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Colloquium 10

Pest risk assessment

Science in support of phytosanitary decision making in the European Community

These slides were presented in the plenary session and followed by discussion and may not necessarily represent the final conclusions

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Discussion Group 4

Challenges in pest risk assessment: evaluating evidence and addressing uncertainties

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“A characteristic challenge in pest risk assessment is that the analyst is forced, based on available evidence and presence of uncertainty, to formulate statements about whether an organism will act as a pest in relation to a PRA area.”

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1. Should inductive and deductive scientific evidence be differently considered in the pest risk assessment?

Example: the **pest establishment potential** can be

- **deduced** from laboratory or field experimental data, or
- with the **inductive approach** it may be predicted based on environmental similarities with areas where the pest have already established.
  Other examples of inductive reasoning are statements like "the pest establishment potential is low because the pest has had the possibility to establish for a long time without doing so"

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Is it important to take account of how the evidence has been generated?

- experimentally confirmed evidence
- evidence generated by inference from comparative analyses, analogy, modelling or observations
- expert judgment (qualitative)

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Discussion on deduction of evidence from experimentally confirmed evidence

- consensus on importance of this approach

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Discussion on induction of evidence from comparison analysis

- good and reliable distribution data is needed
- in case of modelling: uncertainties of models
- risk assessors should recognise situations where the pest did not act as a pest at its origin but in the new environment

  Example: Hyphantria cunea (was no pest in the USA but in central and southern Europe was a very polyphagous quarantine pest) and many other pests (and typical for invasive plants)

Discussion on expert judgment / personal communication as a basis for evidence

- can be useful if no scientific data is available

  Example: Caterpillar from Japan reported in the 20/30ties, only way to obtain information was to contact very old Japanese experts

- can be the basis for further examination
- underlying facts have to be made explicit
- it has to be cited correctly
- not really a good but more a vague source

Conclusions

- ➔ both inductive and deductive scientific evidence should be taken into account
- ➔ both ways of reasoning have advantages and disadvantages,
- ➔ problems may occur if inductive and deductive scientific evidence conflict – then uncertainty is very high
- ➔ expert judgements may also be valuable but underlying facts should be made explicit

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2. In statistical evaluation of evidence, i.e. hypothesis testing, 'Type I' and 'Type II' errors are distinguished as false rejection of the null hypothesis and false acceptance of the null hypothesis.

- Are these concepts valuable for characterisation of risk?
- What could be the type of hypothesis formulation to which type I and type II errors of risk assessment are to be related?
- Is it necessary to relate type I and II errors to risk management scenario's or is there another way?

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		Truth	
		Infested import	**Not infested import**
Data	**Test indicates "infested"**	True Positive	False Positive (i.e. infestation reported but not present) **Type I error**
	Test indicates "not infested"	False Negative (i.e. infestation not detected) **Type II error**	True Negative

Type I error: Concluding that the import is infested while it is not, has the effect that import of a harmless commodity is prohibited and the gains of trade are lost

Type II error: Concluding that the import is free of pest while it is actually infested (failure of detection), has the effect that a pest is allowed to enter the PRA area and the process of introduction of a new pest may progress to the next stage.

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Discussion on hypothesis testing

- both types of errors have to be considered (for the full range of biological, economic and environmental aspects)
- also relevant for interceptions, testing, surveying
- there could be an asymmetry between the two

Discussion on hypothesis testing

- ⇨ Ideally both type I and type II errors should be avoided
- ⇨ Minimizing type I errors (i.e. p-values). corresponds to minimizing the frequency of inappropriately raising trade barriers
- ⇨ Minimizing Type II errors correspond to minimizing the risks for crops and biodiversity

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Discussion on hypothesis testing – is one error more important/dangerous than the other?

- Several members but not all considered Type II error (in fact there is a risk, but you do not recognise it) to be more problematic
- Depends on uncertainty and possible impact of the measures/not taking measures - to be considered case by case

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Discussion on applicability to management

- With the help of **systems approach** (combination of management measures which each on their own would not be effective) it is possible to reduce the false negative (error Type II)

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Conclusions

➔ The concept of classifying error types is valuable and applicable for the whole risk assessment

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3. Modelling is used to generate evidence for pest risk assessment

- What validity and constraints is present in their use?
- How should uncertainty in model parameters be related and available in model results?
- How should decision makers use information generated by models (e.g. model results versus model assumptions)?

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Discussion

- Models may create a false impression of certainty (Some risk managers like modelling results and frequently have less interest in the assumptions)
- The model itself and its assumptions and underlying data (including uncertainties) must be transparent.
- The model must be accessible. The underlying logic must be explained to justify the use of the model
- Modelling is a good tool but should not be the only one
- Use ”ensemble” of models (more than one model)

”It is important to document the areas of uncertainty and the degree of uncertainty in the assessment … This is necessary for transparency and may also be useful for identifying and prioritizing research needs” (IPPC, 2001)

*If **sources of uncertainty** are well defined, and ways are found to make the uncertainty explicit, confidence in the outcome of the PRA will be maximised, and management actions will be more justified and acceptable (Zhu et al. 2001)*

Sources of uncertainty

- **Lack of data**
- **Conflicting data**
- **Complexity** (complex nature of dynamic systems)
- **Descriptions** (words, linguistic uncertainty – especially relevant within qualitative risk assessment
- **Randomness and variability** – cannot be reduced by more data (should therefore be separated from uncertainty in risk assessment)

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Uncertainties from lack of data occur in all stages of pest risk assessment:

- Is the subject organism a pest?
- Pest categorization (Taxonomy)
- Entry
- Establishment
- Spread
- Identification of the endangered area
- Socio-Economic impact
- Environmental impact

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Conclusions

- ➔ The use of resources in a PRA must be prioritised – proper use of modelling
- ➔ Modelling is in some cases a valuable tool
- ➔ Uncertainties in underlying data and due to assumptions and must be communicated as well the model outcome

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4. Much of the international controversy centres around the concepts of “acceptable risk” and “appropriate level of protection” (ALOP).

- Can the process of evaluating evidence and addressing uncertainties reduce controversy in this respect?
- What is required for a ‘meaningful’ presentation of pest risk, its relation to evidence and the degree of uncertainty?
- How can pest risk analysts be brave in their endeavours?

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Discussion on expression and quantification of uncertainties

- For individual factors, esp. critical factors for a decision, uncertainty should be made transparent
- Like in the EPPO Scheme, it would be good to have the uncertainty explained for each question
- Perhaps semi-quantitative (high –medium – low) like in the new EPPO Scheme

Conclusions

- ➔ The concepts of ALOP and “acceptable risk” are commonly political decisions
- ➔ Evaluation of evidence and addressing of uncertainties cannot generally reduce the controversies in these aspects
- ➔ But, our recommendations can enhance the transparency, and thereby provide a better basis for decisions
- ➔ We have to live with the possibility that sometimes a wrong decision will be made