ISTA Reference Pest List & the use of EPPO codes

Nicolas Denancé

nicolas.denance@geves.fr

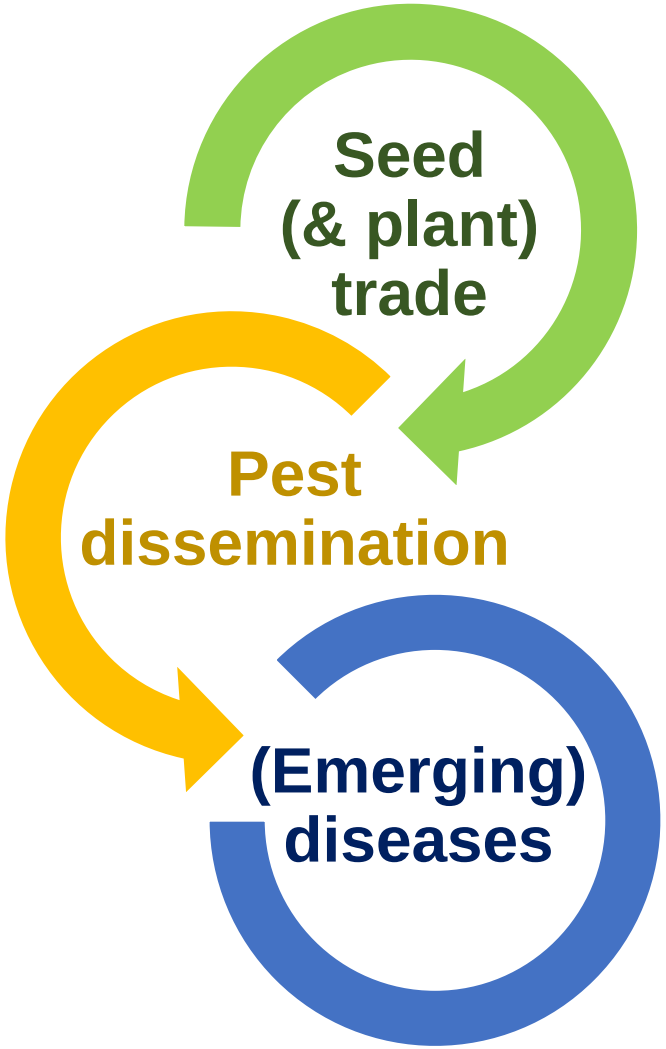
@NicoDNCE

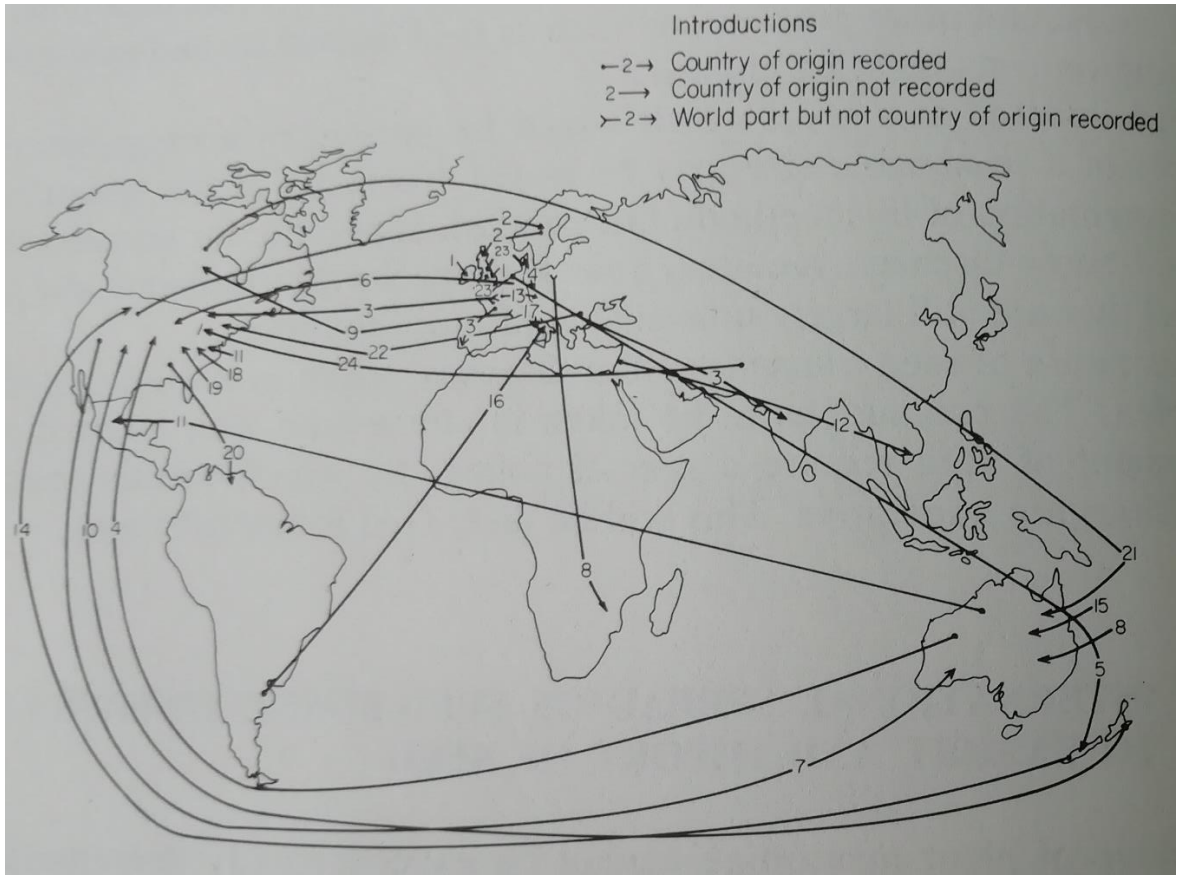
GEVES
Expertise & Performance

Groupe d'Étude et de contrôle des Variétés Et des Semences

Station Nationale d'Essais de Semences

Seed pests threaten food security





1. *Corynebacterium michiganense* (1942)
2. *Pseudomonas glycinea* (1940s)
3. *Xanthomonas campestris* (1961)
4. *Corynebacterium rathayi* (1945, 1965)
5. *Xanthomonas phaseoli* (1969)
6-8. *Puccinia sp.* (1885, 1906, 1940, 1952)
9. *Uromyces betae* (1943)
10. *Tilletia caries* (1854)
11. *Urocystis agropyri* (1919, 1946)
12. *Ustilago tritici* (1970)
13. *Urocystis cepulae* (1924)
