From Africa…

with love

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Coffee facts

Most important agricultural commodity in the world (retail value $ 90 billion/yr)

Most popular beverage with over 400 billion cups yearly

Global coffee consumption has grown by 1.7% / yr over last 20 yrs (ca. 130 million bags/yr)

US monthly imports 20-26% of total global coffee shipments

Increasing demand for certified coffee, e.g. 16% of US market is certified (e.g. organic)
Who produces coffee?

80 countries cultivate coffee (exported to >165 countries)

Most tropical, developing countries

More than 100 million people dependent on coffee

On most plantations, pickers earn <$2 a day
Present challenges to coffee production

Coffee berry borer
Main biotic constrain of coffee production

Climate change / climate variability:
Shrinking area suitable for coffee production

Production of high quality coffee increasingly difficult
The Coffee Berry Borer

Most important pest of commercial coffee

- Low economic threshold which affects quality and quantity
- Concealed lifestyle
- High reproductive & survival potential
- Insecticide resistance
- Pest and its system still poorly understood
The Coffee Berry Borer

The losses

Without interventions, infestation levels up to 90%

Parchment coffee with >1.5% of damage caused by coffee berry borer is rejected for exportation

Annual losses worldwide > $500 million

Affecting the economy of >20 million rural families
What are we doing?

- Pursuing classical biological control through search of new natural enemies
- Chemical ecology of the coffee berry borer
- Climate change & coffee berry borer
  - What would be adaptation or mitigation strategies?
Centre of origin – co-evolution

Coffee berry borer less of a problem in Africa than in new distribution areas

Possibly, natural enemies one important factor

We know some of them, but do we know ALL?

What are other factors?

The answers in Africa?
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Coffee berry borer

- Chemical ecology of the coffee berry borer

Climate change & coffee berry borer

- What would be adaptation and mitigation strategies?
Chemical ecology of the coffee berry borer
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Climate change & coffee berry borer

- What would be adaptation and mitigation strategies?
It is worth looking for new natural enemies

Hyperparasitoid of *Prorops nasuta* in western Kenya

AND a predator of coffee berry borer

Real possibility that Africa harbours even more promising natural enemies

New nematode genus

Requires to study the system over several fruiting periods rather than surveying it only once

*Aphanogmus* sp.

*Karnyothrips flavipes*

Jaramillo & Vega 2009
Jaramillo, Chapman, Vega, Harwood, 2010
A predator of the coffee berry borer

*Karnyothrips flavipes*  
(Phlaeothripidae)

For >100 years coffee entomologists looking for a predator of the borer

Field observations, laboratory trials and molecular gut content analysis revealed that *K. flavipes* is a coffee berry borer predator

First report in Africa

*K. flavipes* is a frequently occurring predator of the pest’s immature stages in Kenya

Jaramillo, Chapman, Vega, Harwood, 2010
A predator of the coffee berry borer

*Karnyothrips flavipes*

Jaramillo, Chapman, Vega, Harwood, 2010
Temporal relationship between emergence of predators and feeding activity upon *H. hampei*. Solid line: percent of predators positive for *H. hampei* DNA; dashed line: mean number of thrips (± SE).

Jaramillo, Chapman, Vega, Harwood, 2010
A predator of the coffee berry borer

*Karnyothrips flavipes*

Mean density of *K. flavipes* (± SE) and the total number of infested coffee berries collected per month from the ground strata (n= 17,792) in a coffee agroecosystem in western Kenya.

Jaramillo, Chapman, Vega, Harwood, 2010
What are we doing?

Coffee berry borer
- Chemical ecology of the coffee berry borer
- Pursuing classical biological control through search of new natural enemies

Climate change & coffee berry borer
- What would be adaptation and mitigation strategies?
Introduction of shade trees in coffee plantations might alleviate negative effects of climate change on coffee production. Jaramillo et al., 2009

In Colombia, an increase in temperature of 1°C would require to move the plantations by 167m in altitude to maintain the same productivity and quality in arabica coffee. Adaptation strategies

Altitudinal expansion potentially feasible, though there are few areas in the tropics where coffee production could expand in altitude.

Introduction of shade trees in coffee plantations might alleviate negative effects of climate change on coffee production.
Shaded coffee plantations in Central America and East Africa: reduction in temperature between 2–6°C, compared to coffee grown without shade

Shade trees mitigate microclimatic extremes and buffer coffee plants from microclimate variability

Decrease in the temperature by:

Ca. 4°C under low altitude conditions

Ca. 2°C under mid to high altitude conditions

Shade coffee agro-ecosystems serve as a refuge for beneficial arthropods

Jaramillo et al., 2009
What are we doing now?

Planned (mid/end 2010)

Presently sampling

Climate change experiments in Kiambu area

Climate change experiments in Mt. Kenya (2011)
Studies in Africa improve our understanding of known natural enemies

‘New’ natural enemies of the coffee berry borer can still be found in Africa

Climate change (global warming) may affect distribution & pest status of the borer

Fitness of the coffee berry borer can increase with small rises in temperature

Sun grown coffee most affected; coffee grown under shade probably most realistic adaptation strategy
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THANK YOU