Netherlands Food and Consumer Product Safety Authority
Ministry of Economic Affairs

Imperial College London

Euphresco Plant Health Research Fellowship Scheme

modelling the probability of pest transfer from produce

Euphresco
Phytosanitary ERA-NET

Euphresco fellowship - project funded by UK & NL

Project title

Practical tools to assess the risk of pest transfer from an imported commodity helping to provide improved rationale for reduced inspection strategies

1 Jan 2014 – 31 Dec 2015

Partners

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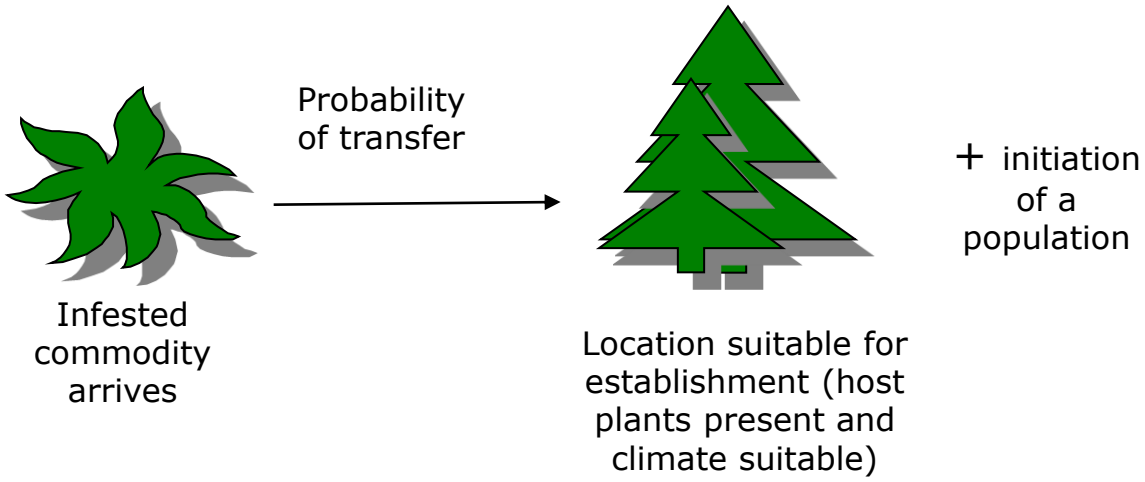
Transfer

Transfer: movement of a pest from an imported commodity to a place where the pest can establish

Model for insects and mites includes transfer + initiation of a population, defined as egg laying at a site suitable for establishment



Objective of the project

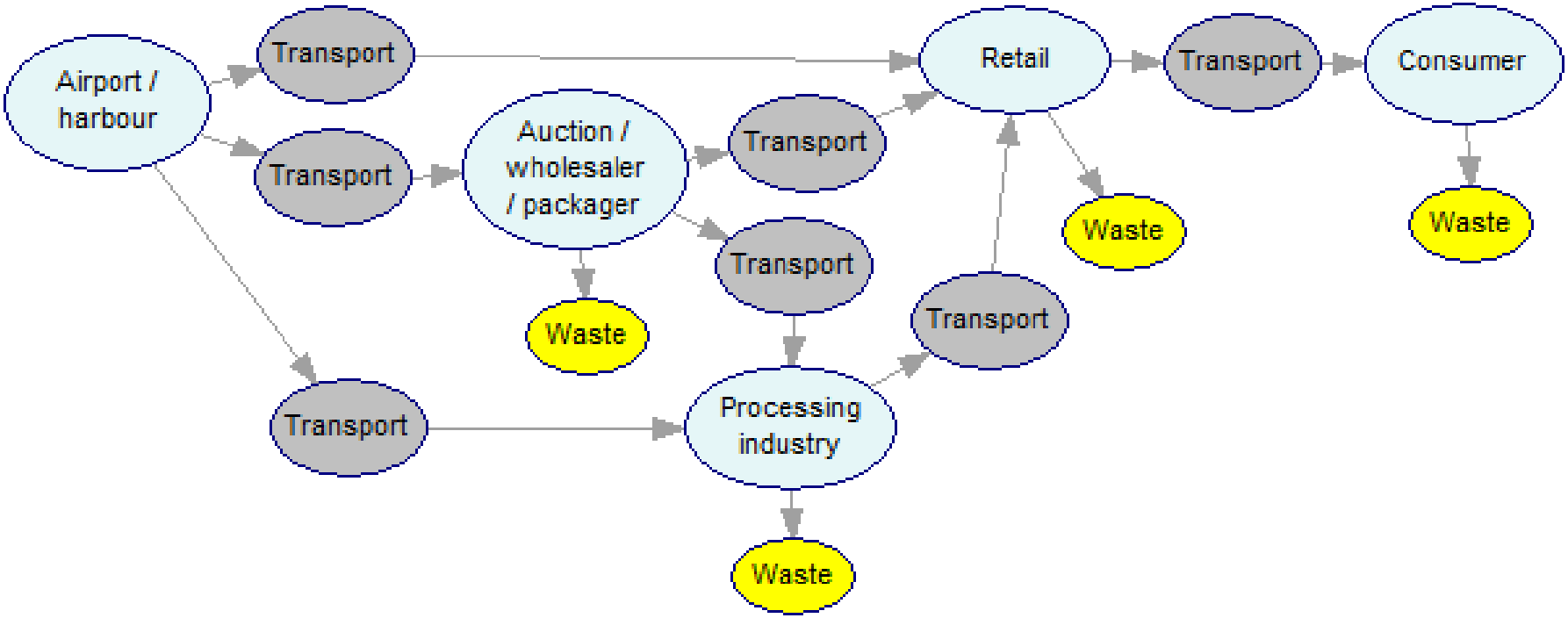
To develop a model to assess in a quantitative way the probability of transfer - including first egg laying – from produce (cut flowers/branches, fruits and vegetables)