14. *Gloeotinia temulenta* (1940)
15-17. *Peronospora sp.* (1881, 1922, 1935)
18. *Botrytis riini* (1926)
19. *Sclerotium oryzae* (1926)
20. *Gloeocercospora sorghi* (1949)
21. *Septoria linicola* (1948)
22. *Epichloë typhina* (1942)
23. *Barley stripe mosaic virus* (1959, 1972)
24. *Squash mosaic virus* (1964)
25. *Ascochyta rabei* (1973)

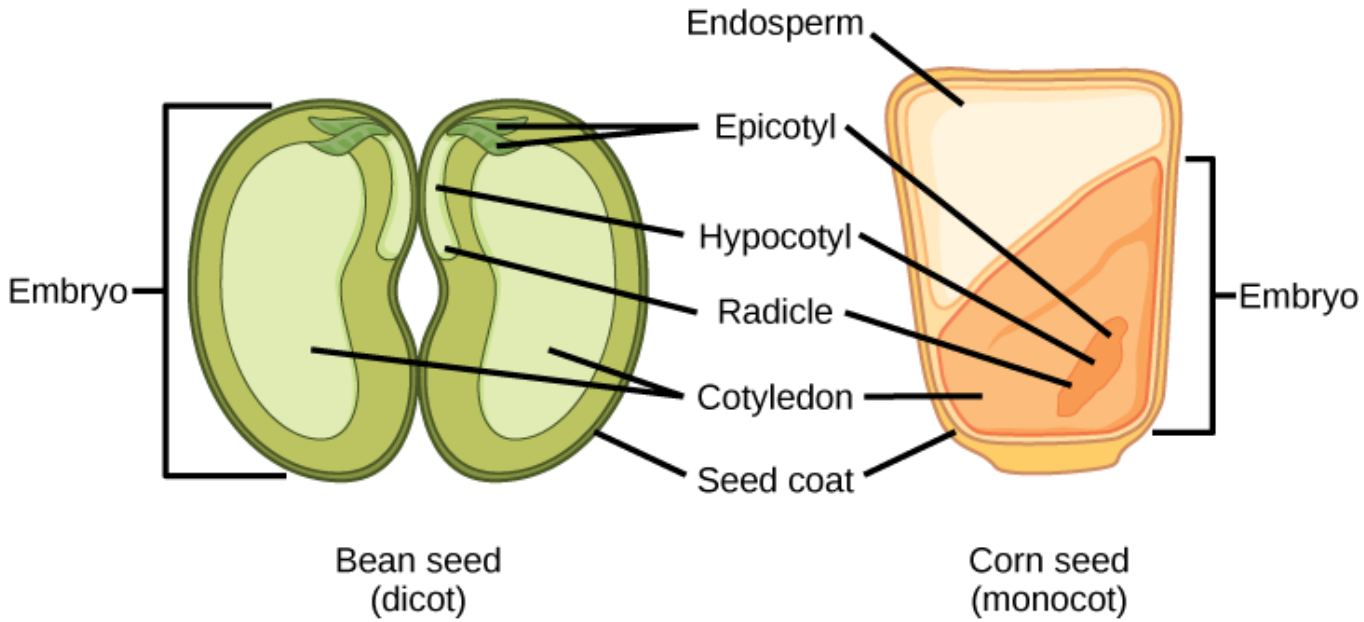
Introduction via infected seeds (1880s – 1970s)

Neergaard, In: Seed Pathology (1977); Strange & Scott, Annu. Rev. phytopathol. (2005); Engering et al., Emerg. Microb. infect. (2013)

Location & transport of seed-borne pests

- **Carried externally**
(i.e., seed surface)

- **Carried internally**
(i.e., seed coat, endosperm, perisperm, embryo)



