



The likelihood of introduction of forest pests and diseases based on their worldwide distribution

René Eschen, Tim Holmes, David Smith and Marc Kenis

www.cabi.org

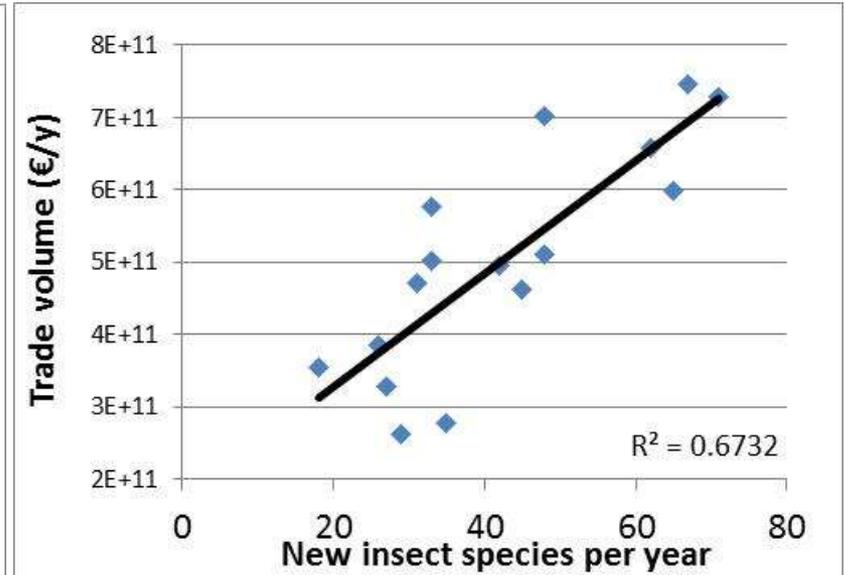
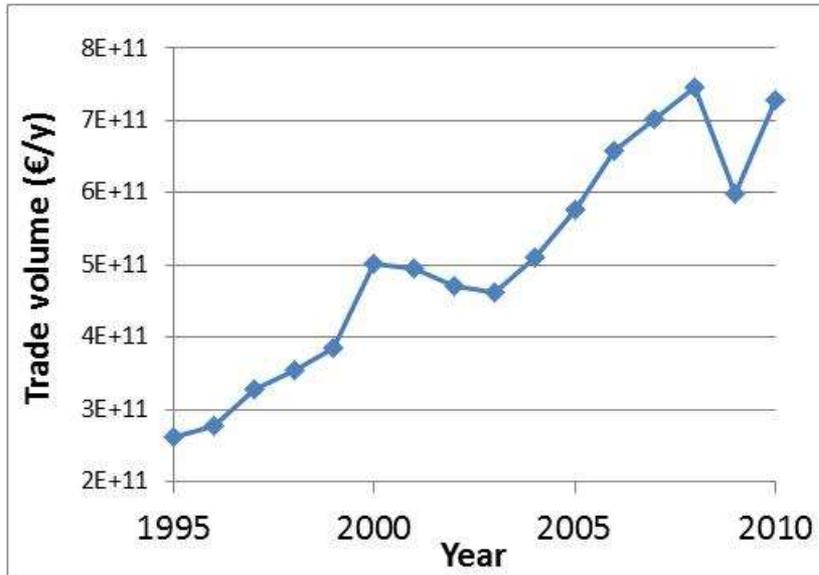
KNOWLEDGE FOR LIFE

Woody plants for planting (WP4P)

WP4P a major pathway for forest pests and diseases

EU imports large, and increasing quantities of WP4P

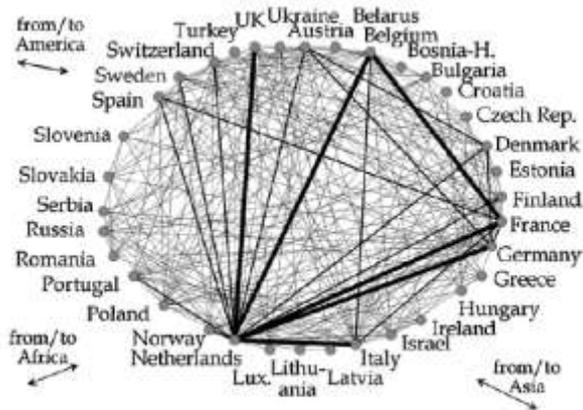
Increasing trade, and changes in trade relationships likely to affect new arrivals



