OIE risk analysis framework: a flexible model for pest risk analysis.

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Summary:

This paper describes the use of the OIE framework for the development of a pest risk analysis for entry of the Red Imported Fire Ant (RIFA). The RIFA release assessment illustrates that the OIE risk analysis framework used for animal/animal product import risk analysis is adaptable to pest risk analysis.

In 2002, in response to an incursion of the insect pest Red Imported Fire Ant (RIFA) (*Solenopsis invicta*), the Ministry of Agriculture and Forestry (MAF) conducted an assessment of the pathways by which RIFA could enter New Zealand. This was modelled on the OIE risk analysis framework[1], illustrating that the framework could be adapted to pest risk analysis. This paper describes the use of the OIE framework for the development of a pest risk analysis for RIFA.

Import risk analysis in New Zealand has traditionally focused on managing those pest and disease risks, associated with international trade in plant and animal products, that are of concern to the productive sectors and human health. In recent years, as a result of greater public awareness of the importance of New Zealand's biosecurity, and its impact on biodiversity, pests affecting indigenous fauna and flora have assumed increased importance. There is a growing need for techniques to assess and manage the risks posed by such organisms.

Plant and animal import risk analyses consider pests and diseases that are directly associated with plants and animals. However, there are pest species of potential environmental, or plant, animal or human health concern that, because of their lifecycle, are unlikely to be introduced via, or not exclusively associated with, animal or plant products. These organisms, often termed 'hitchhiker pests', may be transported on inanimate objects, and are frequently non-specific in their routes of transport to an importing country. Examples include snakes, frogs, and insects. These organisms may also be referred to as 'environmental pests' because, while they may have some consequence, they are not principally threats to the production sector.

RIFA is an example of a hitchhiker pest. Although it has been associated with some plant materials, it can also be transported on inanimate objects[2]. It has the potential to impact on agriculture, horticulture, human health, and the environment of countries to which it is introduced.

In February 2001, a single RIFA nest was discovered at Auckland International Airport. The nest was destroyed and a surveillance program initiated to detect and destroy any further nests. However, MAF was concerned that international travel and trade could reintroduce RIFA. To evaluate this threat, the first part of a qualitative pest risk analysis, based on the OIE framework, was undertaken. The objectives were to determine the routes of importation, or pathways, by which RIFA could be imported, and to rank them so that the limited resources available could be focused on the routes of highest risk.

Under the OIE framework, import risk analysis comprises hazard identification, risk assessment (release assessment, exposure assessment, consequence

assessment, risk estimation), risk management and risk communication. Only the hazard identification and release assessment were carried out in this case. Even so, the applicability of the OIE framework to pest risk analysis was demonstrated. The use of the framework for RIFA hazard identification and release assessment, and the potential to adapt the remaining sections, is summarised below.

Hazard identification is the process of identifying the pathogenic agents (hazards) that could potentially be introduced in the commodity considered for importation. A hazard is defined as "any pathogenic agent that could produce adverse consequences on the importation of a commodity".

Using the OIE model, an animal/animal product import risk analysis generally starts with a well-defined commodity for importation, e.g. cooked chicken meat from all countries. All identified pest and disease organisms that could produce an adverse consequence and could be carried by the commodity are stated as the hazards. Alternatively, a single pest/disease-commodity relationship may be examined e.g. rabies virus in dogs.

Similarly, in a pest risk analysis, the starting point could be a defined commodity, either of plant/animal origin or an inanimate object. The analysis could focus on one pest, or identify all pests potentially associated with the commodity. In that case, the same process as an animal import risk analysis would be followed. Alternatively, a pest risk analysis can begin with a pest of interest - with no associated commodity - and the pathways by which it could be introduced are identified in the analysis. This was the case in the RIFA assessment.

For RIFA, the hazard identification consisted of an in-depth discussion of the biology of the ant (the hazard) in order to identify the stages of the life cycle that could initiate the successful introduction of RIFA into New Zealand. The fomites and plant and animal materials capable of harbouring relevant life stages were discussed to identify the pathways by which RIFA could be introduced. In future analyses, it would be more appropriate for this discussion to be presented in the release assessment.

