Sub-theme:

Emerging innovation in phytosanitary systems

Title:

Horizon scanning for prioritizing invasive alien species with potential to threaten Kenya's agriculture, biodiversity and economy

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Introduction

- Kenya has witnessed a number of invasions by invasive alien species (IAS) in the last decade. The notable ones include
  - tomato leaf miner (*Tuta absoluta*),
  - Fall army worm (*Spodoptera frugiperda*),
  - maize chlorotic mottle virus (MLN),
  - potato cyst nematode (*Globodera rosotchiensis* and *G. pallida*),
  - papaya mealybug (*Paracoccus marginatus*)
  - spotted-wing drosophila (*Drosophila suzukii*)
  - apple snail (*Pomacea canaliculata*).
- Invasions have resulted in massive losses in agricultural productivity affecting millions of livelihoods.

Introduction…/2

- Horizon scanning prioritises the risks of potential IAS through rapid assessments of likelihood of their entry and establishment and their potential socio-economic and environmental impacts.
- Is an approach used to generate information to support IAS planning and management at country level, as well as inform policy and practice
- The approach has been used to determine IAS at the country level such as in Cyprus (Peyton et al. 2019), Great Britain (Roy et al. 2014), Spain (Gassó et al. 2009; Bayón and Vilà 2019) and at the regional level such as the European Union (Roy et al. 2019), Central Europe (Weber and Gut 2004), Western Europe (Gallardo et al. 2016), and the United Kingdom (Sutherland et al. 2008).

Problem Statement

- Once biological invasions are recorded anywhere in the globe, the pests spread across continents unabated (examples: *T. absoluta*, and *S. frugiperda)*. IAS may arrive into countries through various pathways (both intentional or unintentional human activities):
  - International trade- remains a major cause of spread of invasive pests
  - Natural spread- aided by the weather
- **Risk factors**: porosity of the borders, Inadequate border biosecurity, Limited capacity to reduce the risk of invasions, Inadequate information about potential AIS, among others.
- NPPOs lack information on the **potential AIS likely to be introduced from the quarantine pest lists.**
- Information supports planning and implementation of sustainable management strategies (i)prevention of invasions-PRAs, ii)early detection, iii)eradication, iv)containment & eventual management of IAS. This information can also be utilised to identify pest pathways, intercept movements at border points, and assess risk of planned imports.

Justification

- IAS have caused enormous strain on the agricultural sector that supports millions of livelihoods in Kenya. Examples:
  - De Groote et al. (2020) showed that *S. frugiperda* caused losses of about a third of the annual maize production in Kenya.
  - Rwomushana et al. 2019-- showed that 41% of tomato farmers had lost a large proportion of their crop to *T. absoluta*, -114,000 tonnes of tomatoes (based on farmers' own estimates

Objectives

An horizon scanning workshop held in July 2021 utilized an horizon scanning tool:

- To identify and assess IAS that are likely to invade and subsequently threaten the economy of Kenya through impacting agriculture and biodiversity

Methodology

- The prioritisation carried out by experts from CABI and KEPHIS **under support of CABI's PlantwisePlus Programme.** The program will also support additional collaborative activities including **PRA** and **Insight reporting on Horizon**.
- An adapted version of the **consensus method developed for ranking IAS** (Sutherland et al. 2011; Roy et al. 2014, 2019) to rank a list of invertebrates and pathogens that are harmful to plants and could possibly enter Kenya in the near future.
- An horizon **scanning tool in the CABI CPC** utilised, where information from the CPC datasheets is used to generate a list of species that are absent from the selected 'area at risk' (Kenya), but present in specified source areas.
- The risk scoring system used based on that described by Roy et al. (2019): assessment of the likelihood of entry; likelihood of establishment; potential socio-economic impact; and potential environmental impact.

Methodology/…2

- Each of the **four parameters** was scored from 1 (unlikely to enter or establish; or minimal impact) to 5 (very likely to enter or establish; major impact). The definition of each score for each parameter was agreed following testing.
- The **likely pathway of arrival and the confidence levels** used to help focus discussions but did not contribute to the overall score.
- The **overall score** was used to rank species according to their potential threat for Kenya.
- For the highest ranked IAS, a full **PRA** was proposed.

Methodology/...3

- The exercise focused mainly on arthropods and pathogenic organisms (bacteria, phytoplasma, virus and viroids) affecting **eight key commodities**:
  - Citrus, rose bud wood, tomato, avocado, apples, wheat, dragon fruit and chrysanthemums.