Model for transfer + first egg laying

- Begins with arrival of the pest on produce
- Ends after (mating and) first egg laying at a site suitable for establishment
- Model is parameterised for a specific location
- Area/sites suitable for establishment should be known

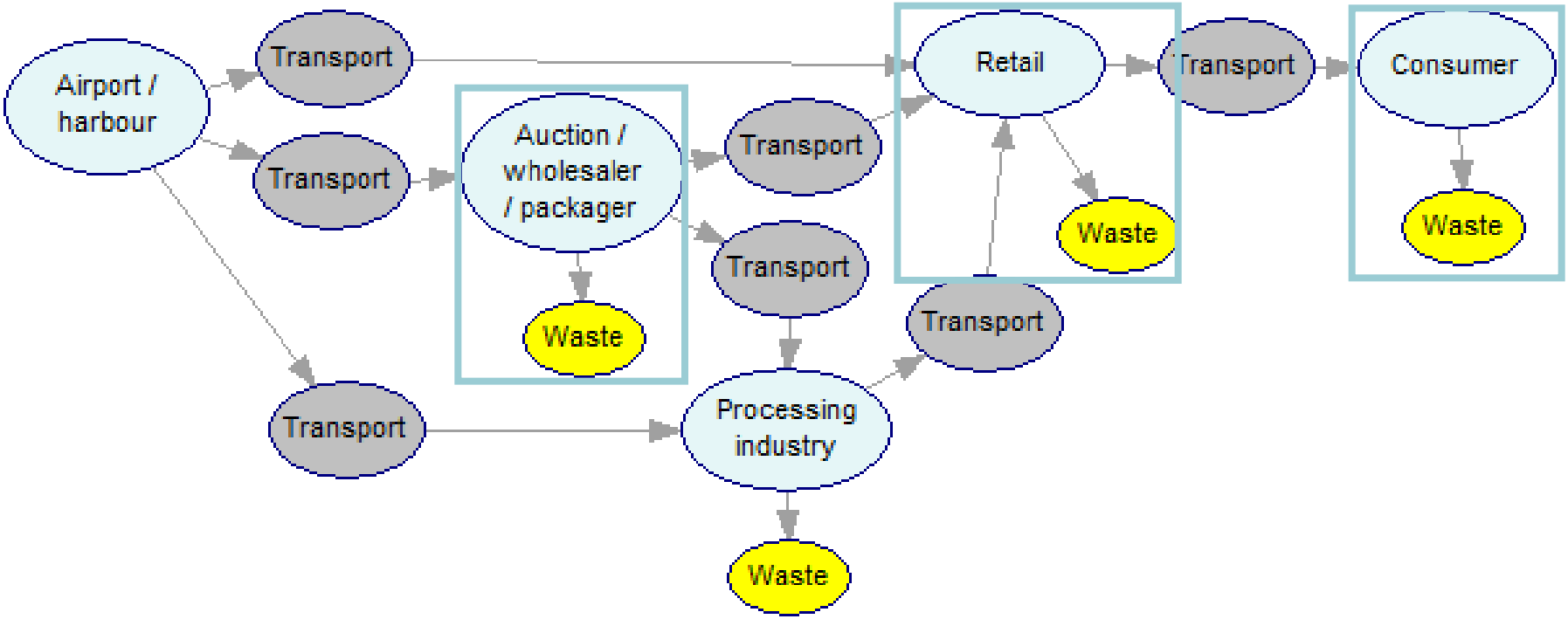
Trade chain

Imported commodity trade chain map for fruit, vegetables and cut flowers



Probability of transfer estimated at 3 x 2 points in the trade chain

Imported commodity trade chain map for fruit, vegetables and cut flowers



Model variables for transfer (questions)