In the OIE framework, the release assessment consists of a description of the biological pathways necessary for an importation to release hazards into an importing country and an estimate of the likelihood of the pathways occurring.

For an animal/animal product risk analysis, each hazard associated with the commodity is discussed individually.

As indicated above, in pest risk analysis the release assessment would consist of a biological discussion of the different fomites and plant and animal materials capable of harbouring the pest to identify the pathways by which it could be introduced. As in the RIFA release assessment, once the pathways have been identified, each would be discussed, giving a description of the events necessary for the pathway to become infested, the ability of the pest to survive transport conditions and duration, and likelihood of such an infestation at the time the fomite or plant or animal material was imported. Where a number of pathways are able to introduce the pest, those of greatest likelihood could be identified to allow efficient allocation of limited resources, as was attempted in the RIFA release assessment.

Exposure assessment, in the OIE framework, describes the biological pathway(s) necessary for exposure of animals and humans in the importing country to the hazards released from the importation and estimating the probability of that exposure occurring. Each hazard identified is considered separately.

For a pest risk analysis, the exposure assessment would consist of an examination of the biological pathway necessary for the pest to spread or become established in the importing country, and an estimation of the likelihood of the required events occurring. A reasoned discussion outlining the pest's critical survival parameters, availability of suitable food sources, presence of intermediate hosts, etc. and the relationship of these factors to conditions in the importing country should be given to determine if establishment would be possible. Quantitative modelling could also be used to determine the potential range of establishment of a pest organism.

Consequence assessment describes, for each hazard, the potential consequences of exposure and estimates the probability of them occurring.

Similarly, a pest risk analysis would identify the potential adverse human or animal health, environmental or socio-economic consequences associated with the entry, establishment or spread of the pest, and an estimation would be given of the likelihood of these occurring. Consequence assessment is likely to be particularly difficult in pest risk analysis due to the increased prominence of environmental effects. The impacts of a pest on unique fauna and flora are usually difficult to predict and, for this reason, a worst-case scenario is often assumed. In addition, there is a diverse range of views in society on the value of the environment, and there is no agreed measure by which to evaluate different environmental impacts.

Risk estimation consists of integrating the results of the release, exposure and consequence assessments to determine whether risk management measures are warranted for each of the identified hazards.

In a pest risk analysis, the results of the release, exposure and consequence assessments could be integrated to produce an estimate of the risks associated with the pest discussed. A summary would be given stating if the pest constitutes a hazard that warrants risk management measures. Where the analysis has discussed a number of potential pathways for introduction, those considered capable of introducing the pest should be identified.

The OIE framework defines risk management as the process of deciding upon and implementing measures to achieve an importing country's appropriate level of protection, whilst ensuring that negative effects on trade are minimised.

This concept applies equally to a pest risk analysis. Risk management measures would be chosen and adopted for the pathways identified in the risk estimation as requiring management. Measures could be developed for each pathway individually or a range of measures known to be effective against the pest of concern could be stated as options for application to the identified pathways.

In conclusion, the use of the OIE framework in pest risk analysis should be guided by the same principles as for animal import risk analysis, including being transparent, consistent, based on the best science available, and well referenced. The RIFA assessment was affected by the same limitations as an animal risk analysis; notably decision-making on the basis of incomplete scientific evidence and uncertainty. However, the framework was an effective tool to allow the presentation of current scientific knowledge, and it allowed decision-making in a consistent and transparent way. The RIFA release assessment illustrates that the OIE risk analysis framework used for animal/animal product import risk analysis is adaptable to pest risk analysis.

References
1. OIE. International Animal Health Code. 23-30. Office International des Epizooties, Paris, 2002.
2. Bradleigh Vinson S and Sorensen AA. Imported fire ants: Life history and impact. Dep of Entomology, Texas A&M University, College Station, Texas, and Agricultural & Environmental Sciences, Texas Dep of Agriculture, Texas, 1986.