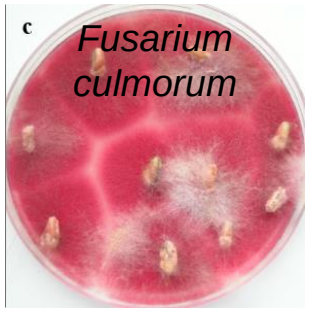
(illustration credit: lumenlearning.com)

Depth of colonization – Impact on:
seed treatments & **detection methods**

Baker & Smith, Annu. Rev. Phytopathol. (1966); Maude, in: Seedborne diseases and their control: principles and practice (1996)

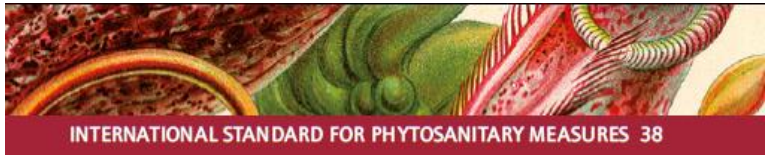
Seed pathway: entry & establishment in new areas

- Seed-borne pests can be **seed-transmitted**
  - pre-/post- emergence damping-off
  - seedlings or plants diseases



Seed pathway:

potential of emerging disease



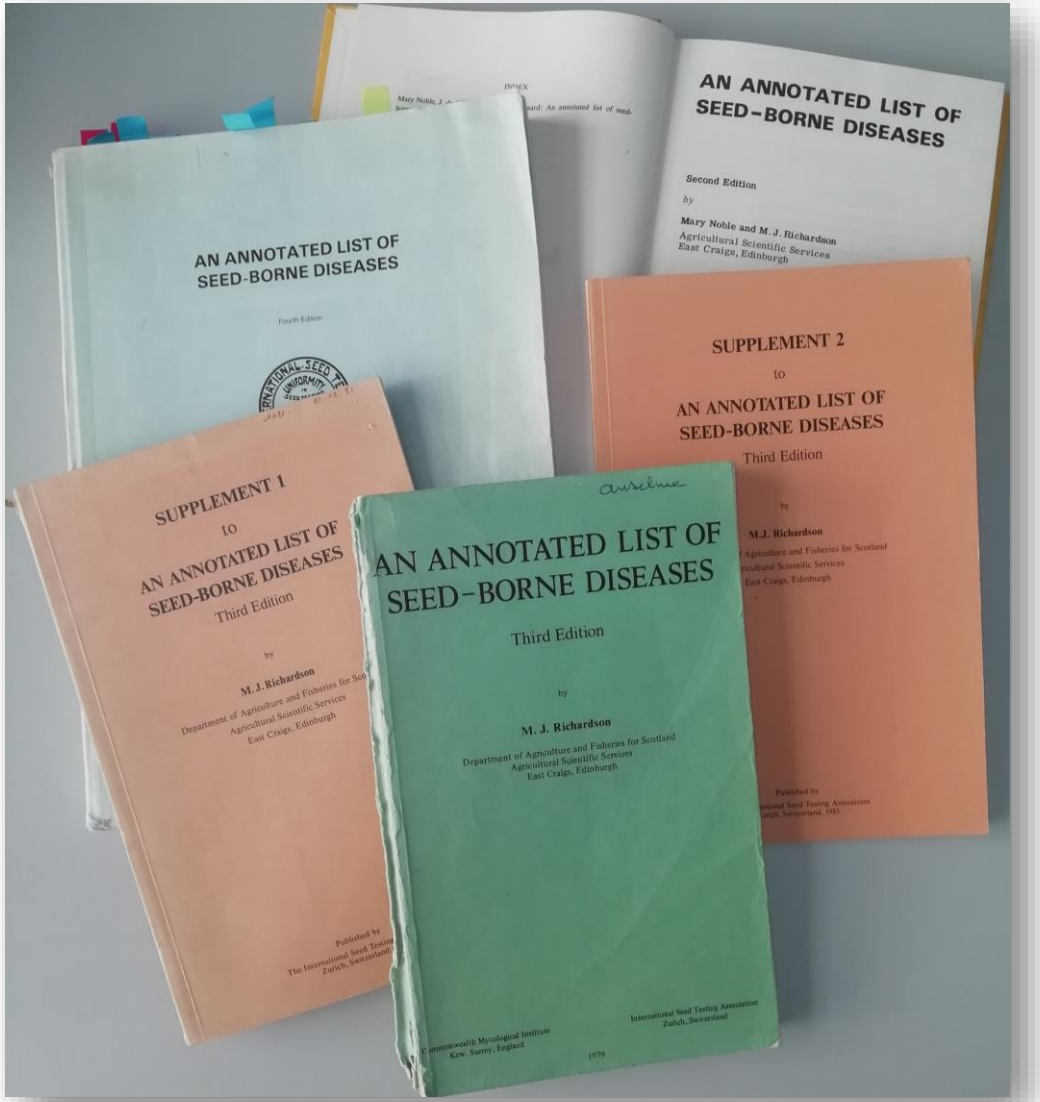
- Pests can **escort** seeds **independently**
  - not attached or mixed with debris
  - potential of environment contamination

Baker & Smith, Annu. Rev. Phytopathol. (1966); Maude (1996); IPPC, in: ISPM38 (2017)