1. Arrival as adult OR
2. Development into adult

AND

3. Reaches suitable habitat

AND

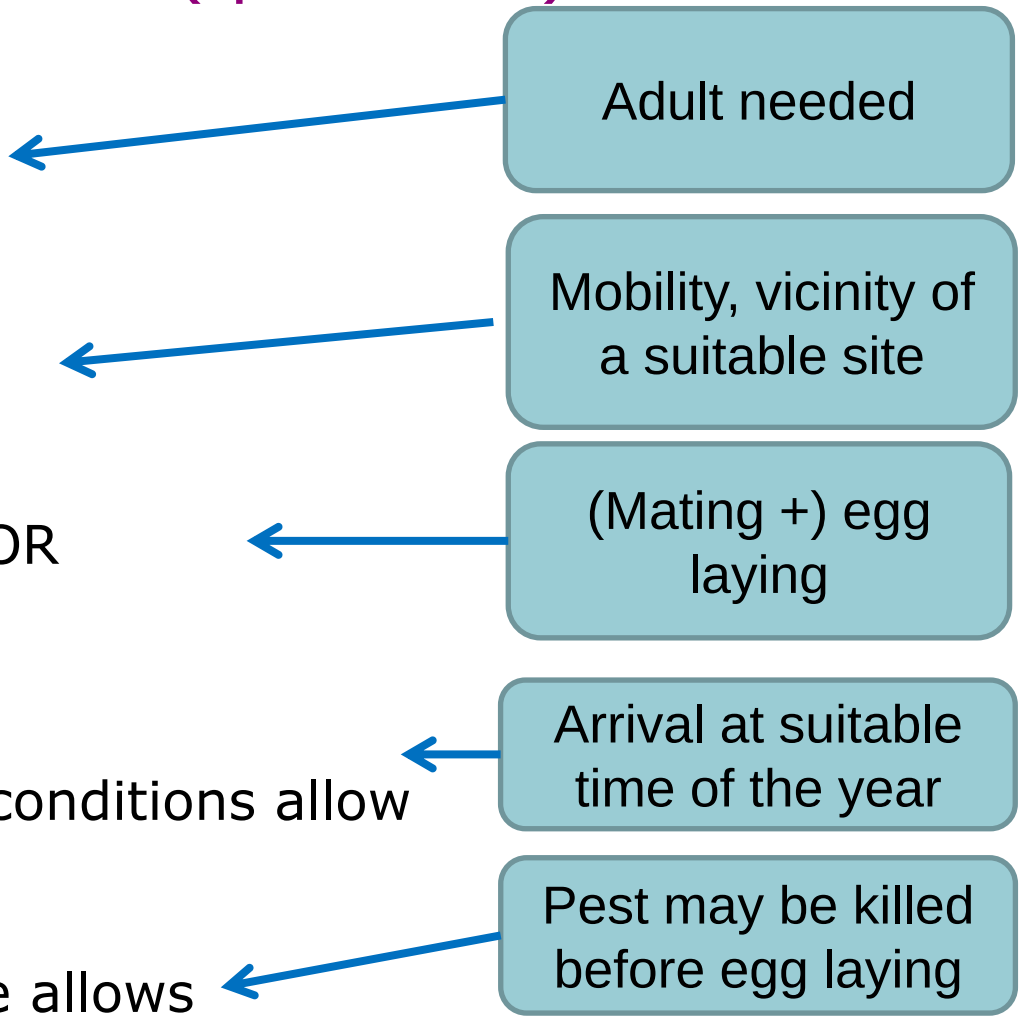
4. Parthenogenic or gravid OR
5. Sufficient individuals

AND

6. Host and environmental conditions allow

AND

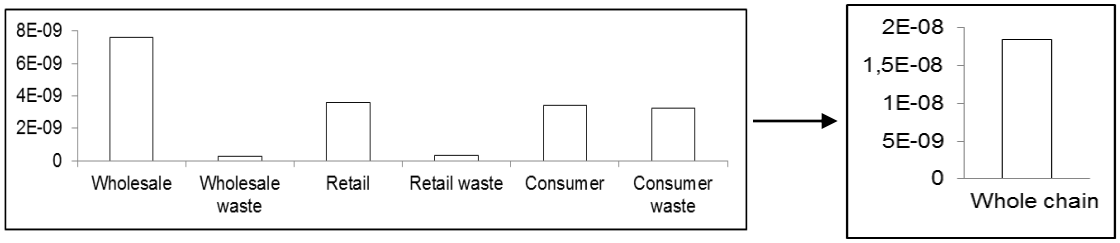
7. Pest management regime allows



Assessment of the probability of transfer

- Seven questions: 2 - 6 score levels defined per question
- Probabilities defined for each score level
- User can also choose a probability according to own belief

- Model output:
  - Probability of transfer at different points in the trade chain + overall probability



Case study pests

Pests in top 10 of most frequently intercepted pests in 2011-2013 (NL)

- *Spodoptera littoralis* – *Rosa* cut flower
- Tephritidae – various species on various fruits
  - *Ceratitis capitata* (present in EU)
  - *Rhagoletis mendax* (no interceptions, NL climate suitable)

- *Bemisia tabaci* – Leafy vegetables
- *Liriomyza sativae* – Leafy vegetables
- *Thrips palmi* – *Solanum* fruit
- *Helicoverpa armigera* – *Rosa* cut flower (before deregulation in 2008)