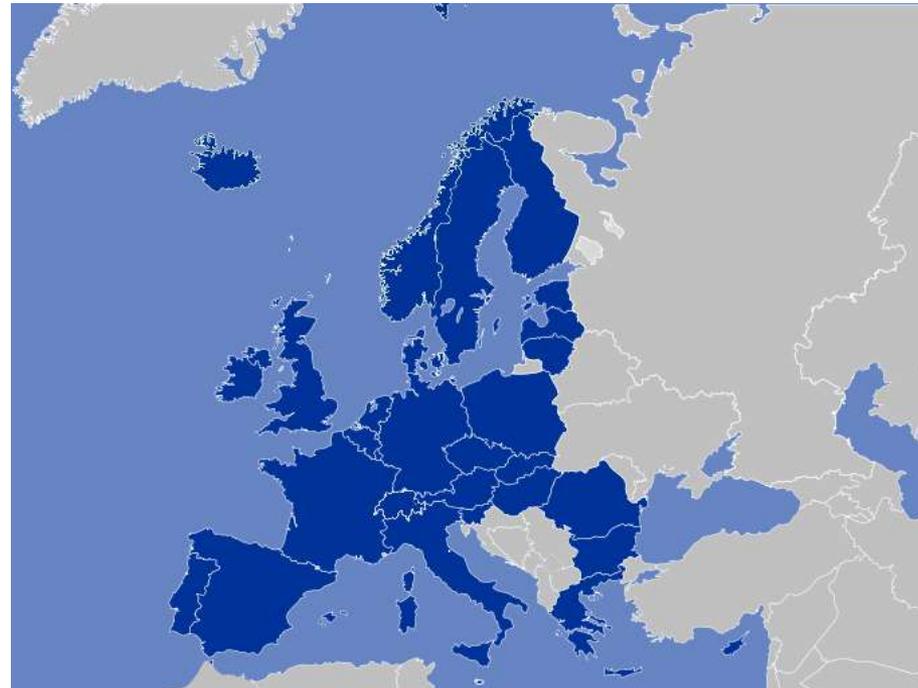
Europe's open internal market

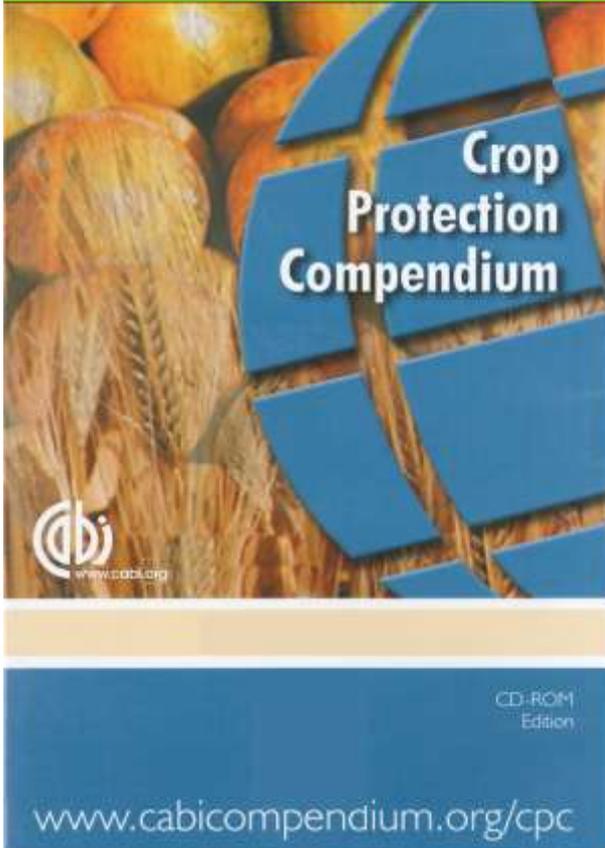
Free movement of goods once inspected and allowed entry into EEA (+ Switzerland)