ISTA published *"An annotated list of seed-borne diseases"*

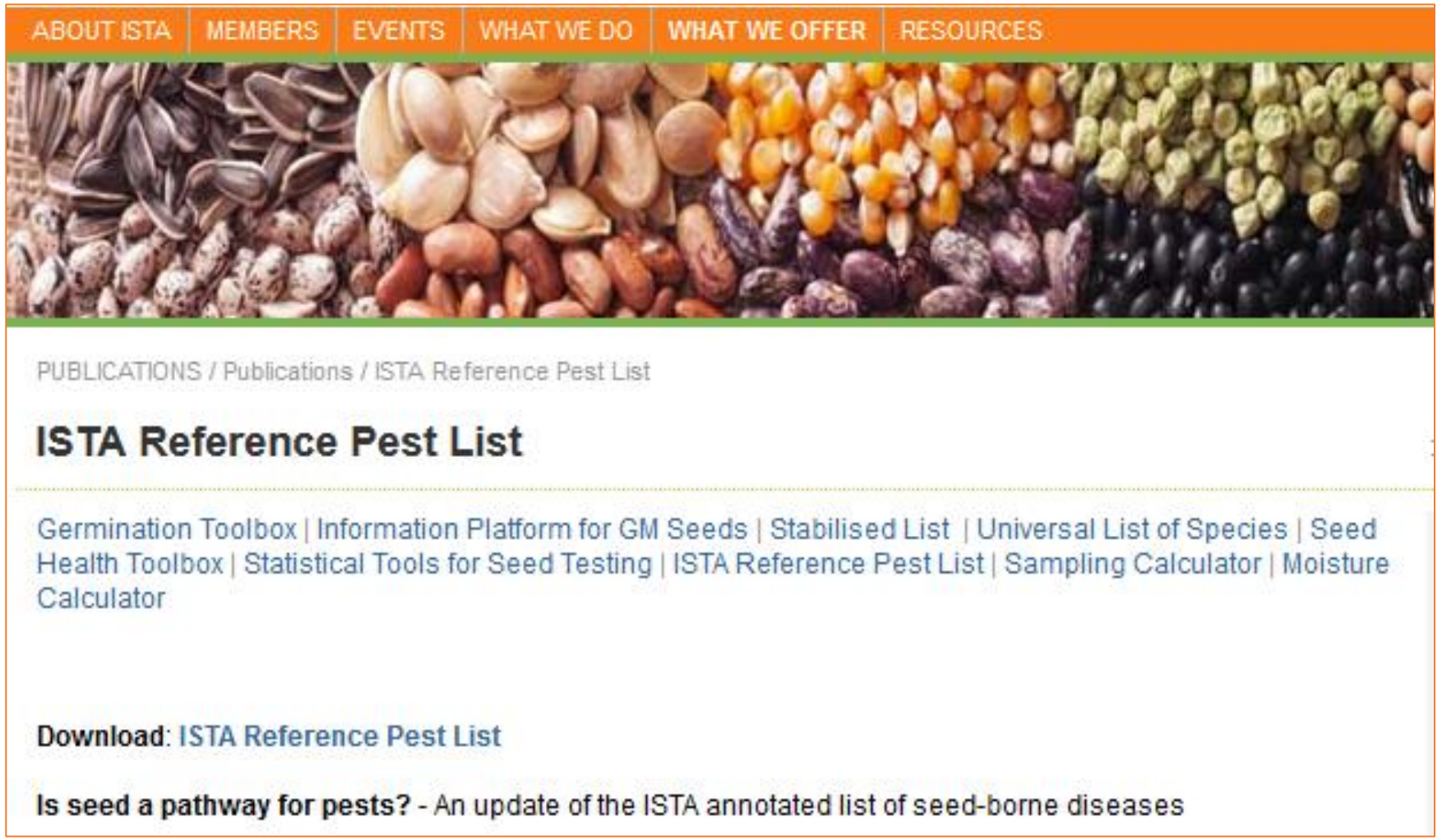
Attendees - 1st Seed Pathology Workshop
Seed Testing Station, Cambridge, UK, 1958.

- 1958 - 1990: **4 editions, 2 supplements**
- Latest revised: **30 years ago**



Noble et al., 1st edition (1958); Noble & Richardson, 2nd edition (1968); Richardson, 3rd edition (1979), Supplement 1 (1981), Supplement 2 (1983), 4th edition (1990); Yorini et al., In: Seed pathology – Progress and problems (1979)

ISTA Reference Pest List



New format:

- Online
- Free access
- Continuous update

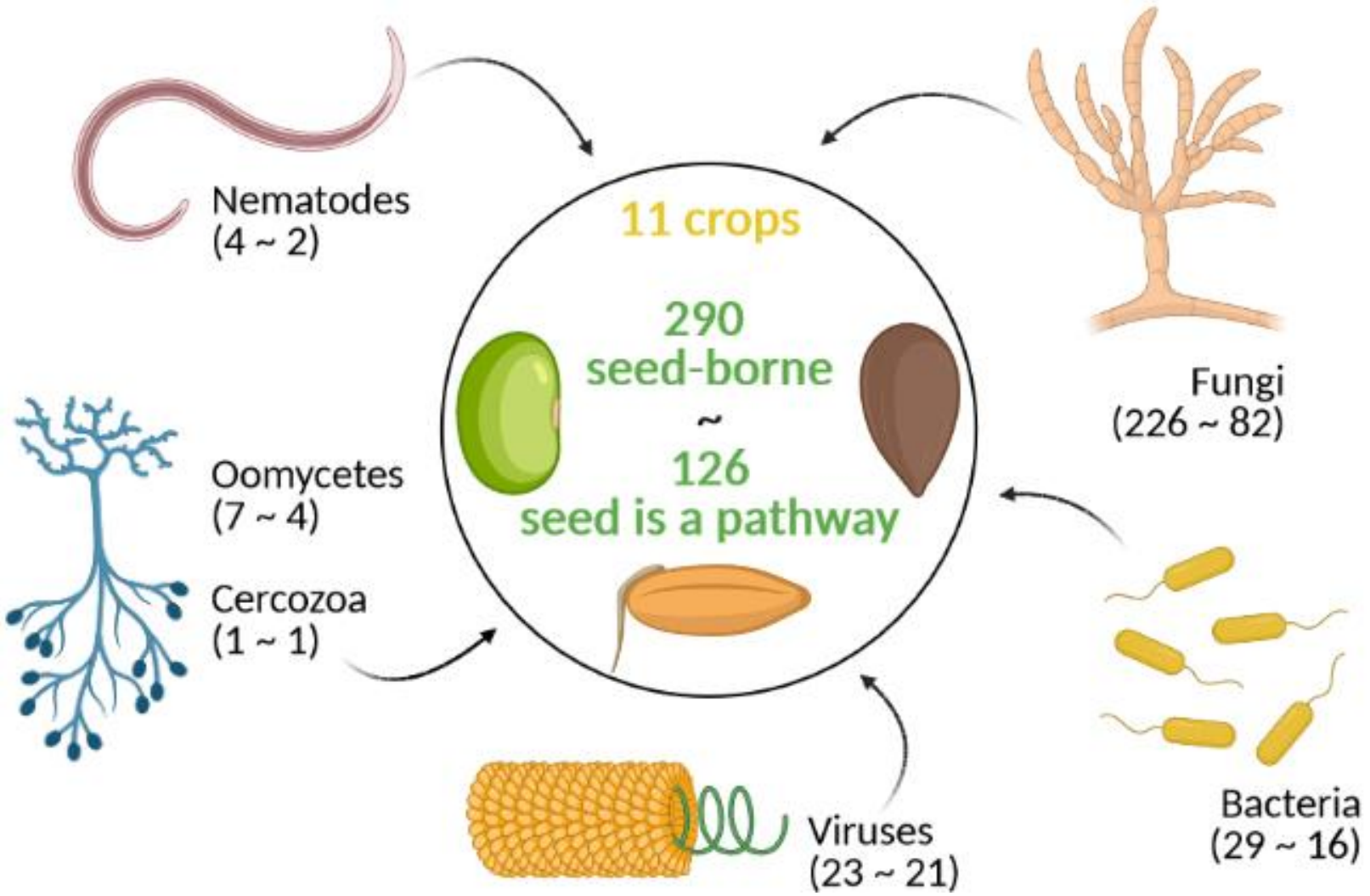
Same objective:

- Tool supporting policymakers' decisions

https://www.seedtest.org/en/ista-reference-pest-list-_content---1--3477.html

ISTA RPL: How many pests?

(v7.0; release Feb. 2021)
(458 references)