Three scenario’s for greenhouse pests

- Scenario 1: Cold chain
- Scenario 2: Packager/Wholesaler near glasshouses
- Scenario 3: Product is packed or sorted in a uncooled shed directly connected to a glasshouse host plant crop

Example rating guidance and belief, Q1

Question	Belief (P)	Rating guidance
1. Is the stage of pests on arrival suitable for transfer? **(adults present?)**	0%	Immature stages only Example: *Helicoverpa armigera* – Rosa cut flower
	1%	Immature stages, rarely an adult
	10%	Adult sometimes present Example: *Thrips palmi* – Solanum fruit
	50%	Adult present in more than 50% of the infested consignments

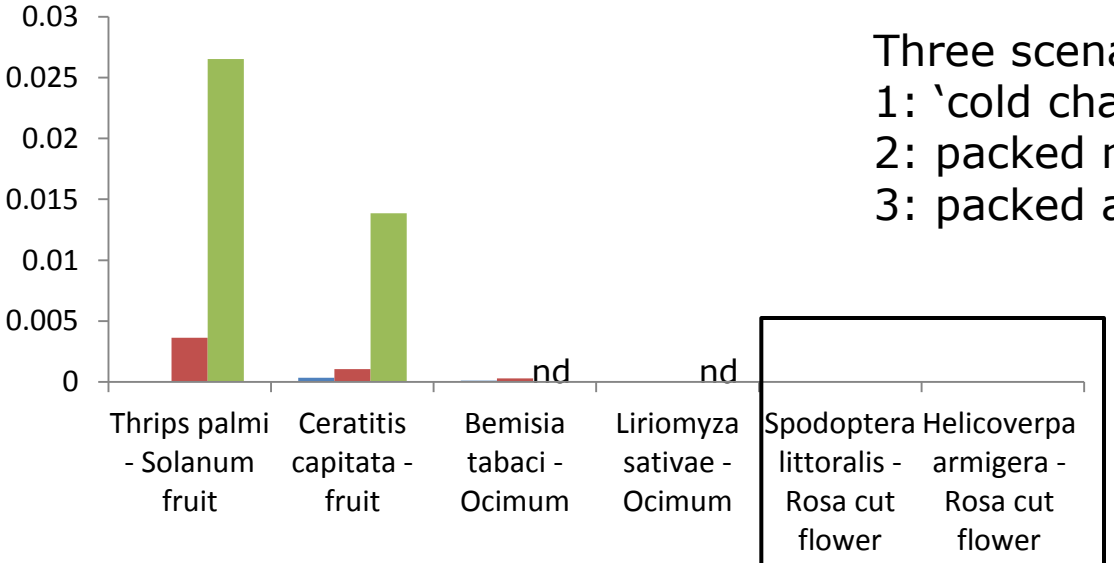
Example rating guidance and belief, Q2

Question	Belief (P)	Rating guidance
2. Development into adult?	0.01%	Extremely unlikely Example: *Helicoverpa armigera*; shelf life too short
	5%	Unlikely
	20%	Moderately likely (e.g. storage time/shelf life allow for full development on the product of at least the late immature stages and in about 20% of the cases and adult can develop. Example: *Bemisia tabaci*: late stage puparium may be present
	50%	Likely (e.g. shelf life/storage time and environmental conditions allow for development into adult

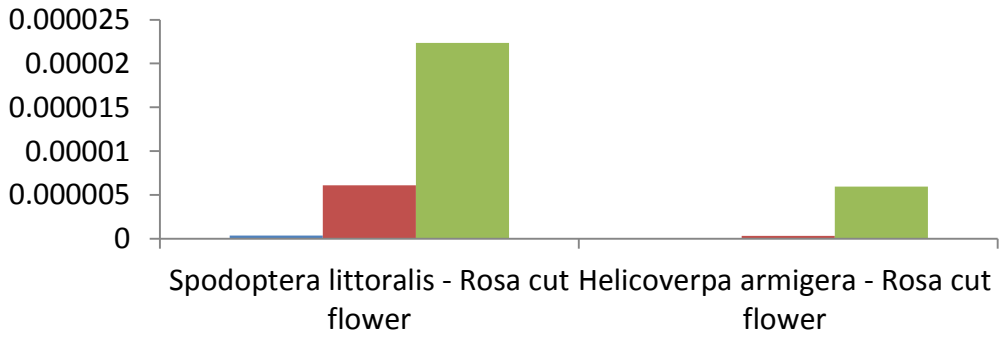
Example rating guidance and belief, Q3

Question	Belief (P)	Rating guidance
3. Likely to reach a site suitable for establishment ?	0.05%	**Potential greenhouse pest** - Low-mobile species (active spread usually less than 100 m) *Thrips palmi – Solanum* fruit (cold chain)
	0.5%	**Potential greenhouse pest** - Mobile species
	10%	**Potential greenhouse pest** - Low-mobile species, packager located close to a greenhouse suitable for establishment *Thrips palmi – Solanum* fruit (packed near glasshouses)
	20%	…
	50%	**Potential greenhouse pest** …or - Low-mobile or mobile species, product packed in a shed directly connected to a greenhouse *Thrips palmi – Solanum* fruit (packed at glasshouse location) **Potential outdoor pest** - Low-mobile species, host plants are very common - …
	80%	…

