sustainable diagnostic resource. Within QBOL, collections harboring plant pathogenic Q-organisms were made available.
- Informative genes from selected species on the EU Directive and EPPO lists have been DNA barcoded from vouchered specimens and the sequences, together with taxonomic features, have been included in a new internet-based database system: Q-bank: [www.q-bank.eu](http://www.q-bank.eu).

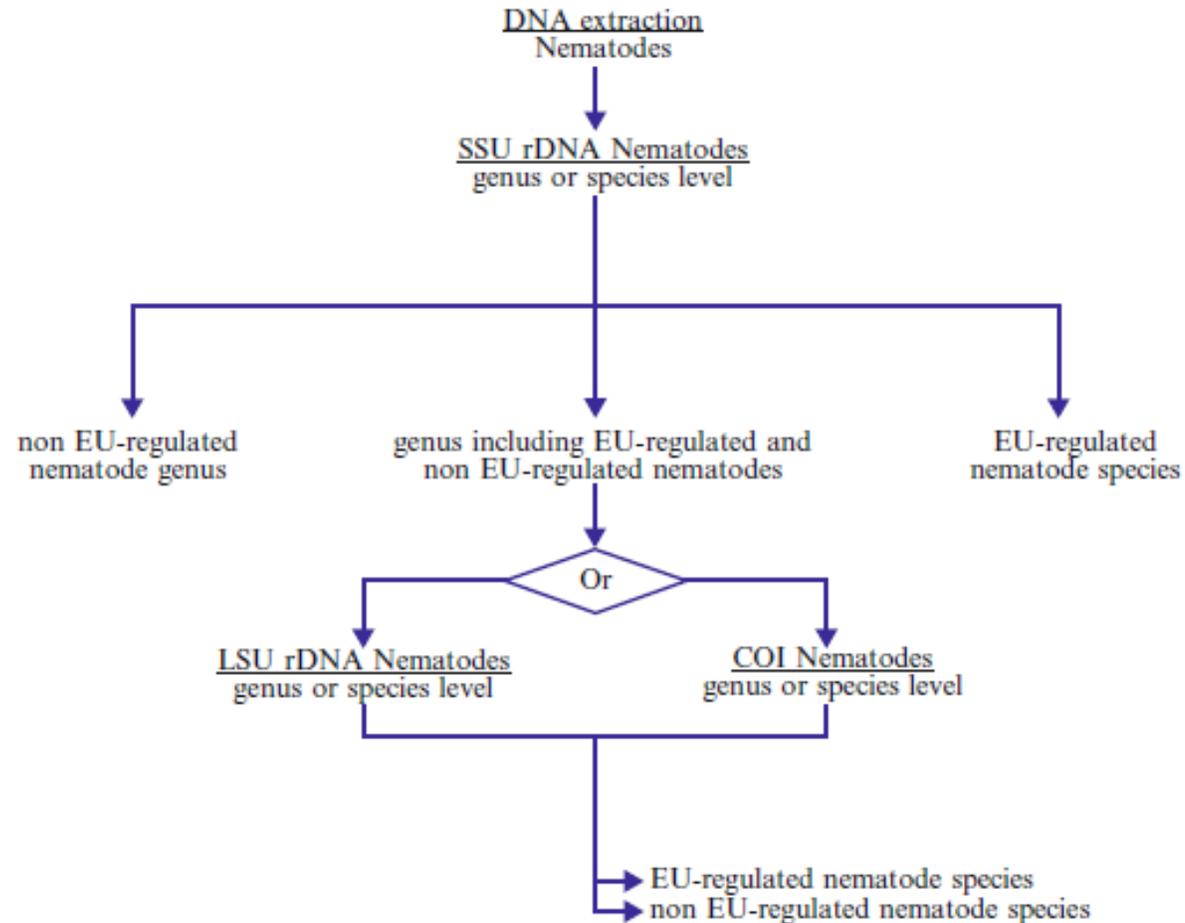
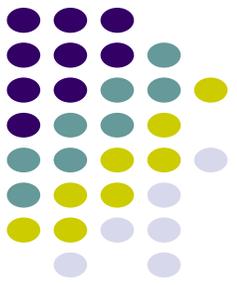
# DNA barcoding of fungi



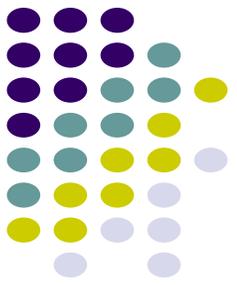
# DNA barcoding of bacteria



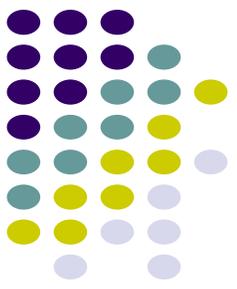
# DNA barcoding of nematode



# DNA Barcode Library/Database/ Informatics



- The database (developed within the Dutch FES project, 2006–2010) has been further developed during the QBOL project. Six databases were created: for fungi, arthropods, bacteria, nematodes, viruses and phytoplasmas.
- The total database Q-bank is freely accessible via internet ([www.q-bank.eu](http://www.q-bank.eu)). A software module to export to and import from Genbank (and therefore EMBL) has also been implemented.
- The Internet-based software is continuously improved to comply with the needs of the end-users. Filling of the databases has been made significantly during last stages of the QBOL project.



- Publication of the created databases has helped internet visitors to regularly use the system. Websites are therefore not restricted to the users participating in the QBOL project anymore. Usage of the different databases are monitored by Google Analytics.
- The bioinformatics and databases of Q-bank are based on the BioloMICS software (BioAware, Belgium). This tool allows specialized and scientific biological databases to be created to fit the specific needs of researchers working on any organisms (from arthropods, bacteria, fungi, nematodes, phytoplasmata, plants to viruses). It is used by a broad base of users such as taxonomists, ecologists, human, or plant pathologists, molecular biologists, pharmacists, industrial researchers, etc.
- The database is thus helping to identify quarantine pathogens and taking adequate measures to contain them.