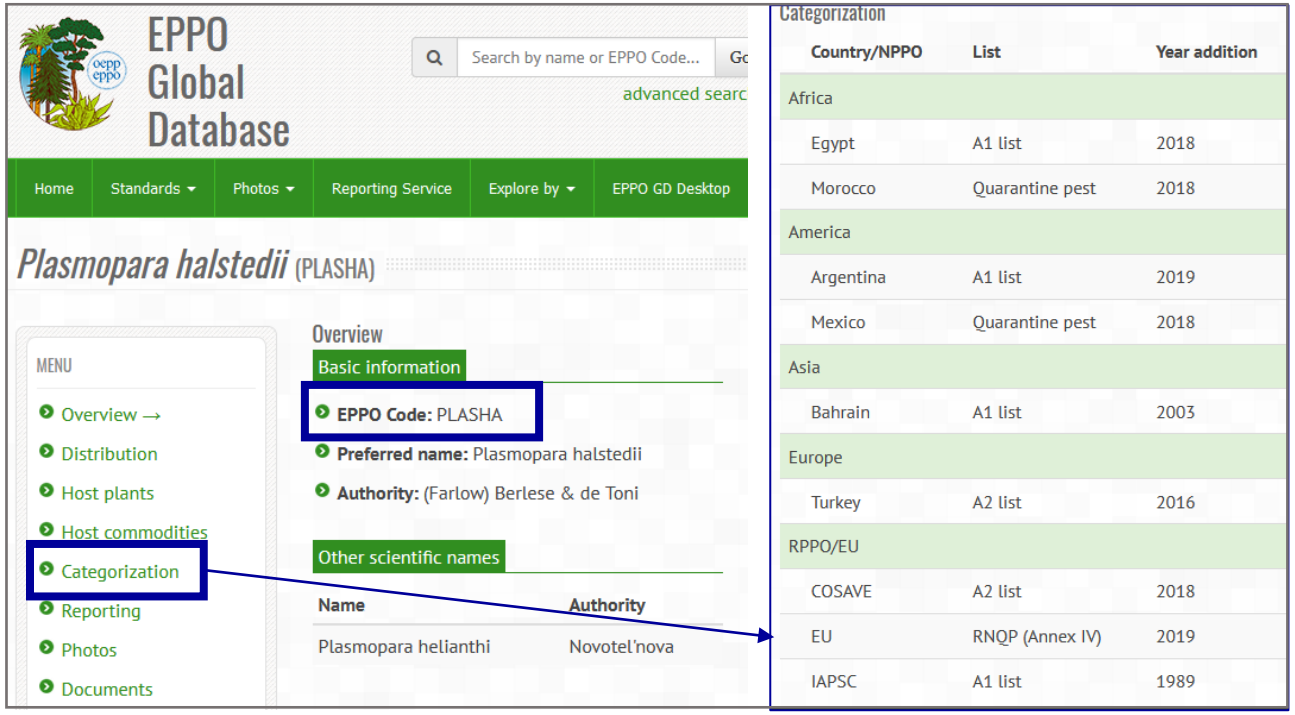


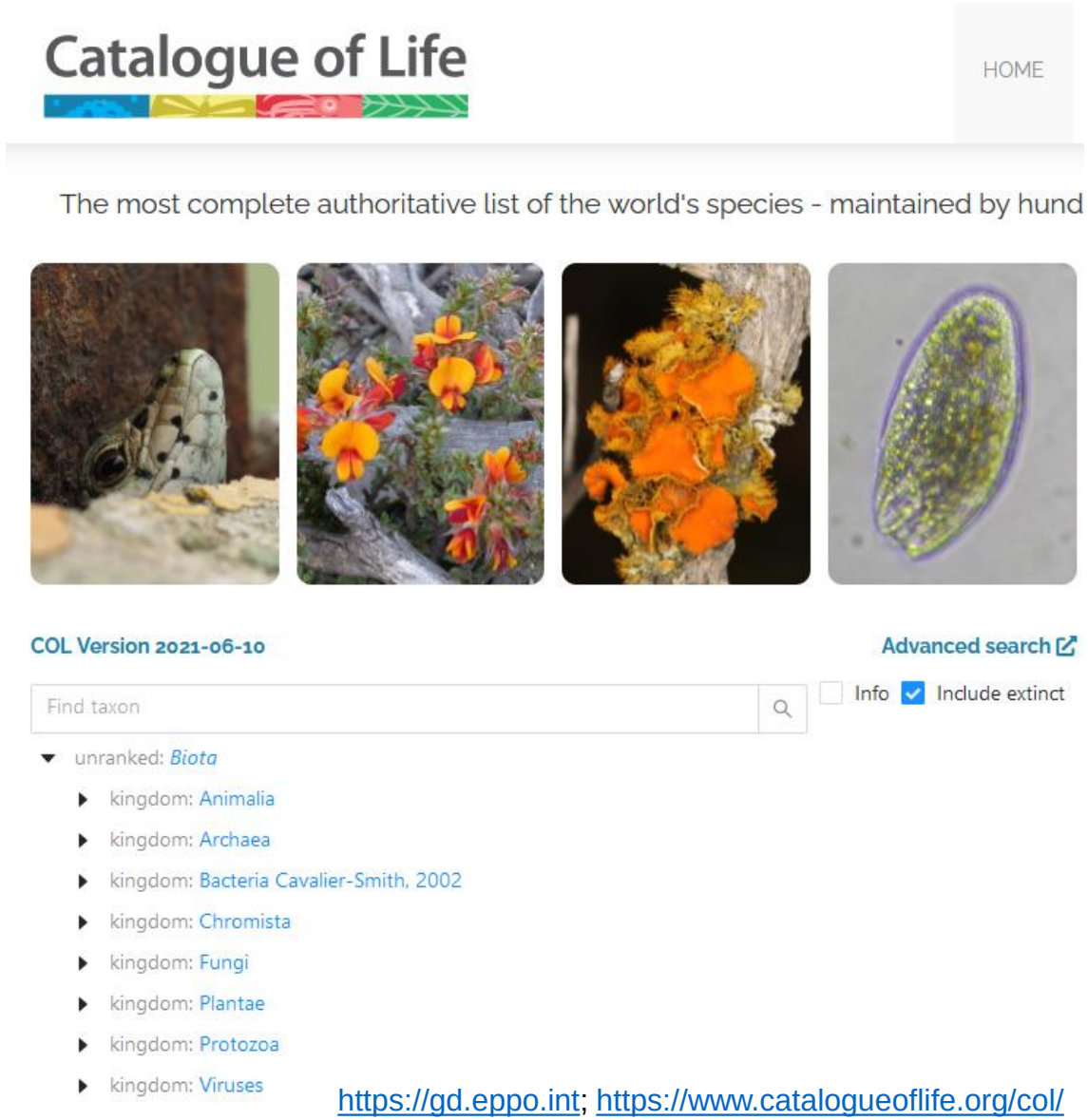
sunflower ♦ rapeseed ♦ alfalfa, soybean ♦ cotton ♦ barley, oat, rice, sorghum, triticale, wheat

(illustration credit: biorender.com)

What's new since the 1990 edition?