Spread limited as a result of Plant Passports and climate



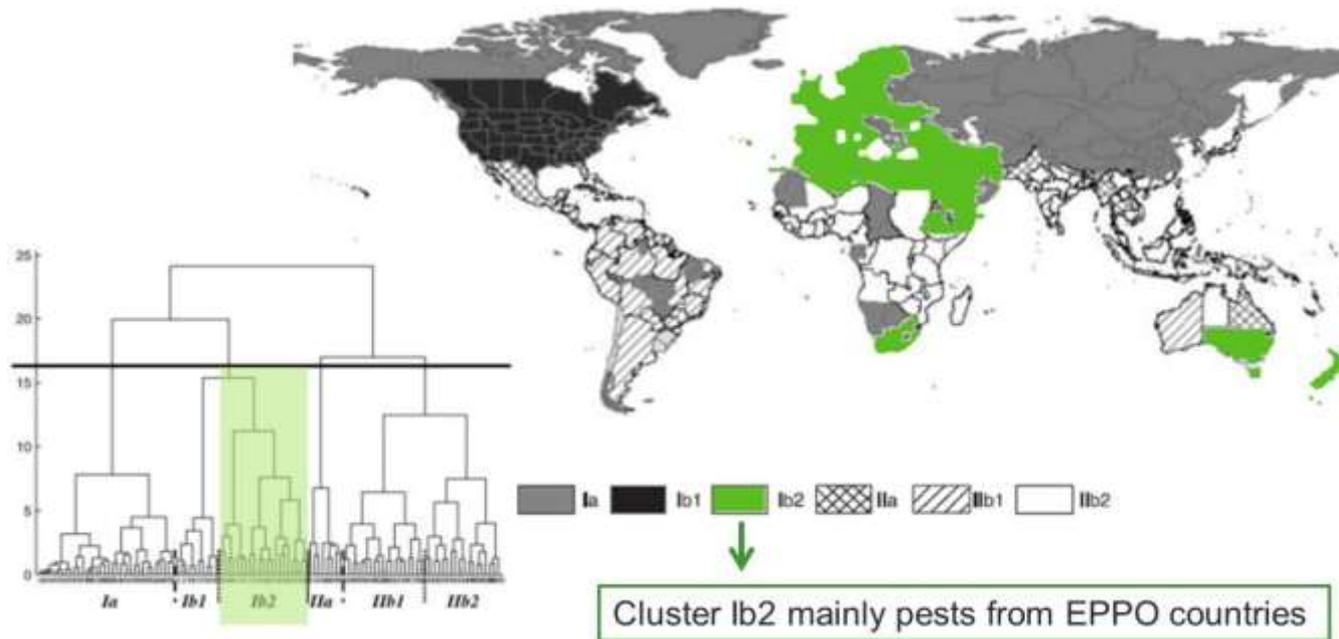
Trade in plants for planting (from Dehnen-Schmutz et al. 2010)





The likelihood of introduction of pests and diseases

- Presence/absence data of known pests used as basis to estimate likelihood of establishment
- Likelihood of establishment based on similarities between countries
- Data extracted from 2003 edition of CABI's CPC
- The results reveal risks from elsewhere (New Zealand, Finland, Australia) and from within (USA)