Results for arthropods

Citrus Arthropod Species	Overall score (A*B*(C+D))	Comments
Bactrocera zonata	128	PRA
Diaspidiotus perniciosus	84	Not actionable
Tetranychus kanzawai	90	Not actionable
Anastrepha ludens	200	PRA and Surveillance
Spodoptera eridania	175	PRA and Surveillance
Spodoptera litura	200	PRA and Surveillance
Thrips palmi	100	PRA
Cornu aspersum	200	PRA and Surveillance
Rhynchophorus palmarum	72	Not actionable
Dialeurodes citri	160	PRA and Surveillance
Parabemisia myricae	200	PRA and Surveillance

Roses Arthropod Species	Overall score (A*B*(C+D))	Comments
Achaea janata	40	Not actionable.
Lymantria dispar	200	Full PRA and surveillance required
Mamestra brassicae	200	Full PRA and surveillance required
Otiorhynchus sulcatus	45	Not actionable
Rastrococcus invadens	200	Full PRA and surveillance required
Tetranychus pacificus	75	Not actionable
Thrips obscuratus	125	Full PRA required
Xestia c-nigrum	72	Not actionable
Xyleborus dispar	36	Not actionable
Pantomorus cervinus	80	Not actionable

Results for pathogens…/2

Pathogens of citrus	Overall score (A*B*(C+D))	Comments
Citrus bark cracking viroid/Citrus viroid IV	64	Not actionable
Citrus bent leaf viroid/ Citrus viroid I	48	Not actionable
Citrus exocortis viroid	150	Full PRA and Surveillance
Citrus leaf rugose virus	12	Not actionable
Citrus psorosis B	112	Full PRA and Surveillance
Citrus viroid III/Citrus dwarfing viroid	96	Full PRA
Citrus viroid V	40	Not actionable
Citrus viroid VI	40	Not actionable
Hop stunt viroid	150	Full PRA and Surveillance
Pythium vexans	175	Full PRA and Surveillance
Spiroplasma citri	175	Full PRA and Surveillance
Xanthomonas campestris	125	Full PRA and Surveillance
Xylella fastidiosa	225	Full PRA and Surveillance

Pathogens of Roses	Overall score (A*B*(C+D))	Comments
Alternaria alternata	**120**	**Full PRA and Surveillance**
Arabis mosaic virus	**72**	**Not actionable**
Armillaria tabescens	**180**	**Full PRA and Surveillance**
Calonectria morganii	**60**	**Not actionable**
Cercospora puderi	**20**	**Not actionable**
Coniothyrium wernsdorffiae	**24**	**Not actionable**
Cryptosporella umbrina	**20**	**Not actionable**
Erwinia herbicola pv. gypsophilae	**120**	**PRA to be done**
Eutypa lata	**60**	**Not actionable**
Heterobasidion annosum sensu lato	**112**	**Full PRA and Surveillance**
Monilinia fructigena	**90**	**Full PRA**
Neonectria ditissima	**120**	**Full PRA and Surveillance**
Peronospora sparsa	**96**	**Full PRA**
Phragmidium tuberculatum	**20**	**Not actionable**
Phytoplasma aurantifolia	**112**	**Full PRA and Surveillance**
Prunus necrotic ringspot virus	**120**	**Full PRA and Surveillance**
Rhizobium rhizogenes (Agrobacterium rhizogenes	**96**	**Full PRA**
Rhizobium rubi	**120**	**Full PRA and Surveillance**
Strawberry latent ringspot virus	**72**	**Not actionable**
Tobacco mosaic virus	**160**	**PRA and Surveillance to be done**
Rose yellow vein virus	**48**	**Not actionable**

Results

- Several high scores realized (**overall between 100 200**)
- Horizon scanning results for the IAS to:
  - support establishment of a plant health register,
  - update quarantine and regulated pest lists
  - support insight reports on likely risks,
  - prioritization of pests for surveillance and PRAs.
  - In summary, availability of information on the IAS enables, development of sustainable interventions to prevent entry, early detection, containment and eradication of IAS where possible.

Conclusion

Pest initiated PRA List in the Next Workshop
Bactrocera zonata
Banana bunchy top virus
Spodoptera eridania
Anastrepha ludens
Carpophillus hemipterus
Cornu aspersum
Tomato brown rugose virus
Pellargonium zonate spot virus
Planoccoides njalensis
Euwallacea fornicatus
Pepino mosaic virus
Candidatus Liberibacter solanacearum
Carpophillus hemipterus
Potato spindle tuber viroid

Recommendations

Need to incorporate horizon scanning into the institutional work plan for:

- development of PRAs,
- detection surveillance programs as well as
- emergence response plans for Kenya.

Acknowledgements

Theme: *"Enhancing Phytosanitary Systems for Healthy Plants, Safe & Sustainable Trade"*

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