

Testing two plant pest risk assessment schemes to support risk management decisions for the European Union: methodology used, data collection process and results obtained from application on a case study pest: *Acidovorax citrulli*.

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Introduction

- Plant Pest Risk Assessment (PRA) is the principle mechanism for assessing the risk of a plant pest to an endangered area and providing the evidence base for pest-related regulation.
- To overcome the limitations of the currently available qualitative PRA schemes, two existing schemes were adapted to incorporate recent developments in plant health risk assessment research with regard to transparency and consistency in assessing the risk, and efficiency in evaluating risk reduction options. Both methods were tested against five case study plant pests.
- We report here: a) the two adapted schemes developed, b) the results from their application to assess the risk for EU countries presented by *Acidovorax citrulli* (Ac) that is the causative agent of the bacterial fruit blight of cucurbits, and c) the evaluation of management options for Ac.

Methods

PHASE 1: INFORMATION GATHERING AND DATA ASSEMBLY FOR CASE STUDY PEST

1) **Compilation of Pest Datasheet** (format based on CABI Crop Protection Compendium): summary of the current state of scientific knowledge for the pest.

2) **Systematic Literature Reviews (SLR)** on particular aspects of the pest, relevant to the assessment of the risk and the evaluation of risk reduction options.

e.g. for Ac, SLRs were performed to identify: a) current methods for detection and identification of Ac b) management measures to be applied to seed of cucurbits

Sources of information: journal indexing services (e.g. CAB Abstracts, Web of Knowledge, AGRICOLA), scientific peer-reviewed journals, NPPOs reports (via distributed questionnaires), EPPO-PQR database, general and specific search engines (e.g. scholar google). Other information used: plant hardiness zones, accumulated degree day zones, Köppen-Geiger climate zones (Fig 1).

PHASE 2: TESTING TWO RISK ASSESSMENTS METHODS AGAINST CASE STUDY PEST

The features of the two schemes ('Method 2b', 'Method 4b') are described in Table 1. The possible pathways of entry were identified. For Ac, three major pathways were analysed (Fig. 2).

Table 1: Features of the risk assessments schemes used

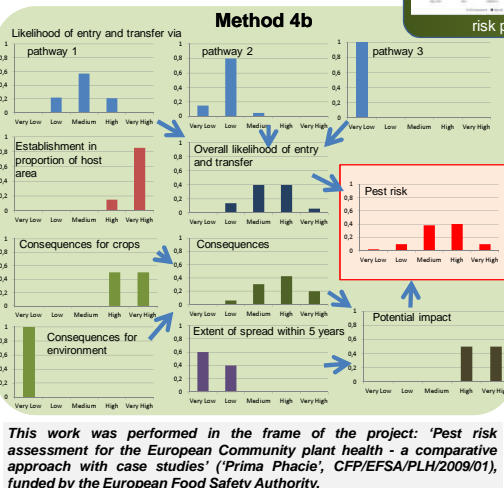
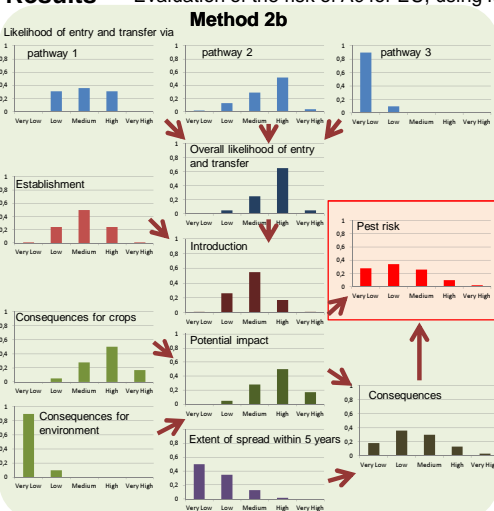
Methods used	Origin of method	Initiation	Entry	Risk elements	Spread	Impact	Other characteristics
EPPO	pest risk analysis	description of reasoning and outline of the scope of the risk assessment	Questions on the pathway on: <ul style="list-style-type: none"> Likelihood of pest being associated (spatially and temporally) with commodity (pathway) at origin, taking into account the biology of the pest Likelihood of pest being associated (spatially and temporally) with commodity (pathway) at origin, taking into account current management conditions (at origin) Likelihood of pest survival during transport and storage Likelihood of pest transfer to a suitable host to initiate a new population 	<ul style="list-style-type: none"> Questions on the factors that likely influence the limits of the area of potential establishment Questions on the factors that likely influence the stability of the area of potential establishment Host plants and suitable habitats Abiotic hosts and other associated species Climate suitability Other abiotic factors Competition and natural enemies The managed environment (cultural practices and control measures) 7. Potential cultivation 8. Other characteristics of the pest affecting the probability of establishment (reproductive strategy, duration of the life cycle, adaptability) Questions on how widely the pest has established in new areas outside its original area of distribution 	<ul style="list-style-type: none"> Five questions on rate of spread and extent of spread after 5 years Diffusion/biogeography Natural spread and spread facilitated by human activity 	<ul style="list-style-type: none"> Six questions on crop impacts Without any control measures With measures already applied against other pests With all available measures in place Up to 18 questions for environmental impacts (native biodiversity, ecosystem processes and patterns, Conservation impacts) Rating does not take into account that a pest with potentially major or massive impact can be easily controlled 	<ul style="list-style-type: none"> Potential impact consequences modified by spread Overall risk combined likelihood of entry and transfer with potential impact Score of risk elements combined by Maximum Factors contributing to risk elements scored on a scale of five divisions Assessors do not apportion likelihood between the five divisions Uncertainty expressed as 'low', 'medium' or 'high'
Method 2b	pest risk analysis	description of reasoning and outline of the scope of the risk assessment	Similar to Method 2b: questions on pathway, apart from the one on the 'likelihood of increase of pest prevalence during storage and/or transport'	A description of the proportion of host area suitable for pest's establishment	Description for examining the proportion of the endangered area occupied at a specific time horizon	One question on potential consequences on crops and managed plants (crop yield and quality)	One question on environmental impacts (e.g. on ecosystem services or biodiversity)
Method 4b	pest risk analysis	description of reasoning and outline of the scope of the risk assessment	Similar to Method 2b: questions on pathway, apart from the one on the 'likelihood of increase of pest prevalence during storage and/or transport'	Taking into account relevant factors such as overlapping host distribution and suitable climate conditions (e.g. plant hardiness zones or Köppen-Geiger climate zones or accumulated degree day zones)	One question on environmental impacts (e.g. on ecosystem services or biodiversity)	One question on potential consequences on crops and managed plants (crop yield and quality)	One question on environmental impacts (e.g. on ecosystem services or biodiversity)