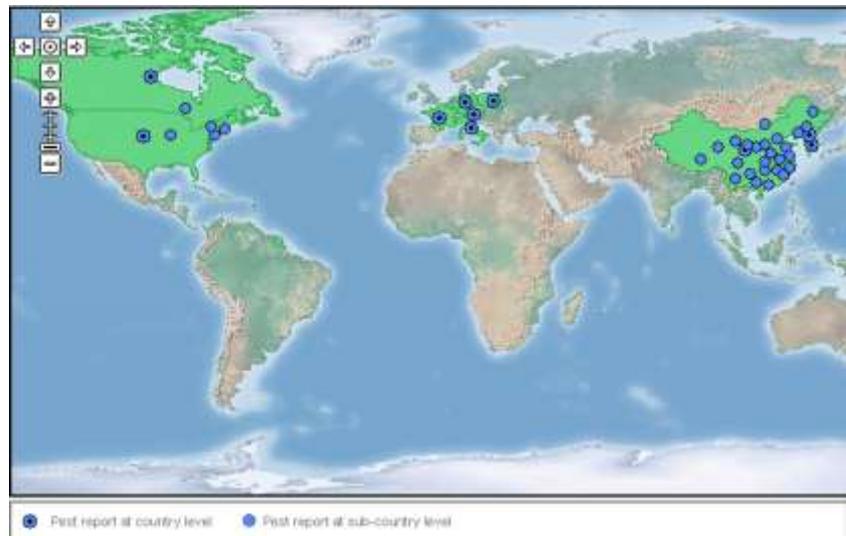


Name	Risk index	P or A	Name	Risk index	P or A
<i>Planococcus citri</i>	0.93	0	<i>Chrysomphalus dictyospermi</i>	0.67	0
<i>Icerya purchasi</i>	0.92	1	<i>Aspidiotus nerii</i>	0.67	1
<i>Myzus persicae</i>	0.87	1	<i>Frankliniella occidentalis</i>	0.61	1
<i>Cydia pomonella</i>	0.86	1	<i>Rhopalosiphum padi</i>	0.61	1
<i>Nezara viridula</i>	0.85	1	<i>Hyperomyzus lactucae</i>	0.61	1
<i>Brevicoryne brassicae</i>	0.83	1	<i>Agrilus convolvuli</i>	0.60	1
<i>Delia platura</i>	0.80	1	<i>Diaspidiotus perniciosus</i>	0.60	1
<i>Phthorimaea operculella</i>	0.79	1	<i>Aphis fabae</i>	0.60	0
<i>Pseudococcus longispinus</i>	0.79	1	<i>Phorocantha semipunctata</i>	0.59	1
<i>Aphis spiraeicola</i>	0.77	1	<i>Heliothrips haemorrhoidalis</i>	0.59	1
<i>Saissetia oleae</i>	0.77	1	<i>Macrosiphum euphorbiae</i>	0.59	1
<i>Coccus hesperidum</i>	0.77	1	<i>Phyllocnistis citrella</i>	0.58	0
<i>Aonidiella aurantii</i>	0.76	1	<i>Ceroplastes rusci</i>	0.57	0
<i>Eriosoma lanigerum</i>	0.76	1	<i>Chrysomphalus aonidum</i>	0.57	0
<i>Aphis gossypii</i>	0.76	1	<i>Parthenolecanium persicae</i>	0.56	1
<i>Viteus vitifoliae</i>	0.75	1	<i>Trichoplasia ni</i>	0.55	0
<i>Ceratitis capitata</i>	0.73	0	<i>Cadra cautella</i>	0.54	0
<i>Agrotis ipsilon</i>	0.73	1	<i>Lepidosaphes beckii</i>	0.54	0
<i>Bomisia tabaci</i>	0.70	1	<i>Aphis craccinora</i>	0.54	1
<i>Helicoverpa armigera</i>	0.70	1	<i>Lampides boeticus</i>	0.54	1
<i>Acyrtosiphon pisum</i>	0.70	1	<i>Agrotis segetum</i>	0.54	0
<i>Thrips tabaci</i>	0.69	1	<i>Sitophilus zeamais</i>	0.53	0
<i>Saissetia coffeae</i>	0.68	1	<i>Pieris brassicae</i>	0.53	0
<i>Rhopalosiphum maidis</i>	0.68	1	<i>Hemiberlesia lataniae</i>	0.52	1
<i>Plutella xylostella</i>	0.68	1	<i>Toxoptera citricida</i>	0.52	1

Likelihood that a species will establish in the target country ~ the fraction of the countries in the cluster in which it is present

1009 taxa, divided into twelve groups (4 Microorganism and 8 Invertebrate)

Up-to-date presence/absence data obtained from CABI's Plantwise database (www.plantwise.org)