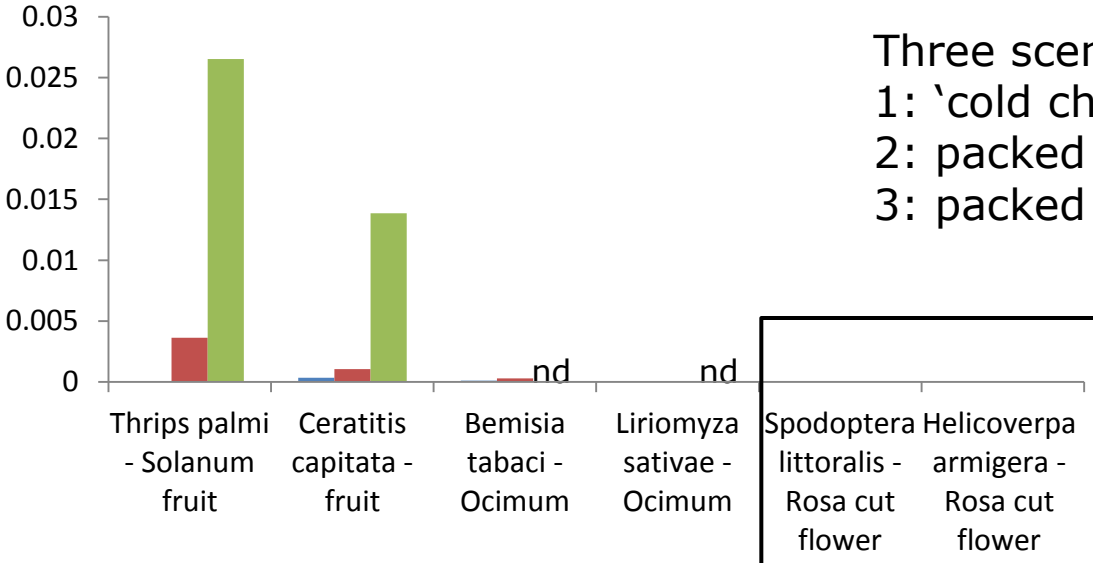
Model output case study pests



Three scenario's
1: 'cold chain'
2: packed near glasshouses
3: packed at a glasshouse location