- Nomenclature (synonyms)
- EPPO codes
- Pest categorization

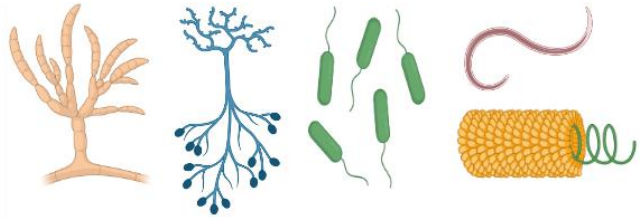




https://gd.eppo.int; https://www.catalogueoflife.org/col/

EPPO codes in the ISTA RPL

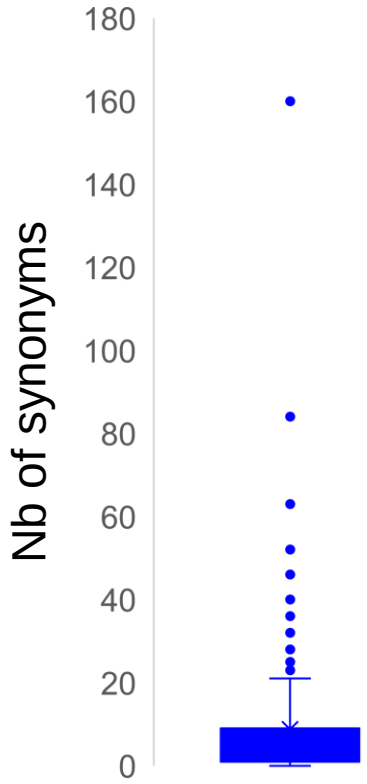
213 (unique) pests



186 with a code (incl. 101 regulated)
27 without a code

Kingdom/Phylum	Current pest name	EPPO code	Synonyms	Is the pest regulated?	EPPO Links (regulated status)
Oomycetes	***Albugo candida*** (Pers.) Roussel, 1806	ALBUCA	*Aecidium candidum* Pers., 1792 *Albugo candida* var. *candida* (Pers.) Roussel, 1806	No	
Fungi	***Colletotrichum capsici*** (Syd. & P. Syd.) E. J. Butler & Bisby, 1931	COLLDU	*Colletotrichum capsici* f. *capsici* (Syd. & P. Syd.) E. J. Butler & Bisby, 1931 *Colletotrichum capsici* f. *cyamopsidicola* M. V. Desai & Prasad, 1955	Yes	https://gd.eppo.int/taxon/COLLDU/categorization
Bacteria	***Curtobacterium flaccumfaciens*** (Hedges, 1922) Collins and Jones, 1984	CORBFL	*Corynebacterium betae* Keyworth et al., 1956 *Corynebacterium flaccumfaciens* (Hedges, 1922) Dowson, 1942	Yes	https://gd.eppo.int/taxon/CORBFL/categorization
Nematodes	***Ditylenchus dipsaci*** (Kühn, 1857) Filipjev, 1936	DITYDI	*Anguillula devastatrix* Kühn, 1869 *Anguillula dipsaci* Kühn, 1857	Yes	https://gd.eppo.int/taxon/DITYDI/categorization
Fungi	***Epicoccum neglectum*** Desm., 1842	-	*Clathrococcum neglectum* (Desm.) Murashk., 1924 *Epicoccum neglectum* f. *menispermi* Sacc., 1878	No	
Fungi	***Fusarium poae*** (Peck) Wollenw., 1913	FUSAPO	*Fusarium poae* f. *pallens* Wollenw., 1930 *Fusarium poae* f. *poae* (Peck) Wollenw., 1913	No	
Nematodes	***Heterodera glycines*** (Ichinohe, 1952)	HETDGL	-	Yes	https://gd.eppo.int/taxon/HETDGL/categorization
Cercozoa	***Plasmodiophora brassicae*** Woronin, 1877	PLADBR	-	Yes	https://gd.eppo.int/taxon/PLADBR/categorization
Oomycetes	***Plasmopara halstedii*** (Farl.) Berl. & De Toni, 1888	PLASHA	*Peronospora halstedii* Farl., 1883 *Plasmopara helianthi* Novot., 1962	Yes	https://gd.eppo.int/taxon/PLASHA/categorization
Bacteria	***Pseudomonas syringae* pv. *tagetis*** van Hall, 1902	PSDMTG	-	Yes	https://gd.eppo.int/taxon/PSDMTG/categorization
Fungi	***Sclerotinia sclerotiorum*** (Lib.) de Bary, 1884	SCLESC	*Helotium sclerotiorum* (Lib.) Fuckel 1866 *Hymenoscyphus sclerotiorum* (Lib.) W. Phillips 1887	Yes	https://gd.eppo.int/taxon/SCLESC/categorization
Viruses	***Soybean mosaic virus*** ICTV	SMV000	-	Yes	https://gd.eppo.int/taxon/SMV000/categorization
Viruses	***Sunflower mosaic virus* ICTV**	SUMV00	-	No	
Bacteria	***Xanthomonas translucens* pv. *undulosa*** (ex Jones et al., 1917) Vauterin et al.,	XANTTU	*Bacterium translucens* var. *undulosum* Smith et al. 1919 *Phytomonas translucens* f. sp. *undulosa* Hagborg, 1936	No	