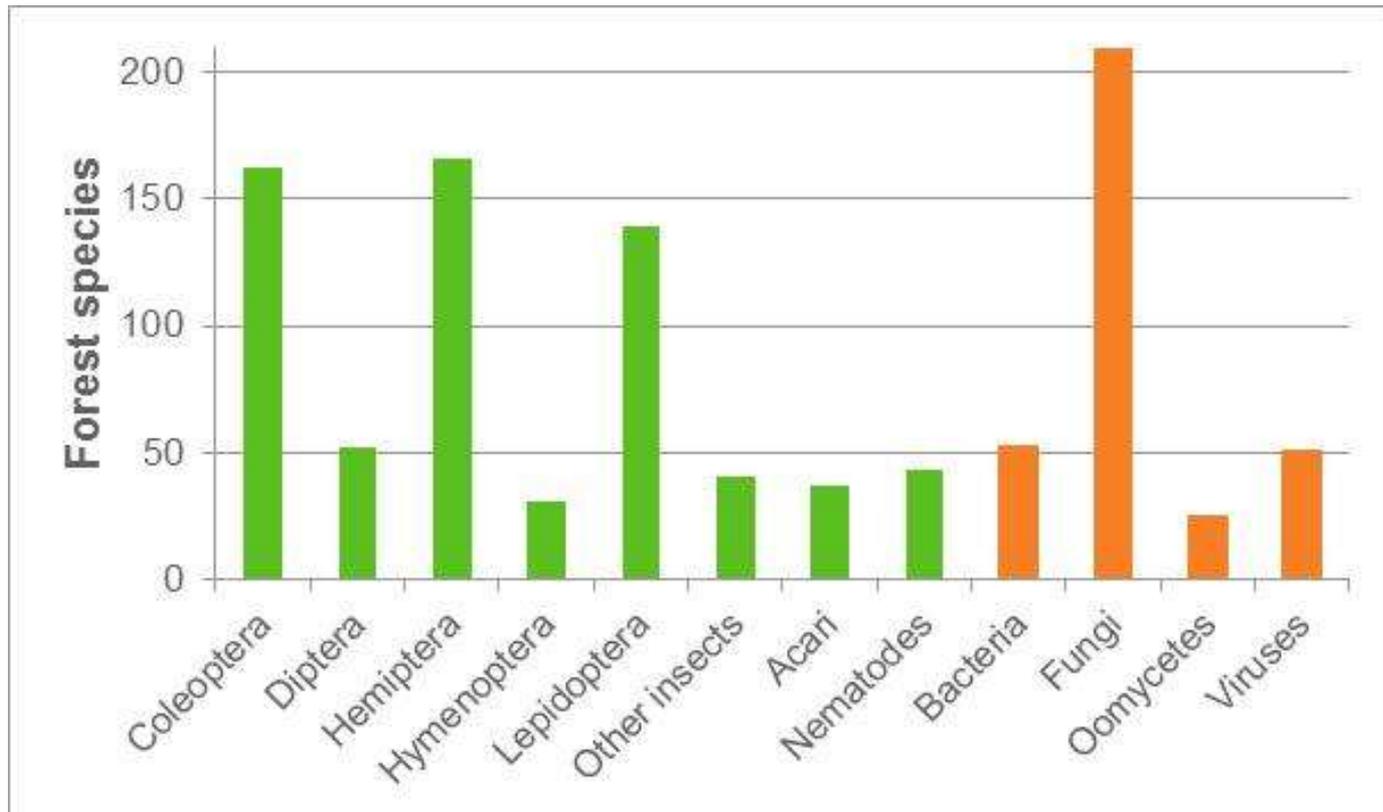
Anoplophora glabripennis

Only species with woody hosts selected

Compared with DAISIE and Fauna Europea and corrected

Species present in <6 regions omitted from clustering

Dividing data into groups adds detail in results



351 Regions considered

197 Nations

Russia split into 9 regions

USA split into 50 states

Canada split into 11 provinces

China split into 30 provinces

Brazil split into 25 states

India split into 29 states and territories

Australia split into 7 states and territories

Hierarchical clustering is base for risk assessment

Cluster with all European countries identified

- Without knowledge of climate and history, countries are grouped based on similarity of occurring species

Relative abundance of species within cluster calculated

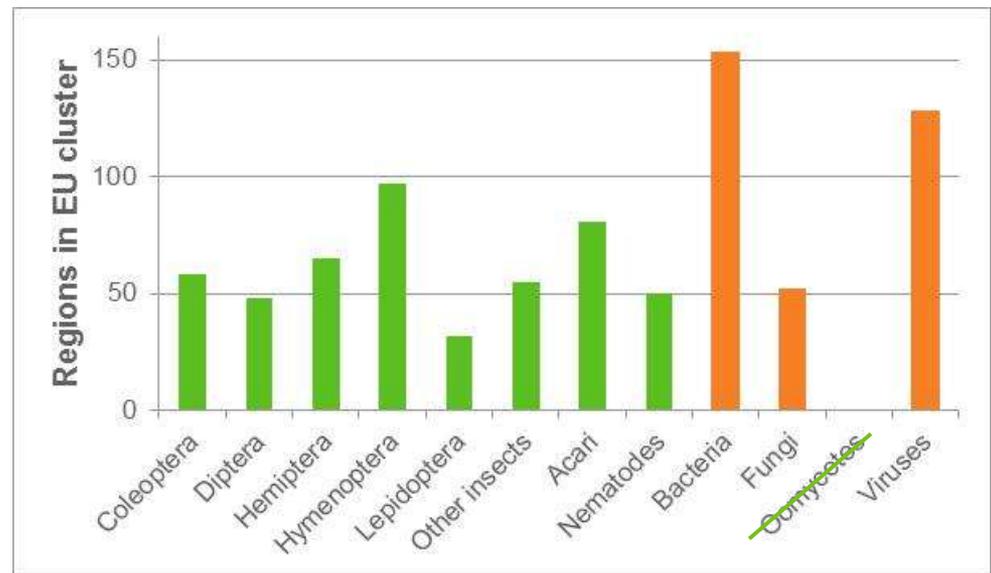
- % of countries where present

Absent species with highest relative abundance in cluster are assumed to pose greatest risk to a country