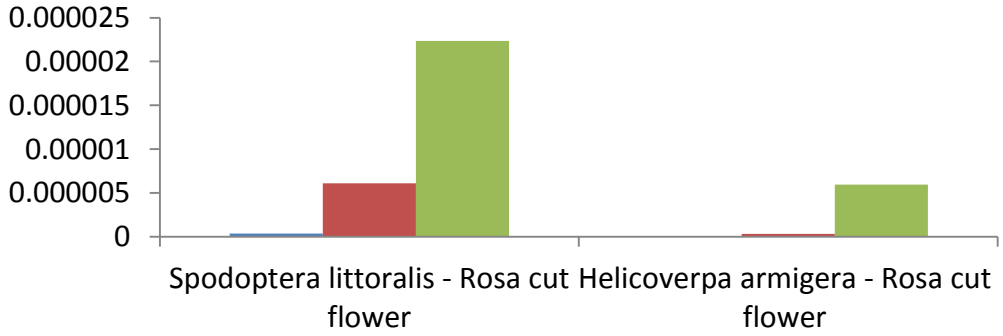


Model output case study pests

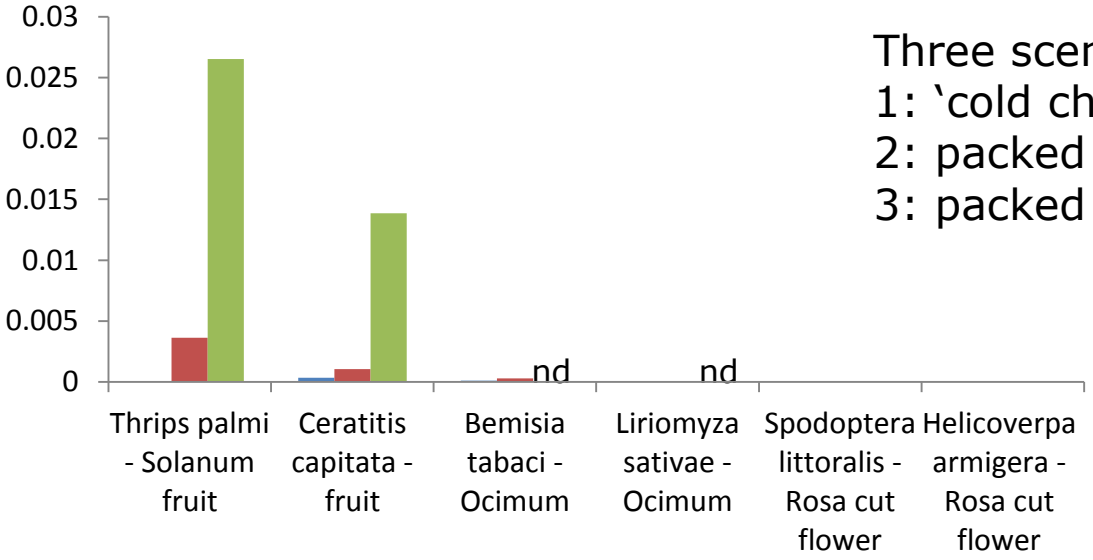


Three scenario's
1: 'cold chain'
2: packed near glasshouses
3: packed at a glasshouse location

