A review on the effect of climate change on cacao pests and diseases

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Outline of presentation

● Introduction
● What is known about climate change and cacao production
● Effect of climate change on insect pests (in general)
● Effect of climate change on insect pests of cacao
● Likely effects of climate change on disease spread
● Effects of shade
● General Recommendations and Conclusions
● Acknowledgements
Introduction

● “Disease triangle” (Gaumann, 1950)

● A dynamic process between a host, a pest and the environment (mutually influencing), resulting in level of disease observed

● Changes in the environment will impact the pest directly but also affects the host eg host resistance

● Stressed plants are often more susceptible to attack
Climate change and cacao production

- Various climatic models produced to examine projected effects of climate change on cocoa production in West Africa
- **Maximum dry season temperatures** projected to become as, or more limiting, for cocoa as **dry season water availability**
- Areas of **low climatic suitability** will increase; areas of **high climatic suitability** will decrease.
- Differences in **climate vulnerability will lead to future shifts** in cocoa production within the region
- **Risk of new deforestation** (new areas more suitable for cocoa growing)
Climate change and insect pests (in general)

- Insects are cold-blooded so developmental rates of their life stages are **strongly dependent on temperature** (biggest influence)
- With **every degree rise** in global temperature, the insect **life cycle will be shorter**
- Other temperature effects incl **extension of geographical range**; changes in **gender ratios** ; introduction of **alternative hosts** and over-wintering hosts
Climate Change and Insect Pests of Cacao

- Very little published effects of environmental factors on CPB.
- Temperature and RH play a major part in the population fluctuations of *Sahlbergella singularis*.
- Second instar nymphs thrive more at very high humidity but desiccated at low humidity (linked to decline in December) due to a drop in the RH.
Mealy bugs

● 6-10 generations/year on cocoa (Ghana)

● Present in field throughout the year but more common in dry season (a rainfall / RH effect)

● Complex interaction of temperature and the life cycle eg egg laying, hatching, proportion of females to males etc

● Effect of temperature was stronger than that of the elevated CO₂ concentration

● Need similar studies on cocoa mealybugs
Climate Change and disease spread

- Changing distribution of cocoa growing - some re-distribution of diseases
- “Minor” pathogens may be more problematic eg *Verticillium* wilt
- Most likely factor in the spread of major cocoa diseases (outside their current regional distribution) is human mediated spread
- *Raising awareness* within the sector and public needed to prevent accidental introductions
- *Biosecurity planning* - pathways of introduction and planned responsibilities
Effects of Shade

- Many **advantages to shade** (carbon storage, biodiversity)
- **Reduces temperature** in the cocoa canopy - reduce vulnerability
- **Role of shade in disease suppression** very complex
- Investigation in Costa Rica examined if FP was suppressed or encouraged in the farming systems there
- **Suggested moderate and uniform shade is beneficial for FP suppression**
- *P megakarya* in Cameroun **made worse by heavy shade**
- *P. megakarya* and for CSSV - shade trees could potentially **act as alternative hosts**
General Conclusions and Recommendations

- **Climate uncertainty** is another threat for producers and whole cocoa industry.
- **Integrate biological data** into existing climate data sets to help build more robust models and to help predict effects of changing weather patterns on cocoa pests/diseases.
- More fundamental information on the effects of environmental factors on major pests and host. Major knowledge gaps.
- **Funding** of basic research to allow improved modelling.
General Conclusions and Recommendations

- Most likely factor in the global spread of major cocoa diseases remains **human mediated spread**
- Raising awareness of **biosecurity planning**
- A **more co-ordinated approach** is needed to plan a **global strategy** for dealing with likely climatic changes over the short term (10-15 years) and further ahead (up to 30 years)
- Multidisciplinary approaches to **plan strategy, devise actions and avoid duplication**
Acknowledgments

- Mars for funding the literature review - in particular Dr Martin Gilmour
- CABI for providing my funding to attend the meeting
- Friends and colleagues for contributing information
- Organizers for inviting me to give the talk
- Thank you for listening!