PHASE 3: EVALUATION OF RISK REDUCTION OPTIONS

- Risk Reduction Options (RROs) that potentially reduce the likelihood of entry were identified.
- The two PRA methods were applied assuming that RROs are: a) not in place or b) applied
- Changes in the risk and evaluation of the effectiveness of RROs were demonstrated by using:
 - a) Pareto type diagrams (bars: likelihood profiles; lines: cumulative likelihoods)
 - b) Risk indices* (*calculated by allocating weights of 0, 1, 2, 3 and 4 to the five divisions: "very low", "low", "medium", "high" and "very high", respectively, multiplying the likelihood score for each division, and summing up these scores)

Results

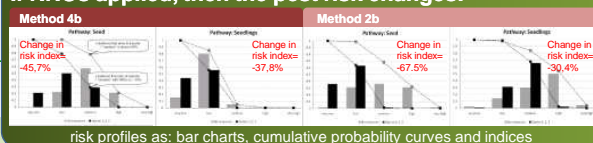
Evaluation of the risk of Ac for EU, using Methods 2b and 4b, without applied measures:



RISK REDUCTION OPTIONS (RROs)

- Seeds and seedlings sourced from a pest free place of production or pest free production site
 - Seed treatment (thermotherapy, chemical treatment)
 - Import inspections of seedlings including seed testing
- (together with good practice should reduce potential spread and impacts after an outbreak)

If RROs applied, then the pest risk changes:



Discussion & References

- Method 2b and 4b have been improved to account for uncertainty and consistently combine elements of risk in order to evaluate pest risk in a qualitative framework.
- Further research is required to refine the methods.
- For the case study pest Ac:
 - Both Method 2b and 4b give an overall pest risk profile with much uncertainty. For Method 2b, the risk is towards the lower end of the scale, while for Method 4b the risk is actually medium to high.
 - Taking into account the major impacts reported where outbreaks of Ac have occurred, but which are normally only reported in a small area, a medium risk by Ac seems a reasonable output and is in line with assessors opinion.
 - Application of the RROs identified shifts the likelihood of entry of Ac to become less likely.
 - RROs' effectiveness can be visualized by comparing bar charts or expressed quantitatively as a change in "Risk Index" although much information is lost.

1. Baker, R.H.A., Bartlett, et al. (2009) EPPO Bulletin, 39: 97-93; 2. EFSA (2010) EFSA Journal 8: 1495-1561; 3. EPPO (2009) EPPO, PM 5/3(4); 4. Paris, EPPO (2012) PQR – EPPO database on quarantine pests (available online) <http://www.eppo.int>