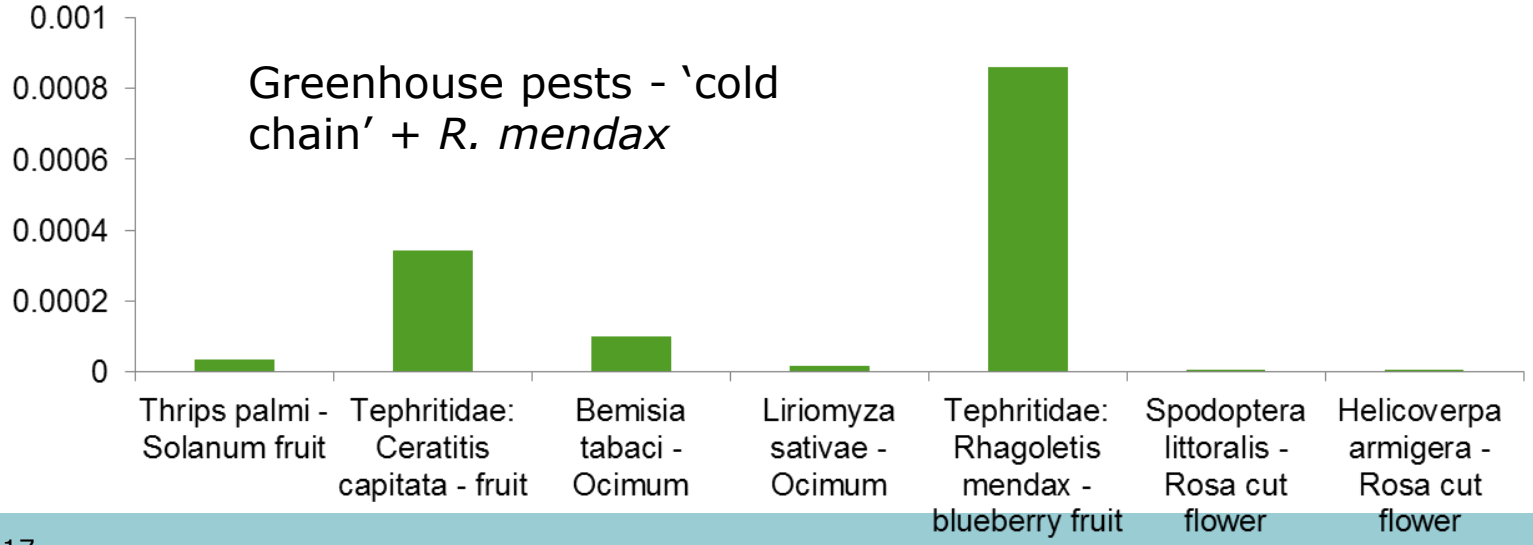
Adult unlikely to develop



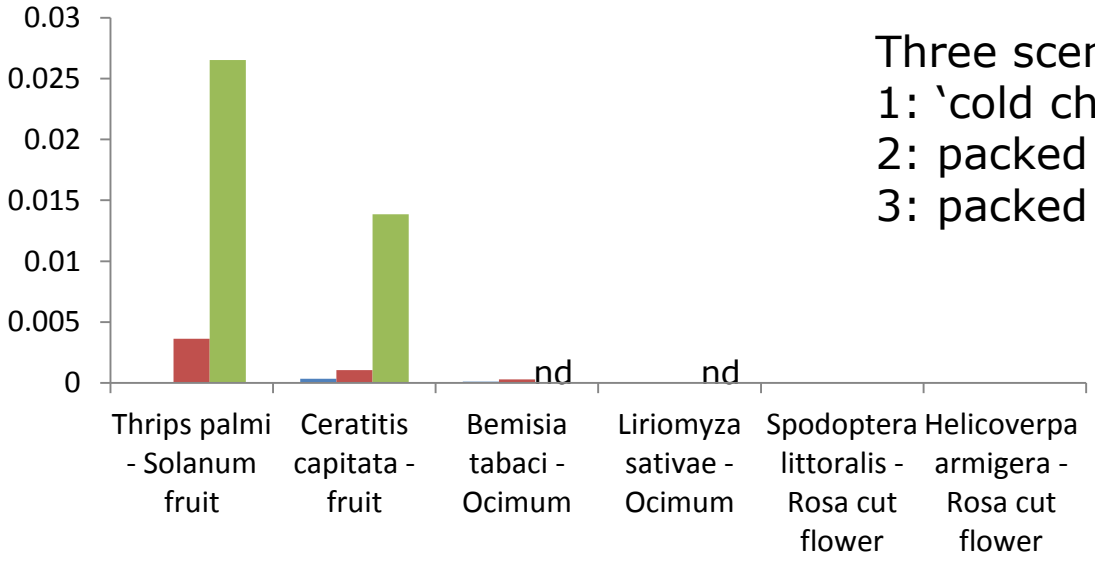
Model output case study pests



Three scenario's
1: 'cold chain'
2: packed near greenhouses
3: packed at greenhouse location



Model output case study pests



Three scenario's
1: 'cold chain'
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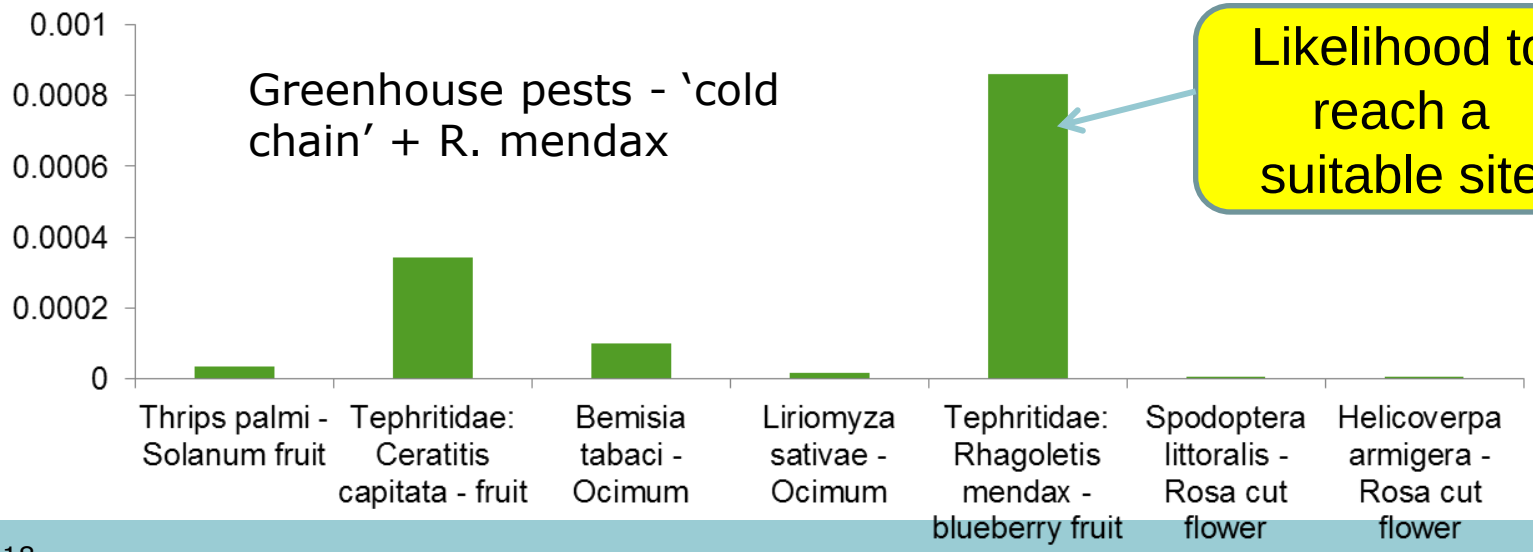
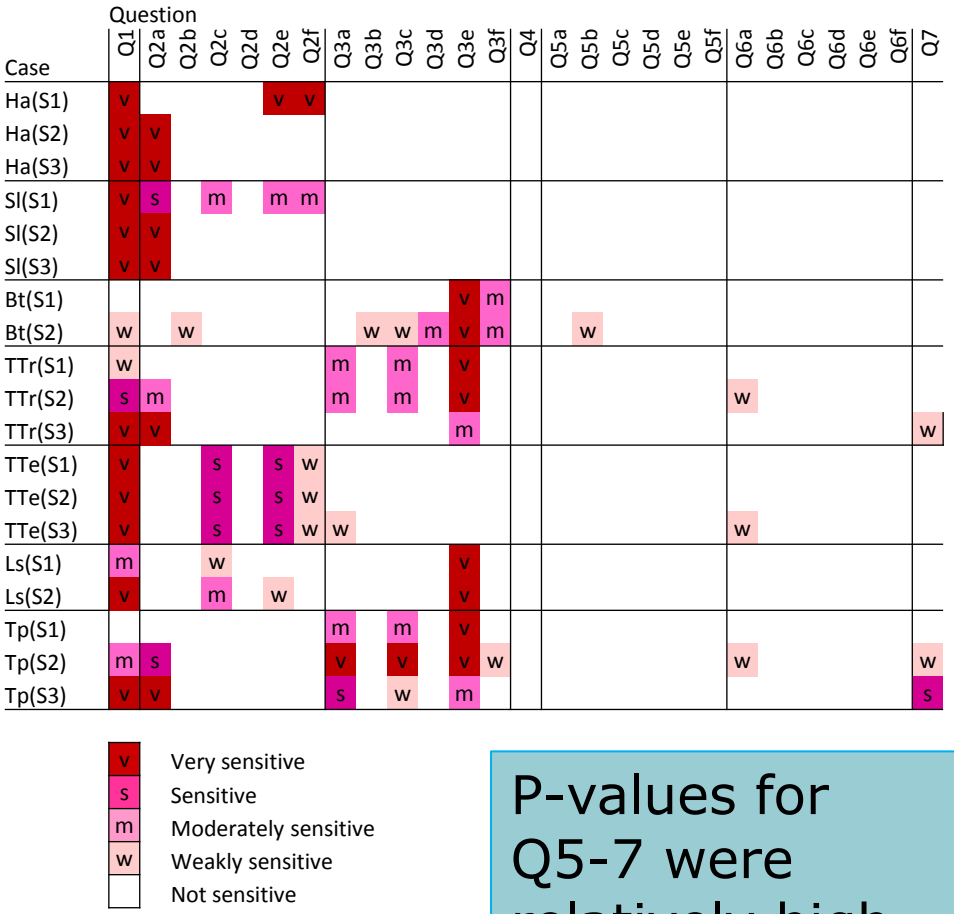