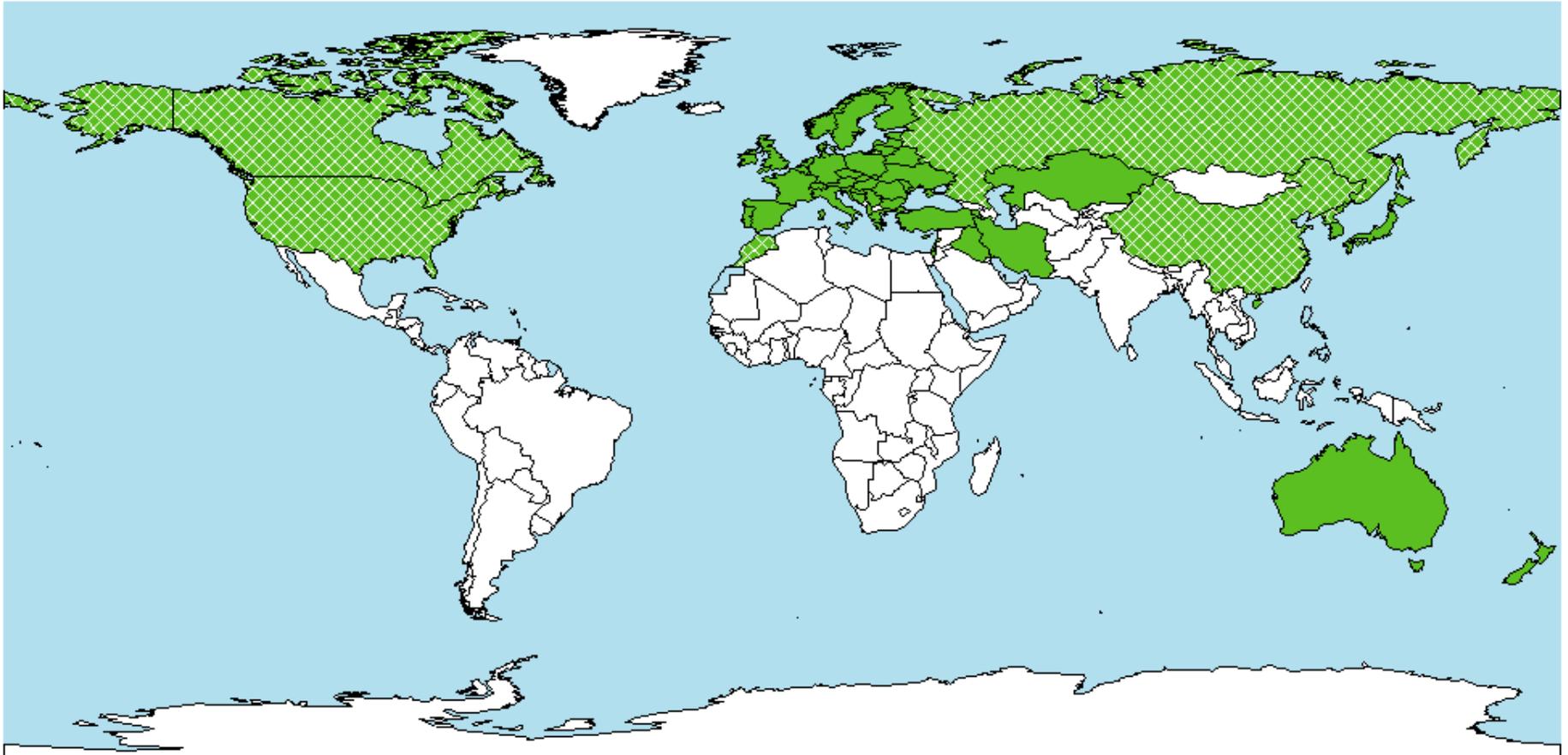
Interpretable clusters formed for most organism groups

Clusters for microorganisms larger

Differences between microorganisms and invertebrates may be due to expertise or technology



Interpretable clusters formed for most organism groups

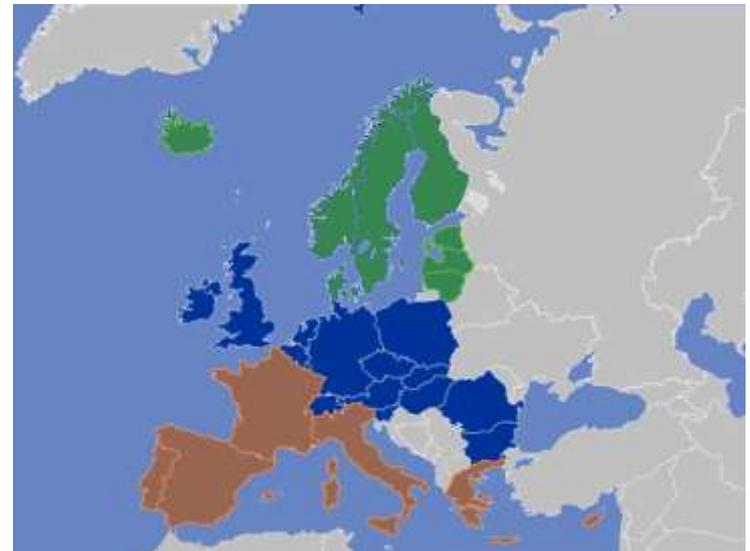
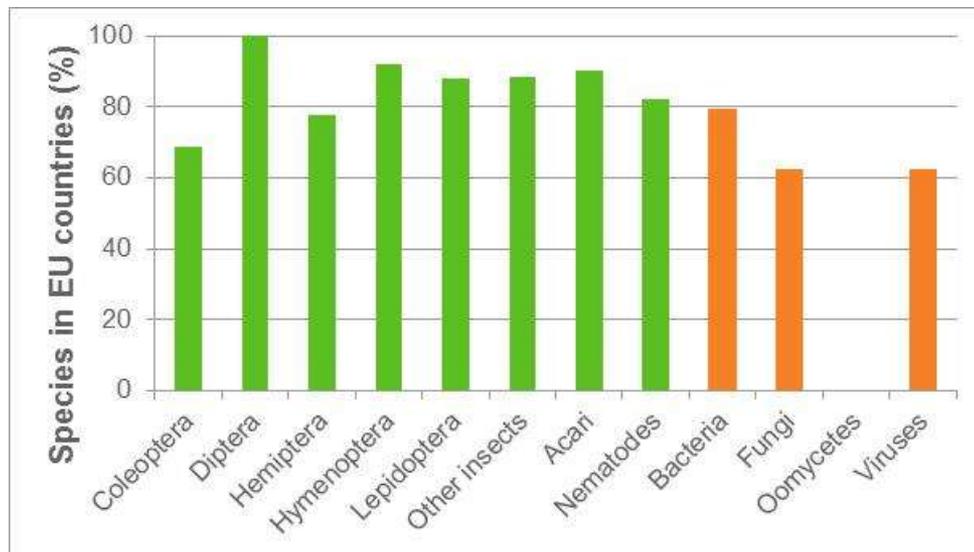