EPPO codes avoid confusion between synonyms…



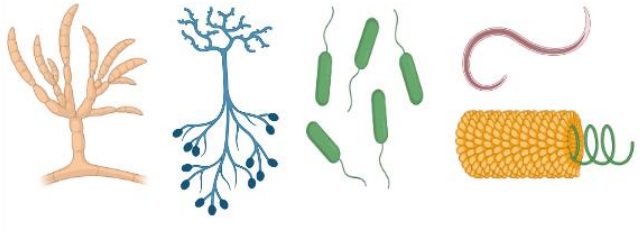
Catalogue of Life

Nb of synonyms:

>50:	4 pests
20-49:	18 pests
10-19:	24 pests
1-9:	106 pests
0:	34 pests

(Big) advantage:

A single language despite taxonomic changes



458 scientific references ♦ 1913 to 2019

But, static codes have their own inconvenience

Phomopsis phaseoli: an example of unclear coding

ascomycota – soybean

pod and stem blight
stem canker
seed decay

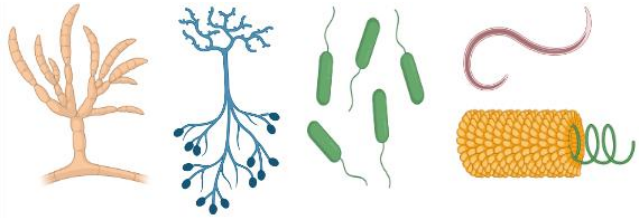
Catalogue of Life (accepted name ♦ 18 synonyms)

Diaporthe aspalathi	DIAPAS
Diaporthe phaseolorum var. *meridionalis*	DIAPAS
Diaporthe batatas	DIAPPB
Diaporthe phaseolorum var. *batatae*	DIAPPB
Diaporthe caulivora	DIAPPC
Diaporthe phaseolorum var. *caulivora*	DIAPPC
Diaporthe phaseolorum	DIAPPH
Diaporthe phaseolorum var. *phaseolorum*	DIAPPH
Phoma subcircinata	DIAPPH
Sphaeria phaseolorum	DIAPPH
Diaporthe phaseolorum var. *sojae*	DIAPPS
Diaporthe sojae	DIAPPS
Phomopsis sojae	DIAPPS

Chorostate batatas	-
Phoma phaseoli	-
Phomopsis phaseoli var. *phaseoli*	-
Phomopsis phaseoli var. *sojae*	-
Septomazzantia phaseolorum	-

How to deal with static codes *vs.* moving taxonomy?

213 (unique) pests
186 EPPO codes



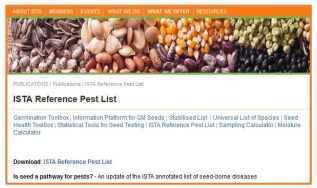
For 61 pests: current name has a EPPO code defined for a synonym

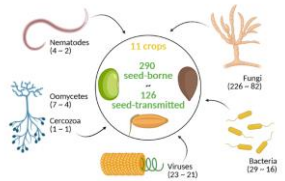
- teleomorph (sexual) vs. anamorph (asexual)
  (e.g., *Cochliobolus vs. Bipolaris*; *Giberella* vs. *Fusarium*)

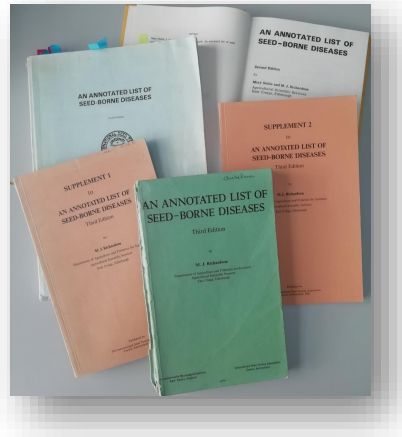
- old taxonomic classification
  (e.g., *Acidovorax*, *Burkholderia,* previously described as *Pseudomonas* and still coded PSDMxx)
  (e.g., *Clavibacter*, previously described as *Corynebacterium* and still coded CORBxx)

Take home messages

- **ISTA Reference Pest List**: bibliographic resource for risk assessors & policymakers







- Focus on non-vegetable species: 11 done // 34 to come

- EPPO Global Database: a powerful resource!

- **EPPO codes:** a good way to speak the same language
  - Ensure traceability upon taxonomic changes
  - Could there be some evolution?

Thank you!

ISTA
Seed Quality Assurance

Executive Committee
Seed Health Committee
Andreas WAIS & Secretariat

GEVES
Expertise & Performance
Groupe d'Étude et de contrôle des Variétés Et des Semences
Station Nationale d'Essais de Semences

Valérie GRIMAULT

Christine HENRY (FERA)
Alex JEBB

Testa

Terry AVELING† (Univ. Pretoria)
Nicole JOUBERT
Edgar MANGWENDE
Gloria MUKWIRIMBA
Renaan THOMPSON