Likelihood to reach a suitable site

Sensitivity analysis (7 case study pests for NL)

1. Arrival as adult OR
2. Development into adult
   AND
3. Reaches suitable habitat
   AND
4. Parthenogenic or gravid OR
5. Sufficient individuals
   AND
6. Host and environmental conditions allow
   AND
7. Pest management regime allows



P-values for Q5-7 were relatively high (Q4 = NO/YES)

EUPHRESCO II

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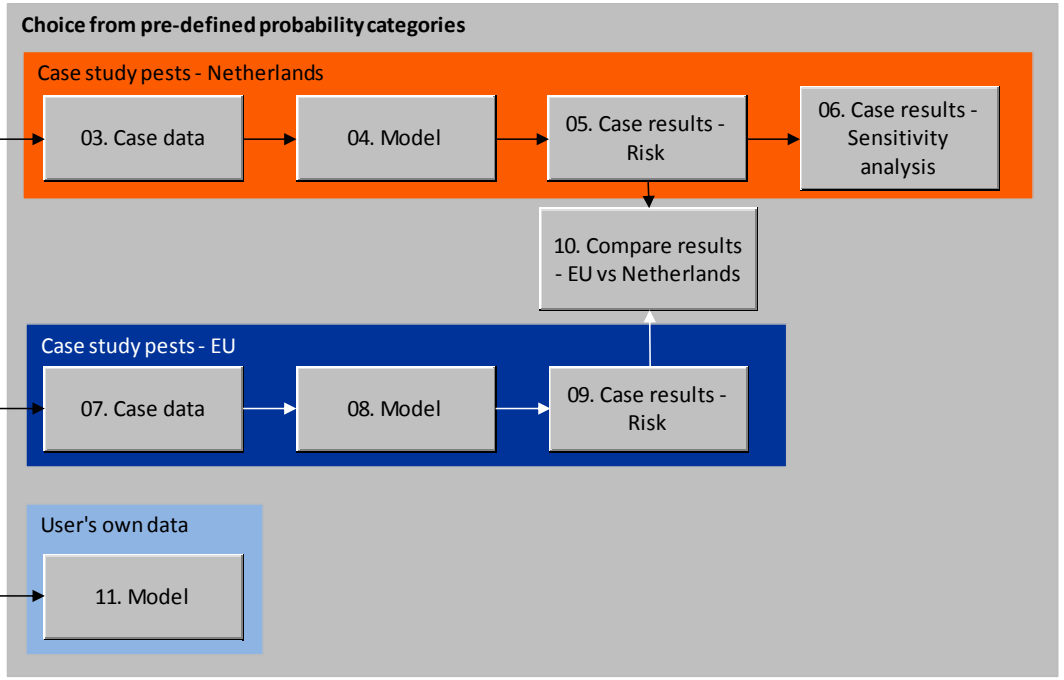
Ministerie van Economische Zaken





Summary and conclusions

- Model developed to estimate the probability of transfer from produce
- Seven parameters for transfer
- The model is parameterised for a specific location
- Predefined rating levels or enter own belief (P)
- Uncertainties: probabilities may rather be used as relative than absolute values
- Most important factors for transfer of case study pests (NL):
  - Presence of adults or likelihood to develop into an adult
  - Vicinity of a site suitable for establishment

- Model available in Excel (contact the authors)

Thank you for your attention!