Over 60% of the species are present in Europe

Open market → spread likely to occur

Actual establishment limited by climate

Next species to become established are those in same cluster, but not yet in EU



Top species not recorded in Europe



Viruses:

Raspberry leaf curl virus (0.13)

Cherry rasp leaf virus (0.09)

Nematodes:

Belonolaimus longicaudatus (0.26)

Hemicriconemoides strictathecatus (0.10)

Bacteria:

Xylella fastidiosa (0.24)

Phytoplasma fraxini (0.19)

Top species not recorded in Europe



Coleoptera:

Ips subelongatus (0.24)

Agrilus planipennis (0.21)

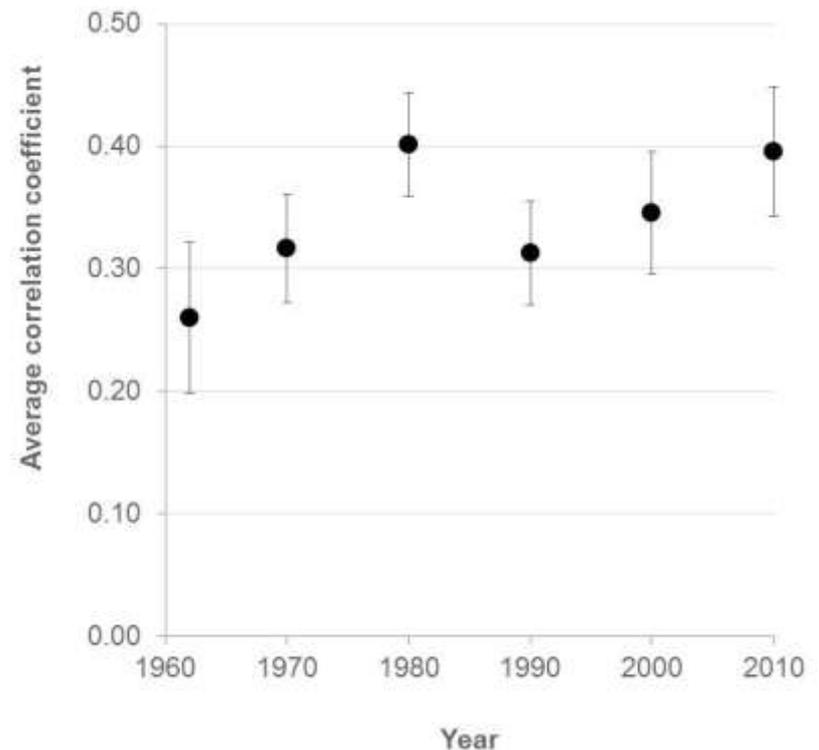
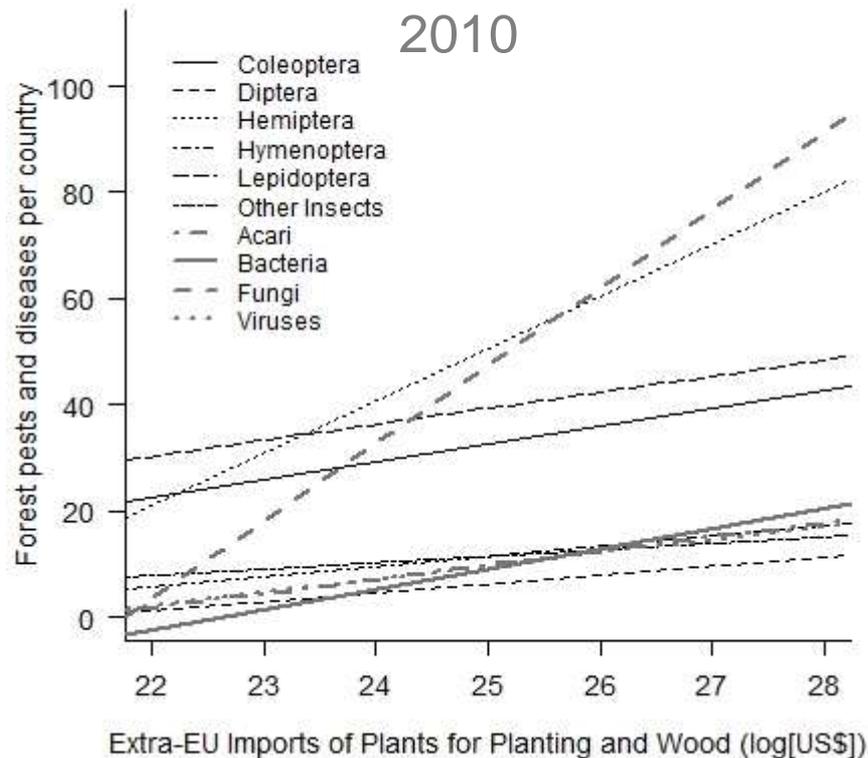
Hesperophanes campestris (0.17)

Scolytus schevyrewi (0.17)

Scolytus morawitzi (0.16)

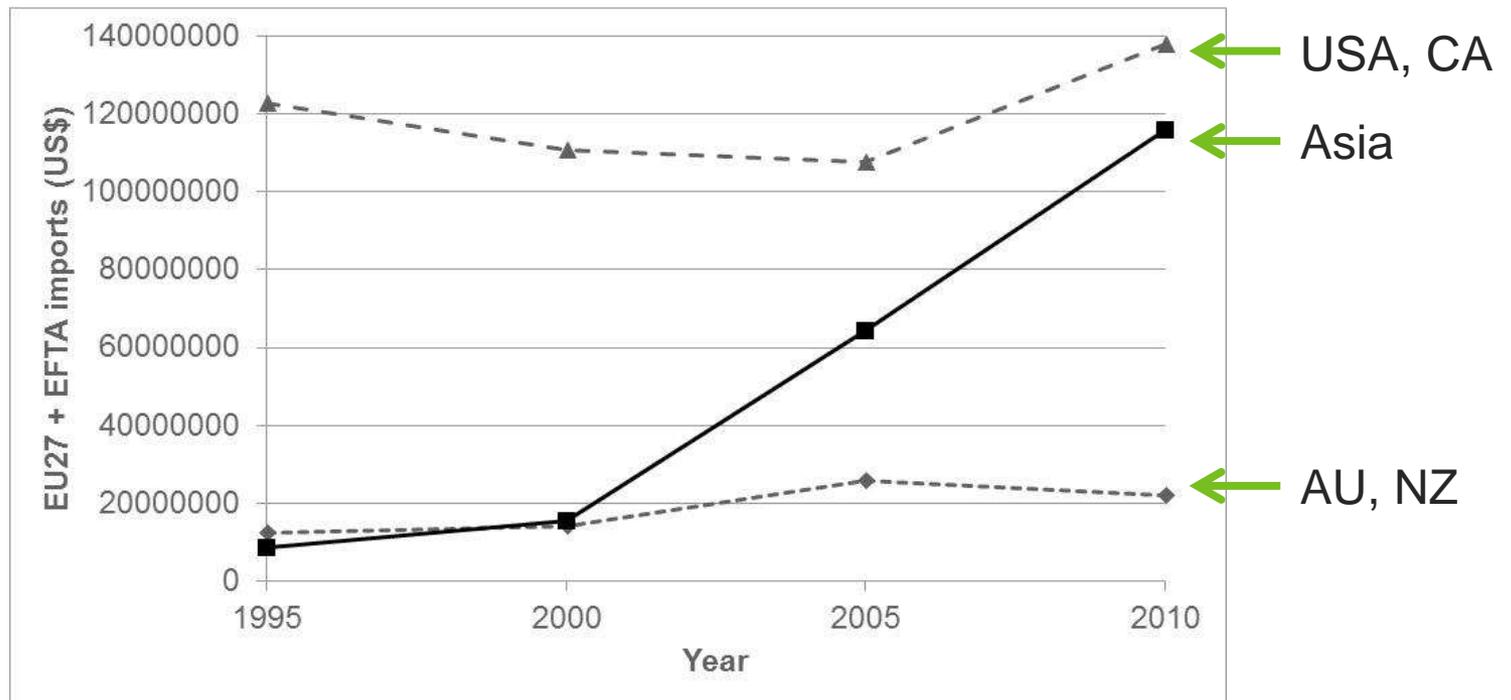
Tetropium gracilicorne (0.16)

Trade volume vs forest pest number



Major changes in sources of WP4P for Europe over the past decade

More than fivefold increase in imports from Asia



Conclusion

Like in US study, highest «risk» is associated with species already present in EU countries

Free movement of goods within a large part of Europe means that these species will be able to spread widely

Species present in cluster, but not EU may pose greatest risk, as a result of adaptation to climate

Establishment in within EU may be restricted by climate

Conclusion

Recent changes in trade relationships may indicate that new pests, not known and recorded in the dataset, may arrive from those regions in the future

- Recent developments in World trade patterns should be taken into account:
 - New species/varieties
 - New origins
 - Shifts in volume/origin relationship

Thank You



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra



www.cabi.org

KNOWLEDGE FOR LIFE